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JOINT VACCINES DEVELOPMENT AND MANUFACTURING POTENTIAL IN OIC-MEMBER STATES

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Introduction

Historically the Chinese were reported to treat healthy people with smallpox scabs in an attempt to minimize their risk of being infected during the epidemic.

Edward Jenner in the eighteenth century inoculated an eighteen year old boy with cowpox exudates and thus provided a proof for using attenuated virus to protect against the severe strains of the virus. Pasteur used the same principle; he passed the virus causing rabies to rabbit and harvested the attenuated virus from its brain. These crude techniques were not without repercussions and side effects; autoimmune disease had been reported in some cases inoculated with Pasteur's attenuated virus harvested from infected rabbit brain.

Today advances in biological research, extensive testings and stringent regulations reduced the risks of side effects and improved the efficiency of vaccine.

In essence vaccines come second to clean water in saving lives. They provide prophylactic treatment to fight against spread of infectious disease caused by bacteria, viruses or parasites-borne diseases. Another type of vaccines provide therapeutic effect for some late stage cancers.

Extensive Vaccination

The World Health Organization (WHO) building on the successful eradication of smallpox by 1970 had established the Expanded Program on Immunization (EPI) in 1974. The EPI targeted six other diseases

including Tuberculosis, Diphtheria, Tetanus, Pertussis, Measles and Poliomyelitis. Five more vaccines are being recommended to prevent Hepatitis B, Haemophilus influenza b, Pneumococcus, Rotavirus and Rubella. Despite their efforts the WHO reported that 3 million people still die every year from diseases that could have been prevented by vaccination.

The COVID 19 Experience

COVID 19 pandemic had pushed more than 100 million people to poverty. The impact was more obviously felt in developing countries, specially those with weak social protection net. Without extensive vaccination the situation is prompted to get worse. Under these conditions, vaccination will not save lives only but it will improve the macroeconomic and fiscal balance in these countries, reduce antimicrobial resistance, reduce government spending, increase productivity and confer herd immunity.

The pandemic showed sharp shortages in the world's vaccine supply creating a sizable gap in vaccine coverage between developed and developing countries. The west is being accused of vaccine nationalism by prioritizing their domestic vaccination programs in an attempt to go back to businesses as usual. Uneven access to vaccine was also experienced in 2009 H1N1 influenza virus pandemic as rich countries bought up most of the global supply of vaccines.

During the H1N1 pandemic, some countries blocked locally produced vaccine from being exported. A similar scenario is being considered in some EU member states in the current COVID 19 Pandemic. Many countries in Africa, Latin America and Asia will not be able to cover their population before 2023 or 2024.

According to Access to Vaccines Index (AVI), 65% of the industry's COVID 19 vaccines production is sold to developed countries, 23% to upper-middle-income countries, 8% to lower middle income countries and 4% to lower income nations.

This situation triggered WHO to voice concern and call for the wealthier countries to support a global sharing of COVID 19 vaccine. To achieve that, the organization established COVID 19 Vaccine Global Access (COVAX) program, which is a pool procurement initiative to bargain low price and provide all countries with access to COVID 19 vaccines. The program aims at securing 2 billion doses for the benefit of developing countries.

Vaccine nationalism and abandoning the developing world needs may fire back on the West economies. According to International Chamber of Commerce (ICC), the economic growth in advanced nations could be slowed down by weak vaccine efforts in the developing world. The Chamber estimated $(4.3-9) trillion loss in GDP across the wealthy countries over the next few years if low-and-middle income countries did not fully recover from the pandemic. For instance Germany would face double-sided risk. Firstly, its export effort would slow down due to weak demand in COVID 19 impacted markets in developing countries. Secondly, Germany may experience reduction in domestic output specially in sectors that rely on import of raw material from developing countries. ICC indicated that the inward domestic prioritization would cost more than sharing and donations of vaccine specially to low-income countries.

OIC-member states showed variable reactions to COVID 19 pandemic, some countries positioned themselves favorably for vaccine production on their own or under license from international pharmaceutical companies which will improve their access to the vaccine in the following years (Table 1), whereas others have practiced procurement through different schemes as shown in (Table 2) for countries in the MENA region.

Table 1. Attempts for Vaccine Production under License or Self-reliance Development

Country	Production under license	Self-reliance development	Partnering companies
Egypt	Y		Sinovac, Sputnik V
Algeria	Y		sputnik V
Iran		Y	
Morocco	Y		Sinopharm

Table 2. Different Procurement Schemes of COVID 19 Vaccine in the MENA Region

Country	Vaccine imports through APAs*	Vaccine clinical trial participation	Vaccine import through COVAX**	Potential foreign vaccine production	Potential national vaccine production	Potential international vaccine logistics hub
Algeria	✓		✓	✓		
Bahrain	✓	✓	✓		✓	
Egypt	✓	✓	✓	✓	✓	✓
Iran	✓		✓		✓	
Iraq	✓		✓			
Jordan	✓	✓	✓			
Kuwait	✓		✓			
Lebanon	✓		✓			
Libya			✓			
Mauritania			✓			
Morocco	✓	✓	✓	✓		
Oman	✓		✓			
Qatar	✓		✓			
Saudi Arabia	✓	✓	✓	✓		
Sudan			✓			
Syria	✓		✓			
Tunisia	✓		✓	✓		
Turkey	✓	✓	✓	✓	✓	
UAE	✓	✓	✓			✓
West Bank			✓			
Yemen			✓			

** APAs: Advance Purchase Agreement.*
*** COVAX: COVID 19 Vaccine Global Access.*

Joint Vaccine Production and Development Prospects in the OIC-Member States

The limited capacity, world-wide, to produce life-saving vaccines and the tendency of vaccine nationalism in wealthy countries is best illustrated in the shortage of COVID 19 vaccine specially in developing countries. Advent of COVID 19, and probably other serious zoonotic viruses in the future, should provide an opportunity for OIC-member states to reflect on ways and means as to how they best insure their countries are well-equipped and prepared for health emergencies.

The way forward is to consolidate the capacities and capabilities of the Islamic countries to combat such diseases through establishing consortium for vaccine manufacturing and development. The new entity should consider vaccine manufacturing of generic types based on license from international pharmaceutical companies. In doing this they enhance their countries research and capabilities through technology transfer that eventually paved the path towards venturing in novel vaccine development from scratch.

Both undertakings, need allocation of human, physical and financial resources with the latter being extremely costly. The estimated cost of development and manufacturing a new vaccine could range from $500 million to $1 billion. A cost that is likely to be prohibitive burden on one country.

Thus IAS in its capacity as think tank of the UMMAH had advocated in its 5-year strategy an initiative to be adopted by Islamic Countries to establish a joint enterprise to produce generic vaccine for humans and animals and at the same time to embark on original work to develop new vaccines for emerging diseases.

The overarching factors and dimensions that justify this undertaking by OIC-member states include the ever-increasing global demand for vaccine, the existence of viable market at OIC level, the vaccine manufacturing experience in some OIC countries, OIC capacity for manufacturing and joint funding capabilities.

1. Global demand for vaccines:
The world birth cohort is currently 140 million explaining the increasing trend in the world population

that is estimated to reach 9.7 billion by the year 2100. The fertility rate in OIC-member states which mostly falls in the range between low-income to upper-middle-income category is higher than that in high-income countries, (Table 3).

Table 3. Share of Global GDP, Percentage of Global Population and Fertility across Countries by their Income

Countries by income	% Global Share		
	GDP	Population	Fertility
High income	47	16	1.6
Upper-middle income	37	37	1.9
Lower-middle income	15	38	2.8
Low-income	1	9	4.6

The increasing population in the world generally and in the developing countries particularly created tremendous need for vaccine manufacturing capacity that is not matched by current supply capacity of affordable vaccine to curb mortality rates caused by vaccine-preventable diseases. As shown in (Table 4) the under-five mortality for 1000 live births during 2000-2010 was significantly higher in OIC-member states than that in developed countries or non-OIC developing countries. The situation is exacerbated by low GDP in developing countries rendering their market unattractive for vaccine manufacture located mostly in developed countries.

Table 4. Under-five Mortality per 1000 Live Births (2000-2010)

Countries	
OIC-member states	76.2
Developed countries	5.6
Non-OIC developing countries	75.0
World	65.7

Realizing this problem, the World Health Organization (WHO) through its Expanded Program on Immunization (EPI) urges the world to respond to challenge of manufacturing unprecedented large quantities of affordable vaccines.

2. Vaccine manufacturing experience in developing world including some OIC-member states:

Historically vaccine industry in developed countries used to supply the majority of prequalified vaccine for all countries including OIC-member states. There are 12 companies in the Developing Countries Vaccine Manufacturers Network (DCVMN) who can supply at least 32 different mostly generic vaccines (Table 5). At the OIC level there now exist 4 countries in the DCVMN (Table 6).

Table 5. Developing Countries Vaccine Manufacturers Network (DCVMN) Member-Companies with Prequalified WHO Vaccines

Company	Country
Bio Farma	Indonesia
Biological-E	India
Bio Manguinhos/Fiocruz	Brazil
The Center for Genetic Engineering and Biotechnology	Cuba
Chengdu Institute	China
Green Cross Pharma.	South Korea
The Government Pharmaceutical Organization	Thailand
Haffkine Institute	India
The Pasteur Institute	Senegal
Serum Institute of India	India
LG Life Sciences	South Korea
Panacea Biotec	India

Table 6. List of OIC-Member States Who are Members of Developing Countries Vaccine Manufacturers Network (DCVMN)

Country	Company
Bangladesh	Incepta Vaccine Limited
Egypt	Vacsera
Indonesia	Bio Farma
Iran	Razi Vaccine and Serum Research Institute, Pasteur Institute of Iran

However, recently manufacturers in developed countries who have the technological skills and production capacity are reluctant to participate in the EPI supplies and instead they devote their efforts to cover a more lucrative market in developed countries. Thus the pharmaceutical industry in developed world targeted their R&D on products that are potentially profitable. This translate into allocating their resources (human & financial) to develop new vaccine intended to respond to high-income countries at the same time they shy-off from providing generic vaccine to markets in developing countries. The affordability of developing countries to purchase expensive vaccines is low and does not constitute a commercial justification for such companies to invest in.

Moreover, the diseases common in developing countries may not be common in developed world. Diarrheal diseases, Malaria and other childhood diseases appear on the developing world's top 10 causes of death. The share of total diseases burden in low-income countries is higher than that in high-income countries (Table 7). Despite the disparity in diseases burden, only 10% share of global commercial investment in R&D is allocated for 90% of the world people living in developing world.

Table 7. Percent Share of Total Diseases Burden in Low and High-Income Countries

Diseases	% of total diseases burden in high-income countries	% of total diseases burden in low-income countries
Communicable diseases	6.2	56.4
Tuberculosis	0.1	3.0
Malaria	0.0	4.9
Respiratory infection	1.2	8.4
Cancer	4.7	2.4

3. Viable Market:

Market for the proposed vaccine facility output would not be a problem for the following reasons:

1. The OIC-member states population is 1.8 billion constituting a market of economy of scale.
2. Manufacturers in developed countries are not any more interested in developing countries' market because of insufficient return.
3. EPI increasing demands for vaccine at affordable prices. Some manufacturers in developing countries started supplying their vaccine to UN agencies after getting them prequalified by WHO. It is noteworthy that UNICEF procured generic vaccine such as DTP (Diphtheria, Tetanus, Pertussis), (Measles, Rubella), MMR (Measles, Mumps, Rubella).

The viability of the market could be assured by either:

1. The push mechanism where upfront financial support is provided for orders of specific vaccine. The mechanism is functional through tax credit, grants or product development partnership.
2. Pull mechanism: through advance market commitment. This could involve governments, Global Alliance for Vaccines and Immunization (GAVI) and the United Nations Children's Fund (UNICEF).

4. OIC capacity for manufacturing vaccine:

OIC-member states upon their political choice can contribute to the global health care by venturing into the domain of manufacturing and development of quality vaccine at affordable prices.

Vaccine industry in developing countries is represented by Developing Countries Vaccine Manufacturers Network (DCVMN) whereas those in developed countries are organized in the International Federation of Pharmaceutical Manufacturers & Associations (IFPMA). Currently the major contribution of IFPMA to global health is through research and development of newer vaccine. The DCVMN contribution is through manufacturing the required quantity of specially generic vaccine needed for EPI at affordable prices for market in developing counties.

Box 1. The acquisition of Bilthoven Biologicals of the Netherlands (a sole supplier of inactivated polio vaccines) by the Serum Institute of India (a member of DCVMN) has allowed the Serum Institute of India to target polio markets in developing and developed world. In another instance Shantha Biotechnics (an ex-member of DCVMN) was acquired by Sanofi Aventis enabling the latter to tap on Santha Biotechnics market at affordable prices.

The DCVMN contributed more than 30 vaccine types in different presentation that have been prequalified by WHO for immunization programs around the world. As of now there are a total of 39 member manufacturers in DCVMN from 15 different countries. Twelve members of them manufactured prequalified vaccine (they could supply vaccine to UN EPI). Only 4 companies from OIC-member states are members in the DCVMN, but only one of them, "Bio Farma" of Indonesia is WHO

prequalified. The company contributed 10 different vaccines amounting to 1/3 of total vaccine types provided by DCVMN.

Interest in vaccine manufacturing is noticeable in some other OIC-member states which exhibited potential for vaccine manufacturing either on its own such as Iran and Turkey or with partnership with foreign pharmaceutical companies such as Egypt, Morocco and Algeria.

Although manufacturing generic vaccine could be reasonably shouldered by some well-off country, the development of new vaccine is costly and could soar up to $500 million to $1 billion dollars constituting a prohibitive barrier for individual state to venture into this domain, Thus it is justifiable and feasible to consolidate financial and human resources within OIC-member states to enter this industry. OIC-member states collectively have the technological skills and production capacity and can tap on the experience gained within its members in DCVMN and other International agencies such as WHO, Netherlands Vaccine Institute (NVI), Bill and Melinda Gates Foundation and CDC, Atlanta.

Technology transfer is vital mechanism to enhance and hone the skills needed for manufacturing. Technical transfer could be either transfer of licensed vaccine which requires intense phase of vaccine specific knowledge and know how or transfer of key personal of global manufacturer until a robust process routine is achieved. The latter could be achieved by collaborating with GSK Vaccines Institute for Global Health (GVGH), the International Vaccine Institute (IVI), the Hilleman Laboratories, The Gates Medical Research Institute and the Influenza Vaccine Technology Transfer Center by WHO.

Example of technology transfer is best seen in the partnership between Program for Appropriate Technology in Health (PATH) and the Serum Institute of India. The former is tasked with product development and latter is responsible for manufacturing. PATH also cooperated with Bharat Biotech to develop low-cost rotavirus vaccine. Another example of technology transfer is seen between Butantan Institute and Sanofi-Pasteur to produce Influenza vaccine.

Aspects that need technology transfer may include:
1. Glycoconjugation to enhance immune reaction of bacterial pathogen that are coated with polysaccharide out layer.
2. Adjuvant research and vaccine presentation and delivery.
3. Newly emerging molecular biological techniques such as "sub units" vaccine and recombinant antigens.
4. Reverse vaccinology which involves screening of the entire genome with aid of bioinformatics to find genes that represent convenient vaccine targets. Subsequently these are produced synthetically and screened in animal models for the immune response.
5. Using mRNA carrying genetic code that upon being expressed will yield an immunogenic protein.

5. Funding:

The cost of establishing function facility for vaccine development and manufacturing is rather high considering the cost of research and development, operation animal models, testing the safety and effectiveness of the vaccine and the preclinical test, the clinical phases (3 phases) and regulatory licensing. Some vaccines may cost $500 million to $1 billion dollars due to mainly high clinical trials failure rates. It is often cited that candidates in every 5000-10000 compounds screened is approved by FDA.

It is up to the OIC political choice to embark on establishing a joint enterprise for vaccine manufacturing and development facility. Financial burden could be shared by the member states based on their GDP. Another source of fund could come from Zakat collected from Muslims all over the globe. A notion that had been propagated by HRH Prince El-Hassan bin Talal who advocated the need for establishing a framework for Zakat in the Islamic world to address its developmental challenges. In addition there exist possible international funding agencies that could be tapped upon. These include Wellcome Trust, PATH, European Union through Framework Program and European Vaccine Initiative (EVI) and the Coalition for Epidemic Preparedness Innovations (CEPI).

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GOVERNANCE IN UNIVERSITIES: INTEGRITY OR INTRUSIONS

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In the Islamic region, it matters in bringing shared enlightenment to the governance of academic institutions; and it matters in preserving the scholarship and full autonomy of universities away from the politics of changing governments.

This paper is directed to governing-board members, administrators, faculty members, students, and human and financial resources managers. Some universities have reached a stage of chaos calling for appropriate shared responsibility and cooperative action among the components of the academic institution. There is a need for constructive affirmative action within the institution to protect its integrity against improper intrusions.

Universities have been transformed from medieval Oxbridge ivory towers to business models. They have to be transparent, efficient, and accountable in running large modern campuses. Boards, presidents, provosts, deans, and heads of departments, in addition to being scholars, they should provide sound management of human and financial resources. Running a university with fiscal budgetary constraints but without adequate autonomy would lead to disaster. The academic institution, public or private, should have the autonomy of deciding on tuition fees to cover the cost of learning, infrastructure (buildings and grounds), maintenance, services, and utilities. Alternatively, university budgets have to be subsidized by government or funding agencies to cover the cost of learning.

University autonomy is crucial for the development of higher-learning institutions. Creating ministries of higher education has politicized universities and interfered in university governance, where institutions lost their authority on access to higher education and admission policy and procedures as well as the quality of learning for achieving intended learning outcomes (ILOs). There is a need for governments to reverse the process of decision-making back to board of trustees and not to ministries of higher education. A Central National Board of Higher Education will coordinate the national policy of higher education and recommended to be composed of chairs of boards of trustees and stakeholders to set the national policy of higher education, and the National Board will be served by executive committee of university presidents or rectors to coordinate and implement the national policy of higher education at their academia.

Structural adjustment to share participation of stakeholders with academia would strengthen the advancement of higher learning institutions for a sustainable future resilient for undertaking changes, in a rapidly changing market and society.

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SCIENCE FOR KNOWLEDGE-BASED ECONOMIC DEVELOPMENT OF THE ISLAMIC WORLD

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Higher Education and Scientific Proficiency are Main Drivers for Sustainable Development:

For developing countries, especially for economically and technologically disadvantaged ones, sustainable economic development needs to be focused on judicious use of existing resources and intellectual capital. Knowledge-based sustainable development requires quality higher education and proficiency in scientific, technological and social science disciplines that underpin socio-economic advancement. Excellence in higher education and quality of research are very closely related; the highest ranking universities of the world also happen to be the best research universities. It is no wonder that the top-ranked universities in the world are almost exclusively situated in the economically and technologically advanced countries in the North with a handful in the rapidly advancing countries, and only a few in the rest of the developing world. In rapidly advancing countries of the developing world, it has been conclusively shown that development of robust domestic PhD programs has directly coincided with rapid economic growth.

In the OIC (*Organisation of Islamic Cooperation*)-member countries also, excellence in higher education and sustainable economic development are critically dependent on scientific proficiency and existence of a solid technology base. Because of relative weakness in science and technology, none of the 57 OIC-member countries are classified as being economically advanced; with many categorised as scientifically-lagging. 21 Islamic countries, predominantly in Sub-Saharan Africa, are classified as *least developed countries* (LDC). Most Islamic countries remain poor and technology deficient. It is not surprising that there are very few universities in the Islamic World that are ranked within the top 400 in the world. Wealth by itself is not the only determinant of economic and scientific advancement. Some oil-rich states, which have opted to buy in expensive readymade technology and expertise to showcase their apparent spectacular economic progress, still do not qualify as advanced economies as they have not yet succeeded in building intrinsic scientific proficiency and quality higher education required for sustainable growth.

The attainment of knowledge-based sustainable development in all OIC-member countries is incumbent upon quality at all levels of education and development of postgraduate research and innovation through the establishment of "world-class" research universities, that can produce PhD researchers and have the capacity to carry out internationally competitive research in strategic and priority areas. So that no country or region in the Islamic World is left behind, it is important to ensure that even the poorest LDCs have at least one such research university. To identify such existing and potential universities in the Islamic World, the *Islamic Development Bank* (IsDB), OIC and the *Islamic-World Academy of Sciences* (IAS) commissioned an extensive study to measure research productivity of different universities based on various parameters (SESRTCIC Report, April 2007)). Provisional rankings of universities within the OIC region, based on information supplied voluntarily by some, has been obtained by using different data sets of overall research productivity. The figures unfortunately suggest that the research productivity of even the highest ranked universities in the OIC region is almost negligible in comparison to top-ranking universities in the developed world.

Some Factors that Adversely Affect Teaching, Training and Research Outcomes in many Universities of the OIC-member countries.

Funding for national education and R&D remains extremely low in most OIC-member countries, amounting to only a fraction of that recommended by UNESCO for developing countries (20% of annual budget or 6-8% of GDP for education, and 2% of GDP for R&D). There is almost negligible funding earmarked for higher education and postgraduate research in most Islamic countries.

Higher education curricula followed in Islamic countries are often not adequately geared towards producing science and technology graduates appropriately trained for the local markets. As a result, there is a disconnect

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between the type of professionals required by the job market and graduates produced by higher education and technology institutions. This results in high unemployment of graduates, and their eventual deployment in jobs that don't require their hard-earned training and expertise.

In most universities and research institutions in the Islamic world there is a serious lack of "critical mass" of fulltime researchers such as PhD students and post-doctoral fellows who drive the engine for economic growth and innovation in developed nations. At the same time there is often very little opportunity to study for a PhD or to carry out postdoctoral research in many Islamic countries. Besides lack of funding for postgraduate research there is also very negligible collaboration with industry for product or process development. Industry funding of developmental research in universities, a strong feature in developed nations, is almost non-existent in most of the Islamic world.

Home-grown research productivity and innovation are given a lot of lip service but, in reality, are not national priorities in most Islamic countries. With the exception of perhaps a few countries (such as Pakistan, Malaysia, Turkey), research productivity is not considered to be an important determinant for personal advancement of academic staff. In a majority of Islamic countries, teaching and administrative loads of senior academics is too high leaving little time for research and for adequate supervision of junior researchers and research students. Internationally competitive research is seriously impeded by scarcity of competitive research grants, inadequate infrastructure and unavailability of major equipment and cutting-edge technologies.

Even with very limited research funding, resources are spread too thin because of misguided emphasis on quantity over quality, and a lack of focus in areas of strength or national and regional priorities. Many Islamic countries share common problems but there is very little regional coordination and cooperation for meeting these common challenges. The ultimate consequence of the myriad of problems facing academics and researchers is the very **debilitating brain drain** from the Islamic world to the economically advanced countries in the West. This is also true for much of the developing world.

The Need to Arrest and Reverse the Brain Drain

It is natural for bright young professionals to seek better opportunities elsewhere because of the poor remuneration and living conditions, inadequate research facilities, and political instability in many of the Islamic countries. Because of dearth of quality PhD programmes at home many of the brightest and most talented students avail the opportunity to study and train abroad but often find it difficult to return to their countries of origin. Many of those who do return to make a contribution eventually migrate in frustration. Personal and material gain, however, is not always the only or major contributing factor for migration.

Postgraduate training in the advanced countries of the West has often very little relevance to the needs of home countries of the students, and training grants and scholarships offered are rarely in areas of need and priorities of the originating countries. On returning home they often find that the research atmosphere and availability of adequate resources are not conducive to continuation of sophisticated research they were involved in during their overseas training. Most importantly they find a serious lack of opportunities to get involved in "world class" research on national or regional problems while working in their own countries of origin. This is perhaps the most compelling reason for the brain drain.

A very useful approach to obviate the above problems would be to institute a "sandwich PhD programme" where postgraduate students would initiate their research in their home country on a topic of national relevance, and spend a period of time overseas in a co-supervisor's laboratory to access high-end technology and expertise, and then return home to complete the PhD research. It would be ideal if overseas co-supervisors were well-established expatriate scientists from the Islamic world as this would enable them to be involved in research, and contribute to capacity development, in their home countries. Such approaches could not only lessen frustration-led migration of young researchers but could also lead to overall brain gain.

It is ironic that the engine for research, and especially modern biosciences research, in the West is largely driven by an army of young scientists from the developing world while there is an acute shortage of trained manpower in their own countries of origin. Of foremost importance is the production of adequate numbers of PhD graduates locally, and creation of conducive conditions for doctoral and postdoctoral research and intellectually stimulating and meaningful employment that keeps them at home. It is unfortunate that expatriate scientists from scientifically lagging and least developed countries are contributing to wealth creation in the West, instead of being provided the opportunity to help build and develop their own countries with their research expertise.

If the debilitating brain drain is to be stemmed then the Islamic countries together must strive to drastically improve the research environment and transform the research culture in their universities. A very serious

effort should be made to ***transform the brain drain*** from the developing world to the industrially advanced countries ***into brain retention and brain circulation*** within the OIC region through appropriate support for both basic and applied research. Additionally, the development of a vibrant and supportive research atmosphere, and provision of decent living and working conditions, would not only help to retain local talent but could also persuade expatriate researchers to return home permanently or periodically. Failure to create such conducive conditions will accentuate the debilitating brain drain. A further aim should be to ***develop a brain bank*** by tapping into the enormous reservoir of talent and expertise available within the community of expatriate scientists and encouraging them to contribute to the development of science and technology in their countries of origin.

Need-Based Higher Education and Goal-Oriented Postgraduate Research and Innovation:

The quality of science-based higher education is very much dependent on the quality and extent of teaching of STEM subjects at primary and secondary levels of education. So, the foremost need is the production by tertiary institutions of sufficient numbers of trained and adequately remunerated teachers. Post-secondary education in developing countries should have much greater emphases on need-based technical and vocational training with curricula aimed at full employment of local graduates, and for avoiding the disconnect between what is taught in tertiary institutions and market requirements.

It is well understood that quality postgraduate research is a major determinant for assessing the quality of universities. Both quality higher education and scientific research are very expensive and often beyond the reach of many countries of the Islamic world, where meagre funding for university research is usually spread too thin. So, in initial stages it is important to focus on a small number of projects of highest priority and collaborate and share resources with other universities and research centres, and form partnerships with industry for product and process development. Such productive interactions could be expanded to include universities in other Islamic countries in areas of common interest through South-South academic collaborations between productive research centres, in different OIC member countries, possessing complementary expertise and facilities. Postgraduate training in technologically more advanced OIC-member countries will greatly benefit researchers from economically disadvantaged and scientifically lagging Islamic countries.

Of seminal importance is the transformation of research culture with increased emphasis on multidisciplinary and multi-institutional collaboration, development of Intellectual Property (IP), technology transfer to industry, and commercialization of research achievements. Strategic and long-term funding for both basic and applied research, through instituting competitive research grant schemes and doctoral and post-doctoral fellowships, is critically important to support collaborative research in areas of priority. It is also very important to pay competitive salaries to academics and researchers, with additional rewards and incentives for research productivity based on publications, patents and technology transfer. It is also very important to establish active partnership with local industries to fund academic and developmental research for product and process development. Unfortunately, productive university-industry linkages are very rare in Islamic countries.

Need for Multidisciplinary Collaboration and Focus in areas of Priority

Most countries in the Islamic world lack adequate resources and infrastructure needed for undertaking world-class research in experimental sciences. It is, therefore, not practical for the scientifically lagging OIC-member countries to aim to be internationally competitive and productive simultaneously in all areas of research. To make the best use of meagre research funds, and in order to improve research productivity and proficiency, there needs to be regional focus on only a small number of priority areas of common interest where there is greatest need and also existing strength and potential. Productive research in these areas will greatly benefit from multidisciplinary and multinational collaboration and cooperation between active research groups and centres possessing complementary expertise and resources.

There is widely held view among policy makers that scientifically lagging and least developed countries don't have the resources and competencies needed to carry out internationally competitive research, particularly in the molecular biosciences, and this expensive exercise should, therefore, be left to the R&D laboratories in the West and in some rapidly advancing countries of the developing world. Such thinking ignores the actual needs, and underestimates the existing capabilities, in the scientifically lagging and least developed countries, and if pursued will ensure that the agenda for growth and sustainability will continue to remain externally driven. In reality, many resource and technology-poor Islamic countries possess very valuable human and intellectual capital, and need to be provided the opportunities to contribute to internationally competitive research that benefits them and the Islamic world.
The solution lies in developing bold initiatives for the modernization of the educational system and building

internationally competitive research capacity through the pooling of resources and expertise within the entire Islamic World. This is where COMSTECH (OIC's Standing Committee on Scientific and Technological Cooperation) can play a very decisive role. However, for this strategy to succeed it is necessary to focus on a small number of initiatives where there is the greatest need and existing strength, and ensure that such priority research has ready access to all required cutting-edge technologies, major equipment and regional core facilities, and has government support through uniform and common IP and regulatory guidelines. Such initiatives will greatly benefit all scientific disciplines, and particularly biopharmaceutical and biotechnology research, in the Islamic world. COMSTECH and IAS, with support from IsDB, could play a catalytic role by enabling and coordinating the development of world-class biomolecular research capacity in the OIC member countries.

Examples of Multinational and Multidisciplinary Biopharmaceutical Research that could Produce Intellectual Property (IP) and Create Wealth for the Islamic World:

There are undoubtedly many areas of high priority research that needs to be carried out in the Islamic world to address common challenges such as Food Security, Health Equity, Renewable Energy, and protection of environment and biodiversity. They are all equally important and need to be championed by experts in the areas. Presented here are only two examples of high-tech Health-related research that could be carried out in, and benefit, the entire Islamic world. These research initiatives would provide excellent opportunities for multi-institutional and multidisciplinary collaborations and for advancing postgraduate and postdoctoral research within the Islamic world.

Health Equity through ready availability of affordable and effective medicines is one of the major concerns for the entire Islamic world. The demand for low cost and effective medicines has till now been largely met through **generic** medicines, which are exact copies of novel small molecule blockbuster drugs. A substantial amount of generic medicine is sourced from developing countries including some in the Islamic world. However, the pipeline of new small-molecule drugs, from which generic medicines are copied, have almost dried up as multinational drug companies have turned their attention largely to new types of therapeutics to meet emerging health challenges.

This provides an opportunity for Islamic countries, including the low-income ones, to get involved in research for the discovery and development of new medicines based on their existing resources and strengths, and by the judicious use of patent exemptions afforded by the *World Trade Organisation* (WTO) to LDCs. There are two areas of pharmaceutical research in the Islamic world, including the low-income LDCs, that have huge potential through multinational and multidisciplinary collaborations between academic and industrial research groups in different parts of the Islamic world. Such collaborations involving research groups in different Islamic countries would be greatly aided by uniform IP and regulatory guidelines. These two areas of biopharmaceutical research were recently (Dec 12, 2020) presented in some detail in a COMSTECH webinar *"Opportunities in the Islamic world for the production of novel natural product-based therapeutics, and affordable Biosimilar Medicines"* (link: *https://youtu.be/8gqfgwr9iDE*). The main points of the webinar are summarised below:

(i) Novel Medicines from Indigenous Biota:

One very promising area of drug discovery and development where Islamic countries, irrespective of economic and developmental status, can productively collaborate, is through **"rational" bioprospecting of the Biota**. Most Islamic countries are endowed with diverse hotspots of unique flora and fauna, and rich traditional medicine systems. Ethno-pharmacologists and medicinal chemists all over the Islamic world have been very prolific in publishing scholarly research articles, but relatively little of this has translated into scientifically-verified safe and efficacious modern drugs. Natural products-based drug research would be greatly enriched by additional involvement of biomolecular researchers studying the molecular basis of disease pathogenesis. The starting point in drug discovery and development could be the **identification of novel lead compounds** from using simple **disease-specific molecular target-based bioassays** to screen libraries of indigenous flora and fauna (as total extracts or isolated organism-specific bioactive molecules). Secondary metabolites of plants, and toxins and venoms of many organisms, have very unique molecular structures and often very specific biological functions. Many of these unique compounds have been the source of well-known modern medicines, and others could have specific medicinal properties that still remain to be discovered.

Both the development of the highly specific bioassays and the discovery of the novel lead molecules would lead to new and very valuable IP that could encourage the involvement of pharmaceutical companies in developmental research and commercialisation. Contemporary chemical and molecular technologies, available in some research centres in more advanced Islamic countries, could be used in the optimisation of the novel lead molecules into candidate drugs (new IP).

Potential drug industry partners, attracted by the series of new IP generated, could be encouraged to collaborate with academic colleagues in carrying out the preclinical animal studies and human clinical trials, and help with the regulatory process and commercialisation.

(ii) Production of Affordable Biosimilar Medicines for the Islamic World:

The second promising area is the development of affordable new biopharmaceuticals by taking advantage patent concessions accorded to LDCs by the WTO. Because of environmental changes and consequent changes in disease patterns, multinational drug companies have largely turned their attention to a new class of very efficacious protein-based pharmaceuticals (**Biologics**). The earlier Biologics were human enzymes, hormones, growth factors and cytokines produced by recombinant DNA technologies. Cheaper versions of earlier (out of patent) biologics, termed **Biosimilars,** have been produced in some developing countries, including a few in the Islamic world, from molecular clones made available by the International Centre for Genetic Engineering and Biotechnology (ICGEB).

The **latest Biologics** are monoclonal antibody (Mab)-type molecules. This new generation of life-saving drugs are extremely expensive (at least $ 50 thousand/ patient/ pa) and simply beyond the means of most people and poorer countries of the developing and Islamic world. There is, therefore a huge demand for the production of cheaper Biosimilars of these wonder drugs through reverse-engineering and recombinant DNA technology. As most Mab-type Biologics are under patent, countries that are the main producers of Biosimilars cannot copy originating Biologics till they come out of patent. Luckily LDCs are exempt from patent restrictions till 2032, and are free to legally copy and produce any drug on the market irrespective of their patent status. Besides exemption from patent restrictions, affordability of new Biosimilars will be contingent upon the development of seed molecular clones in a technology competent LDC.

At least one country in the Islamic world that falls in that category, Bangladesh, has already developed the technological capacity to produce molecular clones of these new Biosimilars. Moreover, Bangladesh has a very well-established pharmaceutical industry that manufactures and exports high quality, and inexpensive, generic medicines to over 130 developed and developing countries including 19 LDCs mostly in Sub-Saharan Africa. However, any LDC that is chosen would need access to cutting-edge technologies available in technologically more advanced Islamic countries, and also require support in carrying out preclinical animal studies and human clinical trials, and in obtaining regulatory approval in OIC-member countries.

While patent restrictions could be avoided, and competitive advantage gained, by producing Biosimilars in suitably competent LDCs, their commercialisation, marketing and affordability in the Islamic world would be greatly impeded unless the cost and time required for gaining regulatory approval are minimised. The stringent and obligatory preclinical animal studies and human clinical trials are very expensive, and unless their costs are substantially reduced, without compromising their safety and efficacy, new life saving drugs developed and produced in any Islamic country will not become affordable and readily available to the common man in the Islamic world.

While US FDA and EU EMA regulations can provide some useful guidelines, medicine regulatory authorities in Islamic countries should take an independent stand to support development and manufacture of new biopharmaceuticals in the Islamic World by helping to reduce the cost and complexity of the regulatory process. Serious consideration should be given to the establishment of an OIC-wide *medicines regulatory authority* (OIC MRA) (with similar jurisdiction as the EU EMA) whose job would be to develop, monitor and implement uniform policy and regulatory guidelines to support and protect the special interests of the pharmaceutical sector throughout the Islamic world. OIC and COMSTECH should also seriously consider establishing strategically located and internationally credible Contract Research Organisations (CRO) that would conduct, at competitive rates, preclinical and clinical trials of candidate drugs developed and manufactured in OIC-member countries

Capacity Development for Internationally Competitive Research and Training:

In order to become internationally competitive, all areas of priority research and the different contemporary scientific disciplines need to build the required world-class research capacity. One of the biggest obstacles to sustainable knowledge-based economic development in the OIC region is the huge "R&D chasm" that exists between initial discovery and its final commercial or social outcome. This serious structural deficiency can't be overcome by supporting only late stage commercial research and importation of technology for that purpose. There must be very strong support for fundamental and developmental research preceding commercialization, and ready availability of contemporary technologies and expertise. Science-based higher education and postgraduate research are quite expensive and not possible without strong political will of governments of Islamic countries, their ability to see the big picture and willingness to spend big to catch up, and remain competitive, with industrialised countries.

As a start, COMSTECH, IAS and national science academies of Islamic countries together could play a critical role in sensitizing the governments of OIC-member countries and persuading them to make the minimum allocations recommended by UNESCO, and establish at least one Research University and one "Centre of Excellence" (national technology hub) in each country. The materially rich countries could host regional "Core Facilities" (high-end technology platforms and special facilities) that can't be replicated in each individual country, and that are critical for the scientific advancement of lesser developed countries.
COMSTECH and IAS, backed by governments of OIC-member countries, and with the support of IsDB and other development partners, should also aim to set up a Trust or Foundation to substantially fund and coordinate multidisciplinary and multi-institutional research in common areas of highest priority within the OIC region. These research and development initiatives could be supported through an OIC Collaborative Research Program that would require applicants to forge multidisciplinary and multi-institutional collaborations between research and development teams from academia, research institutions, regional technology and resource centres, and industry from within the OIC-member countries. Such a collaborative programme will be critically dependent on the availability of postgraduate studentships, and post-doctoral fellowships to run the research engines of Islamic countries. Short term travelling fellowships that allow young researchers in Islamic countries to access cutting-edge technologies and expertise in the laboratories of established expatriate scientists resident in advanced countries, and travelling fellowships to allow expatriate academics and researchers to visit and contribute to scientific development in Islamic countries, could greatly enhance research capacity development in the Islamic world.

NOTE: POWERING THE INTERNET

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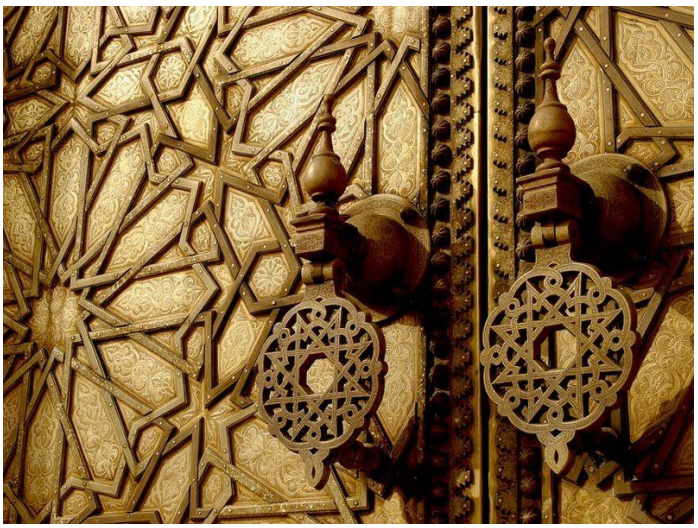
Sustainable availability of energy is the basic need for sustainable development of a society and its different and diverse operations. With the passage of time, more and more this energy is expected to be in the form of electricity and ultimately it is likely to represent more than 95% of the total global energy which was 27,644, 800 GWh in 2019 corresponding to a global installed power capacity of 7,679 GW, Reason for this trend is that this form of energy is highly flexible and practical to use that can vary from milli-watts to Megawatts depending on the type of the electrical and electronic tools involved.

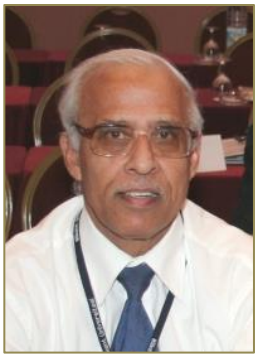
Although the average use of electrical energy is moderately increasing with time, its use is increasing quite fast in the domain of Internet - the present global communication infrastructure. This system used 8 % of the total electric energy produced in the world in 2012; in 2020, 10% of it was used by 4.66 billion active Internet users (about 69 % of the global population) and it is expected to reach 20 % by 2025. This will be the case in spite of the fact that the data centers that consist of groups of networked computer servers used for remote data storage, processing and distribution of a large amount of them and can consume up to 30 GWh/year, have been able to reduce their energy loss due to heating in the electronic systems to a negligible amount using efficient cooling technologies.

However, there is a strong positive side to this development, because the rapidly developing global Internet activity is playing an important role in driving and enriching the global social, cultural and educational activities and a rational and environment friendly economic growth through virtual digital means.



FRAGILE EXISTENCE OF THE DARK ENERGY?

*M. Asghar FIAS**



Abstract: This article presents the different types of evidence against the existence of dark energy in the universe, which is supposed to be the cause of the acceleration of the universe expansion.

1. Evidence of Dark Energy from the Study of Supernovae 1a

1. The accidental but Nobel Prize in physics winning discovery by Arno Penzias and Robert Wilson in 1964 (1) of the 2.752° K blackbody cosmic microwave background (CMB) radiation with its space-isotropic distribution was a watershed event for cosmology and its expansion.

After this, in 1998 the work of two groups (2, 3) showed that the universe's expansion is accelerating and were awarded the 2011 Nobel Prize in physics. They (2) used 18 low and 42 high red-shift supernovae 1a (SN 1a), the "cosmic standard candles", whose peak luminosity was corrected through the empirical standardization using the supernova 1a light-curve width-luminosity relation to ensure that their luminosity would not evolve as a function of the magnitude of their redshifts. Using these effective luminosity values (representing the distances to the different SN1a's) and the redshift data, they constructed the Hubble diagram which was fitted to the Friedman-Lemaître-Robertson-Walker (FLRW) magnitude and redshift relation for a flat ($\Omega M + \Omega\Lambda = 1$) cosmology. Here, M represents the sum of the ordinary/baryonic and dark matter and the Einstein positive cosmological constant Λ represents the repulsive dark energy. The data exclude strongly an open $\Lambda=0$ cosmology, and the best fit gives $\Omega M = 0.28$ and $\Omega\Lambda = 0.72$ leading to the conclusion that the expansion of the universe is accelerating through the presence of the repulsive dark energy.

Since the FLRW metric follows the cosmology principle under which the distribution of energy and matter in the universe is considered isotropic and homogeneous. Hence, the dark energy in the universe should have an isotropic distribution.

2. The dark energy from the Planck probe.
The cosmological model (ΛCDM) based analysis of the Planck cosmology probe CMB data shows that the universe contains 4.82% ordinary matter, 25.8% dark matter and 69% dark energy (6).

2. Problems with Dark Energy

1. The cosmological constant.
The cosmological constant $\Omega\Lambda$ as the repulsive dark energy represents around 0.69 % of the matter and energy content of the universe. The origin of this energy is thought to be the vacuum or zero-point energy of the universe. However, the well-established quantum field theory calculates a value that is 10^120 times bigger than its observed value. If it is not the vacuum or zero-point energy, then, what is the origin of this energy? One does not really know.

2. Statistical analysis of the supernovae 1a data in terms isotropic monopole and directional dipole components.
Recently Jacques Colin et al. (4) carried out a maximum-likelihood statistical analysis of the luminosity-distance data of 740 supernovae 1a using the theoretical luminosity-distance dL of the cosmological principle-based standard ΛCDM model. They developed the dL into a series allowing them to fit the data into a bidimensional isotropic monopole qm and directional dipole qd distribution, Fig1. The cosmic 'deceleration parameter' inferred from the catalogue of Type Ia supernovae is negative (i.e. the expansion rate is accelerating), but it is mainly an anisotropic dipole (q_d) pointing significantly (3.9σ) towards the CMB dipole with qd = -8.03, while its monopole (q_m) component is close to zero rejecting isotropy with 3.9σ . The current 'standard cosmological model' (2, 3) (indicated by a blue star) which has $q_m = -0.55$ and $q_d = 0$, favoring the presence of an isotropic dark energy, is excluded at over 4σ.

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The authors claim that this dipole alignment with the CMB dipole is expected, if the apparent expansion acceleration is an artifact of our being located in a non-Copernican "local bulk flow" caused by the peculiar velocities induced by the gravitational attraction of the surrounding galaxies and clusters. If this dipole acceleration through the local bulk flow, is confirmed through other sources, it would seriously weaken the cosmological principle – the basis of the Cosmological *Model* (ΛCDM).

Jacques Colin et al. in their work used the heliocentric red-shifts, while the authors (2,3) used the CMB-rest-frame red-shifts after the correction for the peculiar velocities.

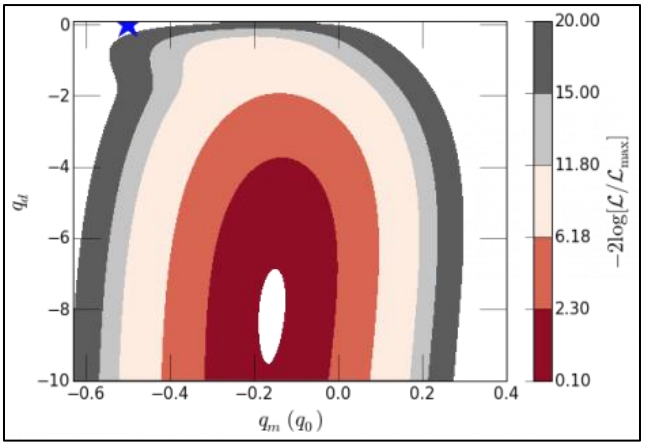

Fig.1.

3. Supernovae luminosity evolution of as a function of the age-dating of their host galaxies.

As mentioned in sec.1, the peak luminosity correction through an empirical standardization technique was meant to ensure that the luminosity of the supernovae 1a would not evolve as a function of their red-shift values. However, the recent (5) high precision age-dating of the supernova host galaxies as function of red-shift values reveals that the luminosity evolution of the supernovae 1a is significant, Fig.2, which reproduces the experimental Hubble residual rather well and questions the very existence of dark energy, because this evolution is not taken into account by the standardization technique (1,2).

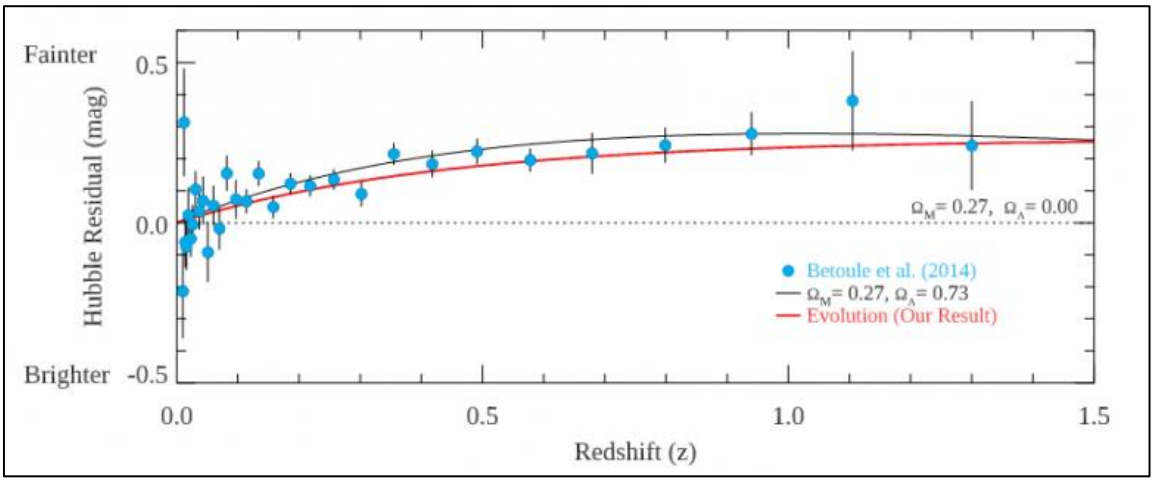

Fig. 2. Luminosity evolution mimicking dark energy in supernova (SN) cosmology (5).

The Hubble residual is the difference in the SN luminosity with respect to the cosmological model without dark energy (the black dotted line). The cyan circles are the binned SN data from Betoule et al. (2014). The red line is the evolution curve based on our age dating of early-type host galaxies. The comparison of our evolution curve with SN data shows that the luminosity evolution can reproduce the Hubble residuals used in the discovery and inference of the dark energy (the black solid line).

4. Baryonic acoustic Oscillations.

The analysis of the local cosmological probes including the "sound horizon" data of the baryonic acoustic oscillations, shows that low-redshift data are consistent with a nonaccelerated universe (7).

5. Inhomogeneous cosmology/ Timescape cosmology.

The cosmological principle which is the basis of the flat-universe (FLWR) metric, states that distribution of mass on grand scale in the universe is homogeneous and isotropic. However, on smaller scales, the presence of matter in the universe is lumpy arranged in galaxies and clusters (8). In between these islands of matter, there are vast voids with low density of matter. Due to the *gravitational time dilation*, the apparent expansion rate of space will be different depending on whether one's frame of reference is fixed in a galaxy/ cluster or in a low-density void. As the measuring frame is always mass based, the time runs slower here than in a void-based frame of reference. It is quite likely that, at present, the space of voids occupies more than half of the universe. Averaging the expansion rate across all the space of voids and galaxies/ clusters, will lead to an apparent faster expansion rate, because voids dominate, giving the *illusion* that the universe expansion is accelerating.
Could the Planck probe CMB-data-based dark energy value of 69% be an *artifact* of this inhomogeneous cosmology?

3. Conclusions

The different types of evidence presented here, tends to show the fragility of the existence of the dark energy, and casts doubt on the acceleration of the expansion of the universe.

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LITERACY AND HUMAN DEVELOPMENT INDEX IN MUSLIM MAJORITY COUNTRIES

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Education is fundamental for development of any nation and higher education is a powerful tool for the eradication of poverty, boosting shared prosperity and making the society strong enough to face challenges of times. This basic fact was very well known to Muslim Ummah during Middle Ages, a Golden Period in Islamic History. "Seek Knowledge" was the known Commandment of Islam for Muslims and they followed it for almost eight hundred years.

Edward G. Browne (1862-1926) rightly observed that, "when Caliphs of Baghdad and Cordova fostered education amongst their subject to the extent that every boy and girl of twelve could read and write, Barons, Lords and their ladies in Europe were scarcely able to write their names (A literary history of Persia, 1902). This was the time when Muslims around the world excelled in all the forms of knowledge for almost eight hundred years and therefore, Marquis of Dufferin and Ava rightly remarked, "It is to Mussalman Science, to Mussalman Art and to Mussalman Literature that Europe has been in a great measure indebted for its extraction from the darkness of the Middle Ages." (Speech delivered in India, 1890). Alas, what happened to Muslims that they distanced themselves from knowledge after 15th century and therefore lost their dominance in world affairs? Literacy languished in all parts of the Islamic World. According to historian Donald Quataert, Muslim literacy rates were only 2 to 3 percent in the early nineteenth century. Even during the mid-twentieth century the situation was not satisfactory. Only few countries like Egypt, Tunisia, Iran, Jordan, Kuwait, Malaysia, Syria, Turkey and Albania had the average literacy of more than 30 percent. Muslim areas under Soviet Union had of course had high literacy rates. This situation (fall) of literacy in the Muslim world was described by George Sarton as "Puzzling" and earlier extraordinary high literacy during early Islam "Baffling" (History of Science).

Muslims around the world during the last four century showed great interest in every aspect of life except education. Poetry, music, painting, ceramics, architecture, metal work etc… became important activities throughout the Islamic world. But very little interest was shown to the fast developing modern education coming from Europe. Probably the most harmful act was their refusal to allow the use of Printing Press in 15th Century, a turning period for Europe. Through the Printing Presses, scientific revolution was made possible in all the sphere of scientific and industrial activity in Europe.

After a long spell of slumber, Muslims all over the world have started to understand that without modern knowledge and higher literacy their exploitation by the West cannot be checked. Fortunately, education is re-emerging in the Islamic World during recent past. Muslim countries are taking strong steps, largely because of economic strength of Oil, for the eradication of poverty and illiteracy.

According to the survey by John Miller, 5 Muslim countries namely Azerbaijan, Tajikistan, Kazakhstan, Turkmenistan and Uzbekistan find places amongst 25 countries with highest literacy rates of 100%. World Bank and UNSECO data for 2018 shows that 25 Muslim Majority countries have achieved average literacy above 90 per cent. These include Saudi Arabia (95%), Indonesia (94%), Malaysia (94%), Iran (90%), Jordan (96%), UAE (94%) and Turkey (95%). Nine countries, including Syria (86%), Tunisia (82 %), Iraq (79%), Egypt (75%) Algeria (73) are and Morocco (72%) were reported to be in the bracket of 70% to 89%. Unfortunately, fifteen countries including largely populated countries of Bangladesh, Pakistan and Nigeria still lag behind in literacy (Less than 62%). However, compared to the literacy Data of 1980 (Av. 30%), 2018 data is highly satisfactory. Global literacy rate (2017) is 82% (Men, 87%; Women 77%).

A redeeming feature is the fact that the Gender Difference (Men and Women) in literacy in many Islamic countries has also fallen sharply. At least 21 countries have the difference only 0 to 7% only.

Tertiary Education (Higher education in all the disciplines of knowledge) in Islamic world needs serious attention. King Mohamed VI of Morocco stressed that "…the integrated development of the principles of Islam and of scientific knowledge (tertiary education) must be achieved irrespective of gender" (UNESCO Conference, 2000). Yes, it is true that scientific awakening is under way in Muslim World. Research spending in many countries, like Saudi Arabia, Iran, Qatar, Turkey etc… has been raised substantially. Tertiary Education in Western countries is generally above 40% whereas barring few countries like Turkey, Saudi Arabia and Indonesia, it is between 2 to 6%. Research spending in Muslim countries also needs serious attention. Only countries like Turkey, Saudi Arabia, Iran and Qatar have substantially raised funds for this purpose. Qatar is reported to have proposed the raise of the Science budget from 0.8% to 2.8% of its GDP.

Many Muslim countries have already established centers of higher learning (Universities) with emphasis on the modern sciences. According to The Times Higher Education World University Rankings 2018 (for 2016-2017), ninety six universities from Muslim

countries have been listed amongst the top 1102 Universities of the world. This is definitely a positive sign towards the need of higher learning in the Islamic World although universities of only 18 Muslim countries could find places in the list. Hope other Muslim countries will find their names in future reports. Of the 96 listed Universities, 22 belong to Turkey followed by Iran 18; Pakistan, 10; Malaysia and Egypt 9 each; Saudi Arabia, 5; U.A.E. and Indonesia 4 each; Jordan and Morocco 3 each; Tunisia 2 and Algeria, Bangladesh, Kuwait, Lebanon, Nigeria, Oman and Qatar 1 each.

Women emancipation can also be felt by a report "that the United States falls behind thirteen Muslim countries in the percentage of women graduating in science to the total science graduate population. The countries whose ratio of women science graduates exceeds that of the United States include Bahrain, Brunei Darussalam, Kyrgyzstan, Lebanon, Qatar and Turkey. Morocco exceeds the United States in the ratio of women engineering graduates as a percentage of the science graduate population." (missionislam.com). Women enrollment for Higher education is more than men in many Islamic countries including Tunisia, Malaysia, Lebanon, Jordan, Bahrain and Libya.

There is no doubt that Muslim World is taking necessary steps, largely because of economic strength of Oil Producing Muslim countries, to compete with the West for the eradication of poverty and illiteracy; still a lot is yet to be done. It is unfortunate that out of about 500 Noble Awardees in Sciences from 1901 to 2013, only two are from Muslim world, namely Ahmed Zewail (Egyptian) who got Noble Award in 1999 for his Chemistry Research and Aziz Sancar, also in Chemistry, from Turkey in 2015. According to a report by Islamic Research Foundation International, U.S., had there been Noble Prize, of course under different name, during Middle Ages, all the prizes would have gone to Muslim Scientists (Report 2013).

Some years back only seven Universities from the Islamic world were listed in the top 500 World Universities. However, according to The Times Higher Education World University Rankings 2018 (for 2016-2017), eighty four universities from Muslim countries have been listed amongst the top 1102 Universities of the world. This is definitely a positive sign towards the need of higher learning in the Islamic World.

A redeeming feature in the rankings is the fact that in forty one universities, female students are higher in numbers than male students. Eleven Universities have more than 65:35 female: male ratio with Imam Abdulrahman Bin Faisal University (22,257 students) of Saudi Arabia having the highest ratio of 81:19, followed by United Arab Emirates Univ. (7,492 students) 79:21, Qatar Univ., (13,342 students) 73:27 and Kuwait Univ., (37,752 students) with the ratio of 72:28. T (Please See the Tables).

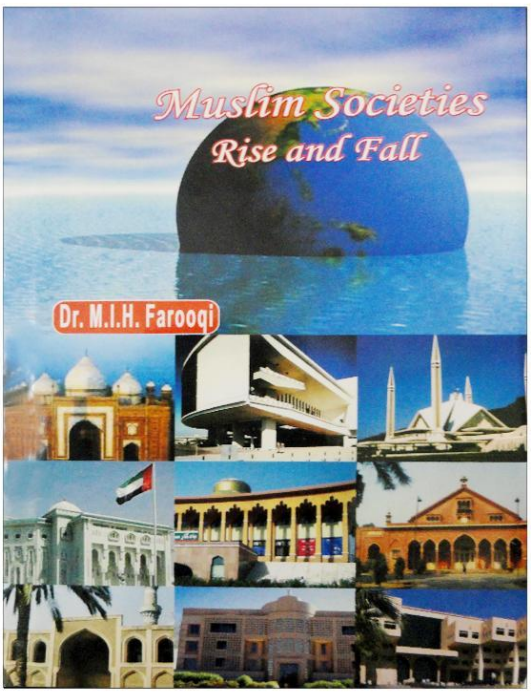
Table I : Status of Muslim Countries-Literacy and HDI

COUNTRY	Literacy Rate 1980/2018	Men/ Women Difference 2007/2018	Human Development Index (Rank) 2018
AFGHANISTAN	12/38	30/27	0.498(168)
ALBANIA	NA/98	13/1.5	0.785(68)
ALGERIA	37/73	20/14	0.754(85)
AZERBAIJAN	NA/100	1.3/0.0	0.757(80)
BAHRAIN	73/96	7/0.5	0.846(43)
BANGLADESH	26/62	22/6	0.46.08(136)
BOSNIA	NA/99	7/2	0.768(77)
BRUNIE	63/96	5/2	0.853(39)
BURKINO FASO	12/36	20/13	0.423(183)
CHAD	15/38	17/16	0.404(186)
COMOROS	NA/78	NA/8	0.503(165)
DJIBOTI	32/67	20/20	0.476(172)
EGYPT	44/75	21/16	0.696(115)
ERITREA	52/74	21/15	0.440(179)
GAMBIA	16/56	NA/16	0.460(174)
GUINEA	25/30	27/15	0.459(175)
GUINEA BISSAU	NA/60	30/23	0.455(177)
INDONESIA	62/94	10/4	0.694(116)
IRAN	50/90	12/8	0.798(60)
IRAQ	50/ 80	31/11	0.685(120)
JORDAN	80/97	10/3	0.7535(95)
KAZAKHSTAN	NA/99	1.2/0.2	0.800(58)
KOSOVO	NA/92	NA/9	NA(NA)
KUWAIT	60/96	4/1.9	0.803(56)
KYRGYZSTAN	NA/99	1.2/0.2	0.672(122)
LEBANON	74/94	11/4	0.757(80)
LIBYA	50/91	20/11	0.76(108)
MALAYSIA	60/95	6/3	0.802(57)
MALDIVE	NA/99	NA/2	0.717(101)
MALI	10/39	NA/19	0.427(182)
MAURITIANA	17/52	21/21	0.520(159)
MOROCCO	28/72	25/20	0.667(123)
NIGER	8/19	17/16	0.34(189)
NIGERIA	NA/59	15/19	0.532(157)
OMAN	NA/94	16/6	0.821(48)
PAKISTAN	31/59	27/26	0.562(150)
PALESTINE	NA/97	NA/3	0.686(119)
QATAR	76/98	1/0.6	0.856(37)
S. ARABIA	50/95	14/5	0.853(39)
SENEGAL	10/56	25/24	0.505(164)
SIERRE LONE	15/48	20/21	0.419(148)
SOMALIA	20/39	25/24	NA(NA)
SUDAN	20/76	20/14	0.502(56)
SYRIA	53/86	26/10	0.536(155)
TAJIKISTAN	NA/100	0.5/0.0	0.650(127)
TUNISIA	55/82	18/15	0.735(95)
TURKEY	60/95	17/6	0.791(64)
TURKMENISTAN	NA/100	1/0.0	0.706(108)
U.A.E.	65/94	NA/2	0.863(34)
UZBEKISTAN	NA/100	0.6/0.0	0.710(105)
YEMEN	27/70	23/30	0.452(178)

Table II : Status of Some Important Non Muslim Countries Literacy and HDI -2018

COUNTRY	Literacy Rate %	Men/ Women Difference %	Education Index	H.D.I.
AUSTRALIA	96.0	0.0	0.927	2
BELGIUM	99.0	0.0	0.812	22
BRAZIL	92.6	-0.7	0.661	79
BULGARIA	98.4	0.7	0.749	57
CANADA	99.0	0.0	0.850	10
CUBA	99.7	-0.1	0.743	68
FRANCE	99.0	0.0	30.816	21
GERMANY	99.0	0.0	0.884	4
GREECE	97.7	1.6	0.797	29
ITALY	99.2	0.4	0.790	26
MEXICO	94.4	2.2	0.638	77
NEW ZEALAND	99.0	0.0	0.917	13
NORWAY	100.0	0.0	0.910	1
PHILIPPINES	96.3	-1.0	0.610	116
RUSSIA	99.7	0.0	0.780	50
SPAIN	98.1	1.3	0.794	27
SWITZERLAND	99.0	0.0	0.844	3
U.K.	99.0	0.0	0.860	16
U.S.A.	99.0	0.0	0.890	11
CHINA	96.4	3.7	0.610	90
INDIA	72.1	18.1	0.473	131
ISRAEL	97.8	2.9	0.854	19
JAPAN	99.0	0.0	0.808	17
MYANMAR	93.1	4.0	0.371	145
THAILAND	96.7	0.0	0.608	87

(This Article is one of the Chapters from the book entitled ***MUSLIM SOCIETIES – RISE & FALL -Revival Efforts*** *by Dr. M. I.H. Farooqi, 2nd Ed. 2020)*



STRENGTHENING OF E-COMMERCE AND E-BUSINESS IN HIGHER EDUCATION INSTITUTES OF ISLAMIC WORLD

Attaullah Shah
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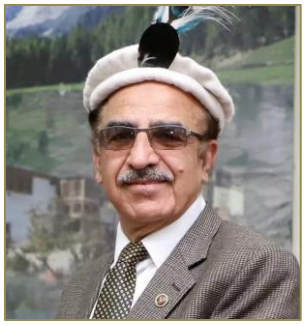

The advent of modern technologies including personal computers, Hardware, software and networks, transformed the way we live, interact and do businesses. The New Normal in the post COVID-19 world has pushed everyone, further into the digital and virtual platforms and today all aspects of life have been transformed to virtual reality one way or the other way. The 4th Generation Industrial Revolution (I4), involves developing, designing and manufacturing of the products and services, while incorporating the modern Information and Communication Technologies. The nine modern technologies, which can bring increase in productivity and cost reduction in the production include *Cloud Computing, Autonomous Robotics, Big Analytics, Simulation Technologies, Horizontal and Vertical Integration, Industrial Internet of Things, Cybersecurity, Additive Manufacturing and Augmented Reality (AR).* I4 will be more dominated by greater flexibility in processes, increased productivity and revenue, higher-quality production and more customized products and services. The Industry-4 revolution will bring 10-20% increase in the productivity of automobiles, food and beverages, machinery and equipment and about 20-30% in other component of manufacturing. These technologies would ultimately lead to increase in quality, reduced cost and wastes, lesser prices and more competition.

E-Commerce emerged a narrower perspective of the E-Business, which mainly focused on sales and business through the internet. However, with time E-Commerce involved purchase of goods and services between businesses, households, individual consumers, governments, other public or private organizations which is carried out via the Internet mainly. The E-Commerce brought many advantages in the modern businesses, including flexibility, less cost of inventory, minimum cost to enter the market, interactive communication, the unlimited operation time, transaction efficiency, simple offer adjustment, positive influence on shopping and consumer behavior

and the possibility of cost-effective expansion to foreign markets. The global e-customers were 1.5 billion in 2015, which has grown at 8% per annum and reached a mammoth number of 2 billion and it is expected that every 3rd or 4th customer is acquiring their products and services online and through e-commerce. The sales volume through e-commerce has jumped from USD 1.1 trillion to 4 trillion in 5 years.

The major sectors which have benefited from the industries like shoes & clothes, consumer electronics and physical media, food, cosmetics and pharmaceutical, furniture and home appliances, special interest products and service.

Role of Universities and HEIs in developing e-commerce:

Higher Education Institutes normally deal with terminal degrees to provide employment to the graduates. Hence the Universities have to be closely connected to the job market, businesses and employers. The HEC job market and Employers' Perception Survey conducted by Grant Thornton in 2016 revealed that the graduates from Pakistani Universities lack the practical and on hand capacity, inquisitiveness and research, critical and analytical thinking, effective interpersonal communication, use of modern technologies and tools, effective writing skills etc. These challenges are more dominant in the teaching and learning of professional degrees, where the hands on experience has been minimal over the years. The recent initiatives of Pakistan Engineering Council and other accreditation councils for introducing Outcome Based Education and Assessment (OBA/OBE) is a great leap forward in this direction but still there is long way to real benefits to the society. To enhance the role of HEIs in promotion of e-commerce and technology enabled employment, some important initiatives are required both at Federal/HEC level and University level.

1. Enhancing the courses of e-commerce in the curriculum of undergrad programs

The undergrad program is normally more rigorous and include four major components. Firstly, the Social and humanities courses, normally include English Communication, Pakistan studies, Islamic studies and some basic management & sociology etc. The second group of courses are related to computing and mathematics. The third group of courses are core courses, which generally include discipline specific breadth courses. The fourth and more important group is related to elective or discipline related depth. For instance, in computer science, there can be many groups of depth courses like Artificial Intelligence, e-commerce, cloud computing, e-learning etc. There is a need to introduce a core course of e-commerce to students of all disciplines. This introductory course may include the fundamentals of e-commerce as new business development portal, review of various platforms, transaction procedure and safety & security measures. At depth level, where more expertise is required, specialization of e-commerce may be created by connecting these graduate with tech industry and software houses.

2. Review of curriculum for e-commerce

The current courses of e-commerce offered at undergrad levels are more basic and theoretical, with little connectivity with the businesses. All such courses need gross root level review by an expert committee from academia, Government and industry, so that these are closely connected to national and international trends and challenges. Some of the important topics which needs to be included are, potential Benefits & Limitations of E-Commerce, Impact of E-Commerce on Business Models, E-Commerce Applications, E-Marketing Strategy, E-Banking, applications of Mobile Commerce., Web Security and Search Engine and Portals.

3. Strengthening of technology platforms for e-commerce

The technology platform comprised of hardware, software and networks have to be strong enough to support the transactions. The best e-Commerce platform is the one that successfully delivers the outcomes and objectives that you have set for your business. The platform requirements with nature of business like B2B (Business to Business) and B2C (Business to Consumer) would need different systems and platforms. A strong, reliable, affordable and high speed internet is always a need of the e-commerce. A good e-commerce platform is comprised of Robust catalogue, Flexible pricing, Website personalization, Flexible shipping, e-Commerce analytics, Google Merchant integration, Facebook integration, Customer review system, Automatic tax and account calculation, Multiple payment gateways, Single customer view, Headless commerce etc. Some of the famous e-commerce platform include Shopify (and Shopify Plus), BigCommerce, Magento, Woocommerce, Squarespace, Wix, Big Cartel, Salesforce Commerce cloud, Volusion etc. Another very important aspect of e-commerce is reliable and fast payments systems, which is still not well organized in Pakistan.

4. Offering specialized e-commerce related certificate courses

E-commerce cannot be established as standalone degree, as the it is more skill oriented. Hence Universities can design and develop specialized certificate courses of 3-6 months under their professional development and Lifelong learning institutes. The major components of this certificate

course can be introduction to e-commerce, web designing, graphic designing, creation of online business, development and deployment of e-commerce website, Social media contents creation and e-commerce marketing etc. National Vocational and Technical Training Commission (NAVTTC) has designed a 6-month intensive course of level 4, which is comprised of 4 modules of total of 803 contact hours with 200 hour class work and 604 hours of work. The four modules of the certificate program are, Business Analysis, Web Designing / Development, Quality Assurance and E-marketing. Such programs can be further customized to the needs and demands of the market.

5. *Skilled and trained faculty for teaching of e-commerce*

Teaching of professional degrees need good academics and practitioners in various fields. The faculty appointment system at HEC, is mainly based on qualification and academic experience in teaching institutes and research institutes. This deprives, the experienced non PhD practitioners to share their skills and knowledge in the emerging technologies with the students. The lack of hands on experience and practical knowledge with majority of faculty in the emerging technologies has been reported time and again. There is a need to bring the concept of Practising Professor from industry on contractual arrangements. For teaching and training of relevant faculty for e-commerce, experienced and market oriented teachers will be required. E-commerce is relatively new field, where sufficient number of expert teachers are not available. Teaching staff should have at least Seven (7) year experience in the field of Web Development, Electronic Commerce, Mobile Commerce and a Masters degree (18 years) in Computer Science, Software Engineering or Information Technology with Research publications and international certifications, as prescribed by the NAVTTC. HEC can initiate a tailored teacher training program for teaching of e-commerce, as master trainers.

6. *Post Graduate Diploma in E-commerce and E-business*

The concept of post graduate diploma (PGD) was mainly initiated in the professional fields to bring interdisciplinary flexibility at one hand and specialization at the other hand. A number of graduates from social sciences and natural sciences, changed their track to computing sciences, through the track of post grad diploma. HEC requires that the post grad diploma must be comprised of two semesters and 30 credit hours course/lab work minimum. The format of PGD is more rigorous, yet its application for transforming to e-commerce specialization, would need some deliberation. There is a general consensus, that e-commerce is more design and skill oriented program. Even a student with normal literacy of computer can become an expert e-commerce guru, with experience. At the beginning level, it will be more advisable that Universities initiate certificate courses in e-commerce for 3 months and advanced certificate for 6 months under the Professional Development and Life Long Learning Institutes/Centres. Later, once trained teachers and human resource is produced, post graduate diploma can be launched. Such programs may not burden or jeopardize the existing degree programs of Universities, being their core strengths.

7. *Connecting the E-commerce programs with industry and E-businesses*

The real success of all professional and degree programs is their linkage with the practical expertise and connecting with job markets. In E-commerce and E-businesses, the students have to be connected with online businesses and portals, like Amazon.com, Daraz.com and Alibaba.com etc. These major online market places, also provide intensive training and development of students for using the opportunities of online businesses and e-commerce. The role of Chambers of Commerce and Industries, Pakistan IT Board and Pakistan Software Export Board, NATTC, and TEVTAs is very critical for the success of e-commerce in Pakistan. The Offices of the Research Innovation and Commercialization (ORICs) of HEIs can play a pivotal role for connecting these programs with the leading online businesses and market places. This can even bring source of revenue for universities by creating partnerships with such graduates, after incubating them for such businesses. The author visited the model offered by University Technology Malaysia (UTM), where students have been incubated, developed and their start-ups have been initiated. The Universities are attracting start-up and angle capital for such businesses and explore for them markets under co-branding and joint marketing. Usually a royalty model of 10-15% revenue is charged from total revenue of such incubates. It is worth mentioning that KIU has established Technology Incubation Centre jointly with Punjab IT Board (PITB) and Federal Ministry of Communication and Information Technology, through their Subsidiary Special Communication Organization (SCO), the only Internet Service Provider (ISP) in Gilgit Baltistan. HEC can hunt some angle and start-up funding for such incubates in the areas of e-commerce. KIU Tech Incubation Centre is offering short courses on web design, freelancing, e-commerce. Under the Tech-incubation Centre, free offices spaces, training workshops, business model development, legal assistance, mentorship and networking opportunities shall be provided. At the same time, KIU has established first Freelance Centre at GB with the

support of Punjab IT Board (PITB), which will offer their courses mostly for females of the region, from first week of March 2021.

The e-commerce industry in Pakistan was about US$ 1 billion this year. With a population of 220 Million and in the Post COVID-19, New Normal, there are high potential of e-commerce and e-businesses for which the market is still untapped. The youth force of 62 % of total population (130 Million plus youth), is one of the very positive indicator that Pakistan will remain young for at least 25-30 years more. However, the low level of computer literacy, non-availability of PayPal and eBay systems for financial transactions in Pakistan, lack of legislation and non-existing of conducive environment, are some of the major impediments in the way of digital transformation of Pakistan. At the other hand, in India the e-commerce has increased from USD 3.8 billion in 2009 to 38 billion in 2017 and expected to reach US$ 200 billion by year 2026. Pakistan e-commerce index has slightly improved from 117 in 2018 to 115 in 2020 out of 151 countries, as compared to Iran 45, Saudi Arabia 49, Malaysia 31. The top ten e-commerce based leading economies of the world include Switzerland, Netherlands, Denmark, Finland, Singapore United Kingdom Germany, Finland Ireland, Norway and China/Hong Kong. The United States stands at 13 number at UNCTAD B2C E-commerce index, 2020. Pakistan has the potentials of increasing its digital economy to US$ 36 billion with 4 million new jobs by year 2025.

The Higher Education Institutes (HEIs) and Universities are bestowed with the role of providing skilled, qualified and talented human resources for the job market, so that youth can play their role in socioeconomic development of the country. The recent initiatives of the Honourable President of Pakistan and Chancellor of Karakorum International University (KIU) for promoting teaching Artificial Intelligence (AI) and e-commerce in HEIs, is a right and timely direction provided by His Excellency. The committed youth force with high quality infrastructure and capacity building in the modern technologies will bring a digital revolution in Pakistan, which can bring more than US$40 billion businesses through e-commerce in the next few years. It is high time that the HEC constitute a task force to delineate the road map for developing short and long term plans for digital transformation of the businesses and creating conducive environment for teaching and practicing of e-commerce, to usher a new era of e-commerce and e-businesses.

THE POST-COVID CLASSROOM: LESSONS FROM A PANDEMIC

Adnan Badran FIAS

Abstract: In December 2019, an outbreak of pneumonia cases with unknown etiology was reported in Wuhan, China. It had then quickly spread to other provinces with more and more patients having fever and cough symptoms. Within a few weeks, a novel coronavirus was identified by the Chinese Centre for Disease Control and Prevention and named as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). The World Health Organization called the illness associated with this infection as "coronavirus infectious diseases 2019 (COVID-19) and on June 27, 2021, it was declared a pandemic, as the virus spread across the globe, reaching 210 countries and territories with 181 million confirmed cases and over 3.9 million deaths.

In April 2020, the number of students staying at home due lockdown measures implemented by their educational institutions reached 1.598 billion in 194 countries. Such lockdown has forced these institutions to switch to online pedagogy. In developing countries, and among them the Arab world, this has exposed inequalities and challenges, such as uneven distribution of internet connectivity between urban and rural areas, with some poor areas not able to afford even the price of the hardware. Students and teachers were not well trained and equipped for online and virtual education. And schooling and campus social life was missed and the student's psychology under online pedagogy may have changed human behavior, which needs to be studied further by social scientists. As for academic conferences, these were postponed, cancelled or carried out online using various platforms.

There is no doubt that online learning has saved the educational sector from disaster. However, after the pandemic, the style of educational pedagogy will be changed, and will not be business as usual.

New learning process will be emerged from face to face to electronics and distance learning. This pedagogy would lead to blended interactive resilient learning to stimulate the minds and thoughts of students toward a challenging future.

WHY DOES THE UNIVERSE CONSIST OF MATTER ONLY?

M. Asghar FIAS

Abstract: This document analyses the current fundamental dilemma of the universe that contains only matter without its partner, anti-matter.

It is generally accepted that the universe was created through a Big Bang that released an enormous amount of energy. Assuming the validity physical laws everywhere and for all times during the evolution of the universe, as the universe cooled beyond the "phase-change of inflation", equal amount of matter and antimatter would have been created as dictated by the Dirac's seminal Equation. Indeed, a large number of experiments have verified that every known kind of particle has a corresponding antiparticle. Under the CPT theorem, a particle such electrons, protons, neutrons, …, and their antiparticles must have the same mass, identical spectroscopic properties and lifetimes, but opposite charges and magnetic moments. For a perfectly symmetric universe, these particles and their anti-particles join, annihilate and produce energy in the form of gamma-rays. Logically, if all the particles and antiparticles in the universe were to join and annihilate, no matter would be left in the universe. However, the observation of the universe, reveals with a high degree of certainty that *only matter* is present everywhere in different forms such as stars, galaxies, plasmas, gases, cosmic dust. It seems that during the evolution of the universe, the physical laws were somehow violated, when applied to the interactions of these particles and their antiparticles leading to the preponderance of matter. In fact, in 1967, Andrei Sakharov (1) identified three conditions necessary for *baryongenesis*: the creation of more baryons (protons and neutrons) than anti-baryons:

1. There must be baryon-number violating interactions,
2. It must exhibit the C- and CP-violations,
3. The universe must be an out-of-thermal-equilibrium system.

Here the C-symmetry violation is necessary so that the interactions that produce more baryons than anti-baryons will not be counterbalanced by the interactions that produce more anti-baryons than baryons. The CP- symmetry violation is also required, because otherwise equal number of left-handed baryons and right-handed anti-baryons would be produced as well as equal number of left-handed anti-baryons and right-handed baryons. Finally, the interactions must be out of thermal equilibrium, since in the case of thermal equilibrium, where the time becomes irrelevant, the CTP symmetry reduces to CP symmetry which has to be avoided, because the validity of the CPT symmetry is considered fundamental in Nature. These three conditions must be satisfied *simultaneously*.

At present, one knows that the C-, P-, and CP-symmetries are conserved in the strong and electromagnetic interactions, but these symmetries are violated in the weak interaction which also controls and determines the decay of the hadrons. However, the problem of baryongenesis: creation of the preponderance of baryons in the universe, is a fundamental one for which there is no adequate explanation in spite of an extensive theoretical effort including the much discussed *sphaleron* technique based on a static solution to the electroweak field equations of the Standard Model of particles leading to the violation of baryon and lepton numbers. (5).

There are two interpretations for this disparity: either the universe began with a small preference for matter in violation of the Dirac Equation or the universe was originally perfectly symmetric, but somehow a set of phenomena contributed to a small imbalance in favor of matter over time. The second point of view is preferred as there is a definite evidence of CP-symmetry violation in the decay of K (2), B (3) and the charmed D (4) mesons as foreseen by the Standard particle Model, but these effects are not strong enough to explain the present baryon asymmetry in the universe. In fact, this effect is so weak that it is insufficient to produce enough matter even for a single galaxy in the universe with billions of galaxies!

In this context, recently a new model of the universe: "The CPT-symmetric universe" (6) has been proposed. In this model, the Big Bang is the starting point of the simultaneous creation of a universe with matter and a back-to-back separated anti-universe with anti-matter, where time runs respectively towards the future for the universe and towards the past for the anti-universe as required by the CPT symmetry. Unlike the existing model of the mono-universe with equal amount of matter and anti-matter, where one has to break the C- and CP symmetries to create the preponderance of matter – the so-called the baryon asymmetry, the new universe contains all the matter created during the Big Bang, while all the anti-matter is confined to the anti-universe.

As everything happens at the instant of the Big Bang, this model excludes the supposed existence of the phenomenon of Inflation that took place around 10^-35 sec after the Big Bang for the mono-universe whose matter and the anti-matter were created after the end

of the operation of this inflation. This model claims that the three neutrinos should be Majorana particles allowing the neutrinoless double β-decay. However, an intensive experimental work on this subject excludes this possibility with a high probability. Moreover, the work on the flavor-change of the different types of neutrinos in flight excludes also the zero-mass hypothesis for the lightest neutrino. The significance of the arrow of time here is rather trivial, because the arrow of time in the mono-universe is linked intimately to the increase in entropy through the 2nd law of thermodynamics.

Apart from the CP-violation involving the systems composed of quarks discussed above, there is a very recent experimental indication, with a 3σ significance, of the CP-violation involving the leptons, seen in the mismatch in the way the muon neutrinos and antineutrinos oscillate by recording the number that reaches the Super-Kamiokande detector with flavors different from that with they were created with at the start from the accelerator 295 km away (7). If this result is confirmed and amounts to what is needed to explain the baryon asymmetry, then, the sphaleron technique (5), may be able to convert spontaneously the CP-violating lepton asymmetry into the baryon asymmetry.

Our universe is considered to be electrically neutral. In fact, the universe has been electrically neutral since right after the Big Bang, when, in the presence of high temperature and high energy density, the baryonic and leptonic matter and anti-matter were created from its radiation. As only electrons and protons are stable particles with equal and opposite electric charges, the incomplete mutual annihilation of their corresponding matter and antimatter due to some violation of physical laws, led to the proton (baryon) and the electron (lepton) number asymmetries. However, under the *electric charge conservation constraint*, these two asymmetries are expected to be equal in magnitude. This equality leads to equal number of protons and electrons ensuring the charge neutrality of the universe. Hence, getting the value of the baryonic asymmetry will automatically lead to the value of the leptonic asymmetry.

In the present context, it is of interest to determine the number density of the baryonic matter in the universe relative to the corresponding number density of the photons. From the 2.7 K CMB radiation with a perfect blackbody spectrum, one obtains the number density of photons Nγ = 3.7 10^2 photons cm^-3, and the number density of baryons Nb = 2 10^-7 baryons cm^-3, leading to their ratio **η = Nb/Nγ = 5.4 10^-10**. Since the baryon number and the photon number are conserved, the baryon- photon ratio remains constant as the universe expands.

It is of interest to understand the origin of this gamma-ray radiation present in the universe: did it result completely from the annihilation of the different types of matter and antimatter in the evolving universe or does it contain some residue from the Big Bang primordial radiation?

Finally, we conclude that in spite of a concerted and varied effort, we are still far from understanding as to why the universe consists of matter only, though there may be hopeful signs for a solution through the CP-violation observed in the leptonic sector of muon neutrinos and antineutrinos.

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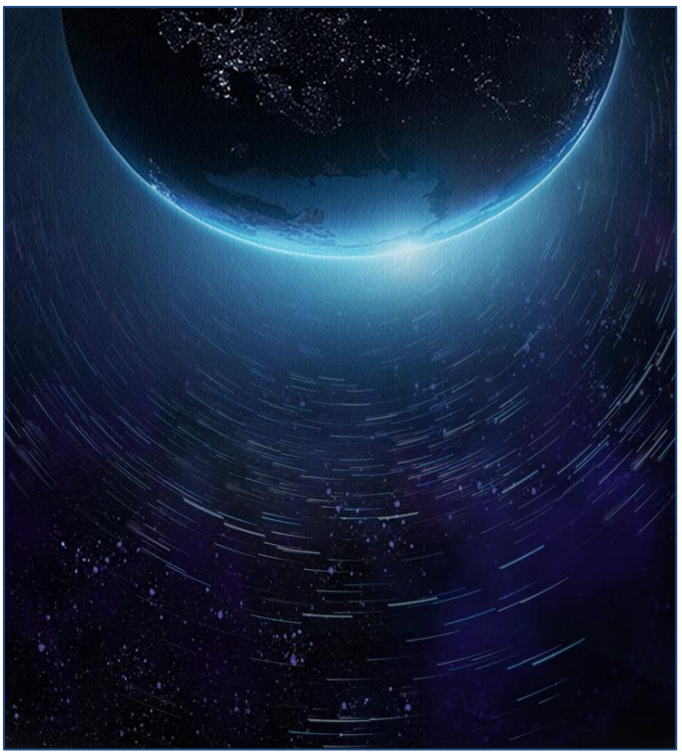


FEASIBILITY OF PAN ISLAMIC COUNTRIES INITIATIVES FOR VACCINE PRODUCTION

REFLECTING UPON CLINICAL TRIALS IN PAKISTAN

Saboora Waris and Tanwir Khaliq

According to "The Economist's" Global Normalcy index, Pakistan is among the top five countries in the world where the life has been least affected by COVID-19. The main reason for this credible ranking has been the Government's response against this pandemic which comprised of multiple actions including prevention of disease through smart lockdowns, isolation of effected people in COVID wards and initiation of a mass vaccination program.

Vaccination of a 220 million population against COVID-19 is a huge challenge for an emerging economy like Pakistan. Since the outbreak of this pandemic in January 2020 and the first administration of COIVD-19 vaccine in the world, Pakistan has vaccinated less than 5 % of its population till date. Since vaccine is produced in only a handful of developed countries, there is a great gap between the supply and demand. It is estimated that developing countries like Pakistan might take years to vaccinate their entire population.

To overcome this problem, the Government of Pakistan encouraged its health sector to come up with some innovative solutions so that the vaccination process can be expedited. Given that Pakistan has very limited resources and vaccine production platform, the health sector responded and collaborated with Chinese vaccine production companies to organize clinical trials in Pakistan as a first step.

Phase-III clinical trials of the CanSino Biologics single-dose Covid-19 were the first ever such trials conducted in Pakistan, wherein around 18,000 volunteers participated from across the Country. These trials were conducted at five centres in Karachi, Lahore and Islamabad. Phase III clinical trials data in Pakistan presented that CanSino had 74.48 % efficacy rate in preventing symptomatic cases and 100 % in preventing severe disease. Later on, Chinese company Cansino Biologics Inc's vaccine was approved by the Drug Regulatory Authority of Pakistan (DRAP) for emergency use. Due to the success of these clinical trials, Pakistan also started co-manufacturing the single dose Adenovirus-vectored Covid-19 vaccine with CanSino Bio at the National Institute of Health (NIH) Islamabad and brands it as PakVac. NIH are hopeful of earning around $30 million through the joint manufacturing of the vaccine in the country.

The second of this phase III clinical trials were of ZF2001, co-developed by the Institute of Microbiology of the Chinese Academy of Sciences and the Anhui Zhifei Longcom Biopharmaceutical Co. ZF2001 is a protein subunit vaccine using harmless piece of virus to provoke immune response against COVID-19. Results of phase I and phase II clinical trials were published in Lancet which is a high impact International Journal and claims 92-97% efficacy of ZF2001. Zf2001 is designed to be administered in three doses over the period of two months to achieve 97% efficacy. Phase III double blinded, placebo controlled clinical trials of ZF2001 were approved by Drug Regulatory Authority Pakistan (DRAP) in February, 2020.

The clinical trial started under the supervision of Country Head, Prof. Dr. Javed Akram, Vice Chancellor of University of Health Sciences Lahore, wherein around 10,000 volunteers participated across the country and these trials were conducted in Islamabad, Lahore, Faisalabad and Karachi simultaneously. Shaheed Zulfiqar Ali Bhutto Medical University (SZABMU), Islamabad is also a part of these clinical trials of ZF2001 and has been approved by DRAP as a clinical trial site.

The Vice Chancellor of SZABMU, Prof. Tanwir Khaliq is the Principal investigator leading these trials at SZABMU. He organized the clinical trial site, set strategic direction of the SZAMBU research team, provided operational and administrative support at the trial site. The trial started on 8th April 2021 and within a period of 03 months, the mass screening of 2151 volunteers for COVID-19 antibodies and active COVID-19 infection was performed.

Seroprevalence data showed that 20% of Pakistani population had COVID-19 exposure in past and COVID-19 positivity rate was 3% from 8 April to 30 June 2020 in Islamabad. SZABMU completed its volunteer recruitment for ZF2001 vaccine trials on 30 June 2020. So far, this project has been successful, participants have received 1262 first dose of the vaccine, 480 second dose and 149 third dose.

As of today, no serious adverse events directly related to the vaccine has been reported in the phase III clinical trial of ZF2001. The previously reported results of phase I, II in Lancet and Phase III clinical trials in Pakistan have corroborated that the vaccine is well tolerated, biosafe and immunogenic, accompanying the succeeding stage of clinical trials.

Owing to the available results so far, the trend is very positive. It is highly likely that these trials will pass the critical phase III and will remain effective. This will pave way for industrial production of COVID-19 vaccines which will help the Government of Pakistan to vaccinate its entire population and save valuable foreign exchange.

IMPORTANCE OF STEM IN ISLAMIC COUNTRIES

REFLECTING UPON WOMEN IN STEM IN ISLAMIC COUNTRIES: PAKISTANI PERSPECTIVE

Syeda Kiran Riaz[1] and Tanwir Khaliq[2]

Since the inception of Nobel Prize in 1895, only 5 women had been honored with the esteemed award in Chemistry out of 183 awards until 2020. But last year changed the paradigm by recognizing the efforts of Emmanuelle Charpentier and Jennifer A. Doudna for discovering CRISPR/Cas9 as gene editing tools. These prizes shaped the importance of women in STEM careers emphasizing the need for attracting and facilitating more women in these scientific disciplines. STEM stands for science, technology, engineering, and mathematics, and encompasses all subjects that come under these four categories. Historically the word STEM roots from the predicament in the United States regarding the scarcity of competent graduates for high-tech jobs. To solve this shortage, governments and institutions around the world have implemented policies to encourage more students to pursue STEM degrees especially targeting at raising the number of women who choose to study in these fields.

STEM courses have traditionally been dominated by men, with women being discouraged from pursuing a technical professional path. According United Nations Education, Scientific and Cultural Organization (UNESCO), only 3 out of 12% women will pursue STEM careers after graduating with a STEM degree. Biases, social conventions, and expectations hold back women, impacting the quality of their education and the subjects they study hence undermining their STEM potential. Only 35% of women opting for STEM disciplines advance towards higher education globally. UNESCO launched its program called STEM and Gender Advancement (SAGA) in 2015 for improving measurement and policies for gender equality in STI. This aspect has also been included in the Times Higher Education (THE) World Impact Rankings for mentioning the number of females in STEM related disciplines and administrative posts in the universities. This policy will pave the way for gender equality in the higher education institutions worldwide in the years to come. Capacity building of countries through teacher trainings, pedagogy and content development is another important facet for cultivating mindset for promoting gender equality in STEM education.

A recently published article in the World Journal of Education by Samira Ibrahim Islam (2019) has highlighted the reforms taken by the countries of the Middle East including Algeria, Bahrain, Cyprus, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, Turkey, United Arab Emirates, and Yemen for sensitivity toward gender issues in STEM careers. At present, almost all these Islamic countries have signed the treaty on the Convention on the Elimination of all Forms of Discrimination against Women (CEDAW). Several Islamic countries in the Middle East have demonstrated commitment to improving education and making it available to all women. Funding has also been increased in these nations for attracting women in STEM careers towards higher education. As a result of these efforts, several renowned women from Middle East are opting for careers such as Chemist, Physicians, Physicist, Engineers, etc.

According to a report published by the World Economic Forum in 2020, Pakistan has one of the greatest gender disparities in the world and is the third worst performer in terms of gender parity. Despite accounting for about half of the population, Pakistani women have a low literacy rate, which contributes to a large gender gap in STEM disciplines. In science and technology, the literacy percentage is significantly lower. According to UNESCO, 47% women who are enrolled in Bachelor's degrees, will subsequently dropout to 36% in admissions for higher education. These figures are even lesser for women pursuing STEM careers. Nevertheless, Government of Pakistan, as well as women working in STEM fields, has been working hard to close the gender gap in STEM. The Government is also trying to improve wage equality and the position of country in educational attainment index since 2018. This has led us to witness the rise of women like Nergis Mavalvala (Pakistani-American physicist; first female Dean of school of sciences at MIT in 2020), Aban Markar Kabraji (a Pakistani Botanist, Regional director of the Asia Regional Office of the International Union for Conservation of Nature (IUCN)), Asifa Akhtar (a Pakistani Biologist, the first international female vice president at Max Planck Society).

As the Vice Chancellor of the only public sector medial university in the federal region of Pakistan, Shaheed Zulfiqar Ali Bhutto Medical University, I am prioritizing the admissions of women at bachelor levels including MBBS, Nursing and other allied health sciences programs. Moreover, conducive environment is being provided to facilitate the admissions of female candidates in Mphil/PhD programs as well as for leading the institute in administrative positions. We are focusing on the training of women in intricate fields such as surgery hence producing first female vascular surgeon of Pakistan Dr. Sana Sharafat Ali under my supervision. Moreover, in order to cover the holistic approach of STEM disciplines, we are also training women engineers for collaborating in the medical imaging project for application of artificial intelligence in vascular surgery to increase the number in AI based workforce as well. This has not only increased our rank in the THE World Impact Rankings but also improvised the image of our institution. As our premier leader Quaid-e-Azam Muhammad Ali Jinnah once said: *"No nation can ever be worthy of its existence that cannot take its women along with the men. No struggle can ever succeed without women participating side by side with men. There are two powers in the world; one is the sword and the other is the pen. There is a great competition and rivalry between the two. There is a third power stronger than both, that of the women."*

[1] *Assistant Professor, Department of Molecular Biology and Biochemistry, Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, Pakistan.*
[2] *Vice Chancellor, Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, Pakistan.*

IAS - COMSTECH
CONFERENCE ON BIODIVERSITY CONCLUDED SUCCESSFULLY

Under the patronage of HRH Prince El Hassan bin Talal, Founding patron of the Islamic World Academy of Sciences, the IAS and COMSTECH organized a conference on Biodiversity that was held online via ZOOM on 1 April 2020.

Many of the Islamic countries are parties of Convention on Biological Diversity (CBD). However, not all of them are part of Nagoya Protocol on Access and Benefit-sharing of genetic material. The up-coming UN Conference on Biological Diversity (COP-15) will review achievement of these frameworks.

The goal of this conference was to raise awareness of Islamic countries of the global international frameworks and protocols governing access to genetic material and to enable active participation in further discussion of its articles. This is important in further formulating or modifying articles in the CBD convention which may have a bearing on the Intellectual Property Rights (IPR) regarding indigenous germplasm and knowledge from developing countries.

The conference addressed different aspects of Biodiversity for the purpose of sharing information in preparation for the fifteenth meeting of the Parties to the Convention on Biological Diversity (COP-15) which will be held in May 2021, in Kunming, China.

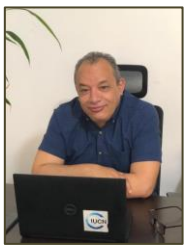
The opening session started off with a welcome note by Prof. Abdullah Al-Musa, President, National Center for Research and Development (NCRD) and Director General, Islamic World Academy of Sciences (IAS), Jordan, followed by a welcome note by Prof. Muhammad Iqbal Choudhary, Coordinator General COMSTECH. Director ICCBS/ Distinguished National Professor. International Center for Chemical and Biological Sciences, University of Karachi, Pakistan. Finally an address by HRH Prince El-Hassan bin Talal, Founding Patron of the Islamic World Academy of Sciences (IAS), Jordan. The opening session can be found on YouTube on the link:
https://www.youtube.com/watch?v=OsOTF978V44

The second session started with Mary Jane Ramos de la Cruz, Technical Officer, International Treaty on Plant Genetic Resources for Food and Agriculture

(ITPGRFA), Food and Agriculture Organization of the United Nations (FAO), Italy, with a presentation on "What are Farmers' Rights under the International Treaty on Plant Genetic Resources for Food and Agriculture".
https://www.youtube.com/watch?v=mrhx3K3KLtI&t=5s

Syed Mahmood Nasir, Former Inspector General of Forests and Focal Point CBD/Nagoya Protocol/ Cartagena Protocol, Pakistan, talked about "Biodiversity under Changing Climate".
https://www.youtube.com/watch?v=IjmzipQ_jbw

Parviz Koohafkan, President of World Agricultural Heritage Foundation, Italy, presented a talk on "Sustainable Food Systems, Agricultural Heritage and Biodiversity Nexus".
https://www.youtube.com/watch?v=y9mNb4BR0PQ



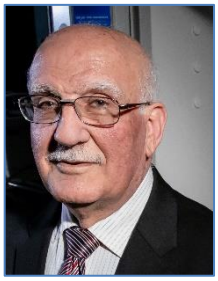
Hany Al-Shaer, Regional Director, IUCN (International Union for Conservation of Nature) Regional Office for West Asia (ROWA), Egypt, presented a paper on "Threats and Challenges of Biodiversity Conservation in West Asia Region".
https://www.youtube.com/watch?v=LzDWoX8uKKw

Zabta Shinwari FIAS, Professor Emeritus, Quaid-i-Azam University, Islamabad, Pakistan, presented a paper on "Biodiversity Loss, Emerging Infectious Diseases Frontier Technologies and Impact".
https://www.youtube.com/watch?v=FU8VlyK_X5Y&t=20s

Final presentation was by Omar Assobhei, Resident Member at the Hassan II Academy of Science and Technology, Morocco, on "Impact of Climate Change and Human Activities on the Biodiversity of Some Atlantic Coastal Ecosystems in Morocco".
https://www.youtube.com/watch?v=AntdKGONHWM&t=1s

IAS HOSTS A SERIES OF WEBINARS ON NANOTECHNOLOGY

Among the many strategic targets of IAS is organizing online webinars via Zoom that discuss scientific and technological issues that promote scientific activities. After the successful completion of a series of webinars on *Agriculture Production and Food Security under COVID-19 Pandemic, the IAS* embarked on a new series under the title *Nanotechnology and its Application in Industry, Agriculture and Medicine.*



First session was by **Dr. Munir Nayfeh** FIAS, *Department of Physics, University of Illinois at Urbana-Champaign, USA, on* **Nanotechnology Innovations in Health Care, from Lab to Consumer.**

Second session was by **Dr. Malik Maaza** FIAS, *UNESCO UNISA Africa Chair in Nanoscience & Nanotechnology, South Africa on* **Nanosciences & Nanotechnologies: Platforms toward SDGS' Attainment.**

Third Session featured **Dr. Alaaldin Alkilany,** *Associate Professor, Pharmaceutical Nanotechnology, Pharmacy School, University of Jordan (JU), Jordan and Director of Accreditation and Quality Assurance Center at JU, presented a talk on* **Nanotechnology: The World of Wonder and the Emerging Opportunities.**

Last session was hosted by **Dr. Huan Meng**, *Professor at the National Center for Nanoscience and Technology(NCNT), China.* The presentation was entitled **Use of Nano-enabled Approach for Efficient Drug Delivery in Gastrointestinal Cancer**

The presentations delivered in the webinars can be found on the IAS YouTube Channel:
https://www.youtube.com/user/TheIASworld/videos

and on the IAS Facebook page:
https://www.facebook.com/iasworld

IAS 23rd CONFERENCE TO BE CONVENED IN MOROCCO IN DECEMBER 2021

Under the patronage of His Majesty King Muhammad VI of Morocco, the Islamic World Academy of Sciences (IAS) jointly with Hassan II Academy of Science and Technology will convene the IAS 23rd international conference in Rabat (Morocco); during 15-16 December 2021.

The conference which will be entitled **Science, Technology and Innovation (STI) Under Ever Changing Global Events** will be realized as a joint activity between the IAS and Hassan II Academy of Science and Technology.

The conference will address topics of major and current concern such as Health, Environment, Water- Energy-Food Nexus, Water Resource Management, Biodiversity and Vaccine Production Prospects in Pan Islamic Countries.

Conference is sponsored by: The Higher Council for Science and Technology (HCST), Jordan, Kuwait Foundation for the Advancement of Sciences (KFAS), Kuwait and OIC Standing Ministerial Committee on Scientific and Technological Co-operation (COMSTECH), Pakistan.

IAS - TUBA WEBINAR ON BIODIVERSITY IN SEPTEMBER 2021

On 25 September 2021, the Islamic World Academy of Sciences (**IAS**) and Turkish Academy of Sciences (**TÜBA**) are hosting a webinar on Biodiversity.

Presentations will be on the following topics: **Importance of Circular Economy for Biodiversity** by *Prof. İsmail Koyuncu*, Professor, Environmental Engineering Department, Istanbul Technical University, Turkey, **Wild Edible Fruit Biodiversity in Turkey** by *Prof. Sezai Ercisli*, Professor, Agricultural Faculty Department of Horticulture, Ataturk University, Turkey, and **Anatolian Aquatic Biodiversity in the Face of Climate Change and Intensifying Anthropogenic Pressures** by *Dr. Korhan Özkan*, Assistant Professor, Institute of Marine Sciences, Middle East Technical University, Turkey.

Register in advance for this meeting:
https://zoom.us/meeting/register/tJcsfu6pqzojGNEER_AFEJZGWu2wcncWMjk1

IAS BECOMES AN AFFILIATED MEMBER OF THE INTERNATIONAL SCIENCE COUNCIL (ISC)

In May 2021, the Islamic World Academy of Sciences (IAS) joined the International Science Council (**ISC**) as an Affiliated Member.

The International Science Council (ISC) is a non-governmental organization with a unique global membership that brings together 40 international scientific Unions and Associations and over 140 national and regional scientific organizations including Academies and Research Councils.

The ISC was created in 2018 as the result of a merger between the International Council for Science (ICSU) and the International Social Science Council (ISSC).

Through this membership, the IAS will be able to collaborate with ISC in the frame of various programs, to promote international research and scholarship on key global challenges, increase evidence-informed understanding and decision making at all levels of public policy, discourse and action and protect scientific freedom and advocating principles for the responsible practice of science.

IAS JOINS THE SUSTAINABLE HEALTH EQUITY MOVEMENT (SHEM)

IAS joined the Sustainable Health Equity Movement (SHEM) in early 2021 and has been an active member since. SHEM is a gathering of public health experts, healthcare workers, scientists research centres, academics, professional associations, universities, and related institutions. They are committed to the main challenges of our times and promoting sustainable health equity.

The IAS, through its Director General has been actively involved in SHEM activities and has recently participated in the General Assembly where he presented proposals on climate change and technology transfer of vaccine manufacturing to developing countries. This was in response to SHEM's request to present ideas on how the Movement can advance in advocating for a sustainable health equity approach in all policies, nationally and internationally, in relation to the context of the pandemic.

IAS AND HCST SIGN A MEMORANDUM OF UNDERSTANDING

The Islamic World Academy of Sciences (**IAS**) and the Higher Council for Science and Technology (**HCST**) signed a Memorandum of Understanding to raise national capabilities in the Islamic world in various fields of science and technology.

The memorandum, signed by the Secretary General of HCST, Dr. Dia Al-Din Arafa, and the Director of the Academy, Dr. Abdullah Al Musa, aims to establish meaningful strategic partnerships that will achieve economic and social development, to translate the visions of His Majesty King Abdullah II, and the interests of His Highness Prince El Hassan bin Talal, Founder and Patron of the Islamic World Academy of Sciences, Founder and President of the Higher Council for Science and Technology.

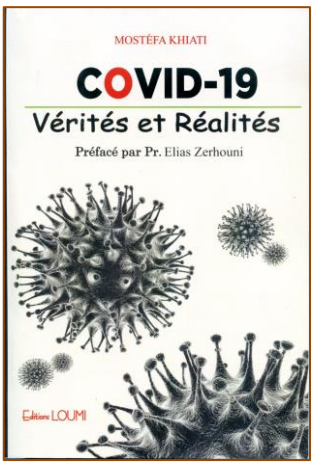
The memorandum provides financial support from HCST to the IAS to establish a joint annual global conference under the auspices of His Highness Prince El Hassan bin Talal, among the priorities agreed upon in Jordan and the OIC countries, such as food security, water, epidemiological/health, information technology, artificial intelligence, nanotechnology and many emerging topics in the fields of science and technology.

According to the memorandum, the IAS will present the outputs and recommendations of the conference to the HCST to be developed and benefited from through its researchers, centers and scientific networks. HCST will also participate in conference sessions to discuss, present and implement recommendations locally and in the Organization of the Islamic Cooperation (OIC) member countries.

RECENT BOOKS BY PROF. MOSTÉFA KHIATI FIAS

COVID-19: TRUTHS AND REALITIES

589 p., Loumi Ed
Algiers 2020



"The story of Covid 19 is unfortunately not over but it must be documented rigorously, in real time, to serve as a reference and future resource for all the experts and decision-makers who will be brought, I hope, to redefine their approach and prepare the public health system for the future. This is where I congratulate Professor Khiati for his extraordinary work of capturing and documenting into a remarkable work. It is rare to see such a comprehensive and high-quality work written while the subject matter of this book is still lively and evolving. "

Prof. Elias Zerhouni.

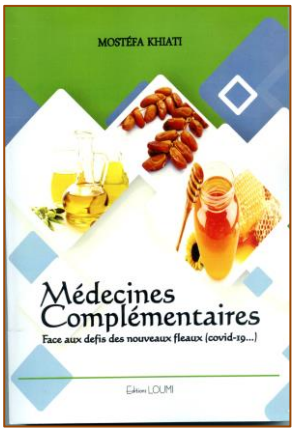
The pandemic, by its magnitude and the speed of its spread, has exceeded the capacities of all health systems, even those of the countries deemed to be the most efficient and the most advanced. The delay in taking containment measures of a few days has amounted to thousands of cases of contamination. The massive influx of patients has undermined even the most efficient healthcare systems. The dysfunctions observed in Third World countries were expected but sometimes turned out to be more significant than those expected.

Algeria, which had a health system considered "the best in Africa", behaved quite correctly. It took early steps to reduce the impact of the pandemic that had just hit Europe.

In this book, Professor Mostefa Khiati tried to tackle a very topical subject, that of Covid-19. He "succeeded in capturing the fundamental elements of this pandemic and the highlights of the global response with real-time documentation of all the sources available not only in Algeria but across the world. Analyzing not only the medical facts but also the national and global socio-political context in which this event is evolving is a tour de force.

COMPLEMENTARY MEDICINES FACED WITH THE CHALLENGES OF NEW SCOURGES (COVID-19)

425 p., Loumi Ed
Algiers 2021



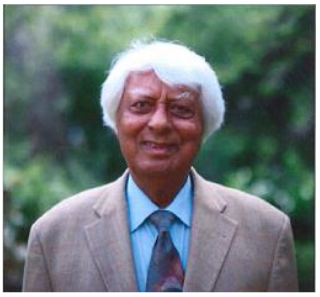
Algeria has an exceptional floristic heritage. It is very rich in biodiversity, with arid zones, wetlands, Highlands, wooded areas exceptionally rich in natural habitats and species in the Tell (Beni Snous, Ouarsénis, Kabylie, Jijel, etc.) and its potential is not all listed.

Chronic patients, more than others, often need complementary therapy to improve their quality of life. They need guidance. By organising the non-conventional medicine sector, the State has everything to gain: better health coverage, judicious exploitation of existing potential, job creation, export of phytosanitary products, etc. These products are for both human and veterinary use and are not expensive compared to the molecules marketed by the drug laboratories. This is why the State must initiate a policy of promoting medicinal plants by recognising and simplifying the registration procedure for traditional medicines, facilitating their traceability and marketing.
The use of complementary medicine is a global trend, it is cheap and can implement a traditional sector that deserves to be valued.

In this book, Professor Mostefa Khiati has tried to tackle a very topical subject, that of complementary medicines, which today constitute a recourse for many patients in our country. Algeria, which has enormous potential in this field, should develop this sector in order to provide a service to the population on the one hand and to export quality products abroad on the other.

MOSTÉFA KHIATI FIAS *is a pediatrician, professor at the University of Algiers with extensive knowledge in nutrition and high experience in health policy. He is the author of fifty books in different fields: paediatrics, history of medicine, childhood and ethics. He is interested in the history of medicine but his interest has widened to other fields. He never stops teeming us with new topics and new discoveries.*

PROF. SYED QAIM PARTICIPATES IN THE ORGANIZATION OF ADVANCED INTERNATIONAL SCHOOLS IN SOUTH KOREA



Prof. Dr. Syed Muhammad Qaim, FIAS, of the Forschungszentrum Juelich and the University of Cologne, Germany, has been invited to co-organise Advanced International Schools on Radionuclides and Radiopharmaceuticals, held every year since 2019 in Seoul, South Korea. Supported by the International Atomic Energy Agency (IAEA), the World Council on Isotopes (WCI), the Korea International Cooperation Agency (KOICA) and the Korean Atomic Energy Research Institute (KAERI), the advanced schools in the form of e-learning courses, extending over several weeks, are held for the benefit of young researchers from developing countries, mostly in Asia. As Chair of the Standing Committee on Education and Training of the WCI, Professor Qaim represents the WCI in the Organisation Committee of the Schools.

In addition, he gives a series of lectures on Nuclear Data and Accelerator- based Radionuclides and acts as a tutor to the participants. This type of advanced courses constitute a great service to the developing countries.
Originating from Pakistan and educated in UK, Prof. Syed Qaim got settled in Germany about 50 years ago. Since then, besides his research and teaching activities within Germany, he has also been vigorously working towards the development of science in the Third World.

In recognition of his researches and dedicated services to the cause of science in developing countries, he was elected as a Fellow of TWAS from the North, and also given high honours in about 10 countries, among them Bangladesh, Egypt, Hungary, Pakistan and UK.

FRESH WATER

Comment by M. Asghar on:

SCIENCE POTENTIAL FOR SUSTAINABLE WATER POLICY AND CLIMATE CHANGE

Adnan Badran

Published in IAS Newsletter, Vol. 29, No. 45 (May - August 2021)

Dr. Adnan Badran has tried to analyze the present existentially more and more disturbing situation of fresh water in different parts of the world especially in most of the relatively dry and desertic Middle East. To help to mitigate the present tight situation, one has to rationalize water use in agriculture. At present, most of the agricultural system that uses more than 70 percent of available fresh water, is based on highly wasteful flood-irrigation of fields that often results in water-logging leading to harmful salinity of the soil that disturbs strongly its fertility. Here, one has to move to highly economic water-dripping system and/or to a forced-water-sprinkling one coupled to solar-energy-based photovoltaic (PV) system to provide the electric power for pumping water. The countries that are open to sea, try to set up water desalination plants, but these plants consume a lot of energy provided by fossil fuels worsening the Co_2 foot-print for climate. One can use low-carbon nuclear energy, but this energy is technically complex, expensive and not readily available, though, countries such as Jordan are making effort in this direction. In this context, there are world-wide programs of setting up floating small modular nuclear reactors.

For the Earth, rain is the only and unique desalination process through the Sun's radiation-caused evaporation of mostly sea water that covers more than 70% of Earth's surface. In the case of artificial rain, one uses airplanes or rockets to seed clouds using catalysts such as dry ice (solid CO2 at -78.5 °C, it sublimates into gas at -56.4°C), silver iodide (electrolyte that self-ionizes in the presence of water) and salt powder (a hygroscopic substance) to coagulate tiny water droplets into bigger and heavier ones leading to an increased precipitation and rain.

In another more interesting system based on the Corona Effect, a high electric field ionizes the air molecules and the resulting ions acting as seeds help to coagulate the water droplets present in the atmosphere humidity without clouds, leading to precipitation and rain. The physical system consists of specially designed Corona Effect antennas fixed at the top of towers installed at carefully chosen places. They can be electrically charged through green electricity produced via the photovoltaic (PV) systems plus a battery installed locally. Unlike the chemical-based cloud seeding system, the Corona Effect system can operate permanently without any interruption. According to the Weather Tec, Company, this system has been installed in Australia, Jordan, Switzerland and UAE. In the case of Jordan with certain number of units in place, the Company claims that this has led to a real increase of 35% in rain fall in the country, where in most of the areas, it rains less than 100 mm per year.

FELLOWS NO LONGER WITH US

THE LATE PROF. KHALID YUSOFF (MALAYSIA)

Professor Dato' Khalid Yusoff, was a Professor of Medicine and Senior Consultant Cardiologist and the Foundation Dean of the Faculty of Medicine, Universiti Teknologi MARA.

He was the Dean of the Faculty of Medicine at Universiti Kebangsaan Malaysia. During that time, he built the postgraduate programme to be the biggest in the country. Research was activated through a number of initiatives including adopting a Protected Research Time for the academic staff, encouraging participating in international conferences, organizing the Annual Research Weeks, creating the Clinical Research Unit, and proposing to the University the Universiti Kebangsaan Molecular Biology Institute (UMBI).

Professor Dato' Khalid Yusoff had a major interest in coronary heart disease and hypertension, and pursued active research in these areas through epidemiological, fundamental and translational research.

He has published or contributed to 3 books, 163 papers, 336 presentations at international conferences and 6 National Clinical Practice Guidelines. He was a much sought-after speaker at conferences, nationally and internationally. His H-index is 12, and cumulative citation of over 2400. He joined the National Science and Research Council (NSRC), and co-chairs the NSRC's Evaluation Research Performance and Impact of Public Research Assets. He is a member of the National BioEthics Council.

Professor Dato' Khalid Yusoff was a Founder President of the Malaysian Society of Hypertension, and the President of the College of Physicians of Malaysia. He served on the Council of the Academy of Medicine of Malaysia, and the Council of the Academy of Sciences of Malaysia and its Medical and Health Sciences Cluster Chairman, and was a member of its Publication Committee and Membership Committee. He established the Medical Deans' Council in 2001 and served as its Foundation Chairman.

Prof. Yusoff had received a number of recognitions and awards. He was elected to the Fellowships of the Royal College of Physicians of Edinburgh (1993), Royal College of Physicians of London (1998), Royal College of Physicians and Surgeons of Glasgow (1998), Academy of Medicine of Malaysia (1999), Academy of Sciences of Malaysia (2005), and The American College of Cardiology (1997). He was an Honorary Fellow of the Royal Australasian College of Physicians (2011). He received the Gold Award from the Royal College of Physicians of London in 1995

Prof. Khalid was elected as a Fellow of the Islamic World Academy of Sciences in 2012.

THE LATE PROF. NAJIH EL RAWI (IRAQ)

Born in Rawa, Iraq, on 4 April 1937. He obtained his BSc in Civil Engineering from the University of Wales in Cardiff (UK) in 1957, his MSc in 1963 from Purdue University (Indiana, USA) in Road Engineering, and his PhD from the Oklahoma State University in Civil Engineering (Soil Stabilization) (1967).

Dr El-Rawi started his career, as an instructor at the University of Baghdad in 1967, became an Assistant Professor in 1971 and Full Professor in 1980. He became an Emeritus Professor of Civil Engineering in 1990.

He was dean of the Higher Institute of Industrial Engineering (University of Baghdad), 1968-1969; dean of the College of Industry (currently the Technological University), 1969-1970; Member of the Bureau of Educational Affairs, Revolutionary Command Council, 1974-1975; and Member of the Council of Higher Education, 1970-1974 and 1980-1985.

Prof. El-Rawi was a Member of the Board of Trustees of Al-Mustansiryah University, 1970-1974; President of the Council of Scientific Research (Ministerial Level), 1980-1989; Member of the Board of Trustees of the Arabian Gulf University – Bahrain, 1986-1989; and Member of the Board of Trustees of the Teachers Union University College, 1990-1996.

He served as Deputy Minister of Municipalities (1974); Deputy Minister of Public Works and Housing, 1974-1977; Minister of Industry and Minerals, 1977-1978; and Member of a number of boards of administration of several industries. He was president of the following national committees in Iraq; Technology Transfer (1984-1989), Man and the Biosphere (1980-1989), International Geological Correlation Programme (1980-1989), and Geophysics and Geodesy (1982-1989).

Prof. El Rawi is a former Head of the Union of Arab Educators (1983-1989), and is a former Member of the Council of the World Federation of Educators (1973-1974) and (1979-1982). He is a Member of the American Society of Civil Engineers (1967), the Iraq Engineering Society (1959), and an Associate Member of the Society Sigma-Xi since 1967.

Prof. El Rawi has published many articles and studies and was a Founding Fellow of the Islamic World Academy of Sciences (1986). He was the president of the Iraqi Academy of Sciences (1996-2000).

Areas of Research: Soil Stabilization, Highway Materials and Engineering Education & Transfer of Technology.

THE LATE PROF. WIRANTO ARISMUNANDAR (INDONESIA)

Prof. Wiranto earned an MSc in Mechanical Engineering from the University of Indonesia (1959), an MSc in Mechanical Engineering from Purdue University, USA (1960), conducted post-graduate studies as a Research Associate in the Department of Mechanical Engineering at Stanford University, USA (1961-1962), and participated in a training course on rocket propulsion in Japan (1965).

He served as Vice-Chairman of the Indonesian National Institute of Aeronautics and Space (LAPAN) (1978-1989), President of the Institute of Technology Bandung (ITB) (1988-1997), and Minister of Education and Culture of the Republic of Indonesia (1998).

Prof. Arismunandar had been a member of the following professional bodies: the National [Indonesian] Energy Committee, the National Telecommunications Council, the Society of Indonesian Engineers, the World Energy Conference, the Indonesian National Committee, the Society of Automotive Engineers of Australasia, the Japan Society of Automotive Engineers, the American Institute of Aeronautics and Astronautics, the American Society of Mechanical Engineers, the Indonesian Space Society, the Society of Automotive Engineers of Indonesia (Founding Member), the Indonesian Aeronautics and Astronautics Institute, the Indonesian National Research Council, the People's Consultative Council of the Republic of Indonesia (1992-1997), the Consultative Board of the Indonesian Islamic Council, and Senior Scientist for the Indonesian Agency for the Assessment and Application of Technology, and Technology Adviser of the Indonesian Aircraft Industry since 1979. He was also on the Advisory Board of the Journal of the Indonesian Aeronautics and Astronautics Institute, and was Chief Editor of TEKNOLOGI magazine. Further, he has been an adviser to a number of industrial and engineering companies and a consultant to the Indonesian National Atomic Energy Agency.

He presented over 100 papers at national and international meetings, conferences and symposium throughout the world and published 13 books.

He had been awarded the Satyalancana Dwidya Sistha medal of merit by the Indonesian Minister of Defense four times (1968, 1983, 1989 and 1992). He had also been awarded the following Indonesian national medals: Satyalancana Karya Satya 1st Class (1990), Satyalancana Karya Satya for 30 years of service, and Bintang Jasa Utama (1998).

Prof. Arismunandar was a Founding Fellow of the IAS in 1986.

ABU ABDULLAH AL-BATTANI (858-929 AD)*

Abu Abdullah Muhammad Ibn Jabir Ibn Sinan al-Battani al-Harrani was born around 858 AD in Harran, and according to one account, in Battan, a State of Harran. Battani was first educated by his father Jabir Ibn Sinan al-Battani, who was also a well-known scientist. He then moved to Raqqa, situated on the bank of the Euphrates, where he received advanced education and later flourished as a scholar.

Battani was a famous astronomer, mathematician and astrologer. He has been held as one of the greatest astronomists of Islam. He is responsible for a number of important discoveries in astronomy, which was the result of a long career of 42 years of research beginning at *Raqqa* when he was young. His well-known discovery is the remarkably accurate determination of the solar year as being 365 days, 5 hours, 46 51 minutes and 24 seconds, which is very close to the latest estimates. He found that the longitude of the sun's apogee had increased by 16°, 47' since Ptolemy. This implied the important discovery of the motion of the solar apsides and of a slow variation in the equation of time. He did not believe in the trepidation of the equinoxes, although Copernicus held it.

At-Battani determined with remarkable accuracy the obliquity of the ecliptic, the length of the seasons and the true and mean orbit of the sun.

He proved, in sharp contrast to Ptolemy, the variation of the apparent angular diameter of the sun and the possibility of annular eclipses. He rectified several orbits of the moon and the planets and propounded a new and very ingenious theory to determine the conditions of visibility of the new moon. In mathematics, he was the first to replace the use of Greek chords by *sines*, with a clear understanding of their superiority. He also developed the concept of cotangent and furnished their table in degrees.

He wrote a number of books on astronomy and trigonometry. His most famous book was his astronomical treatise with tables, which was translated into Latin in the twelfth century. An old translation of this is available at the Vatican. His *Zij* was, in fact, more accurate than all others written by that time.

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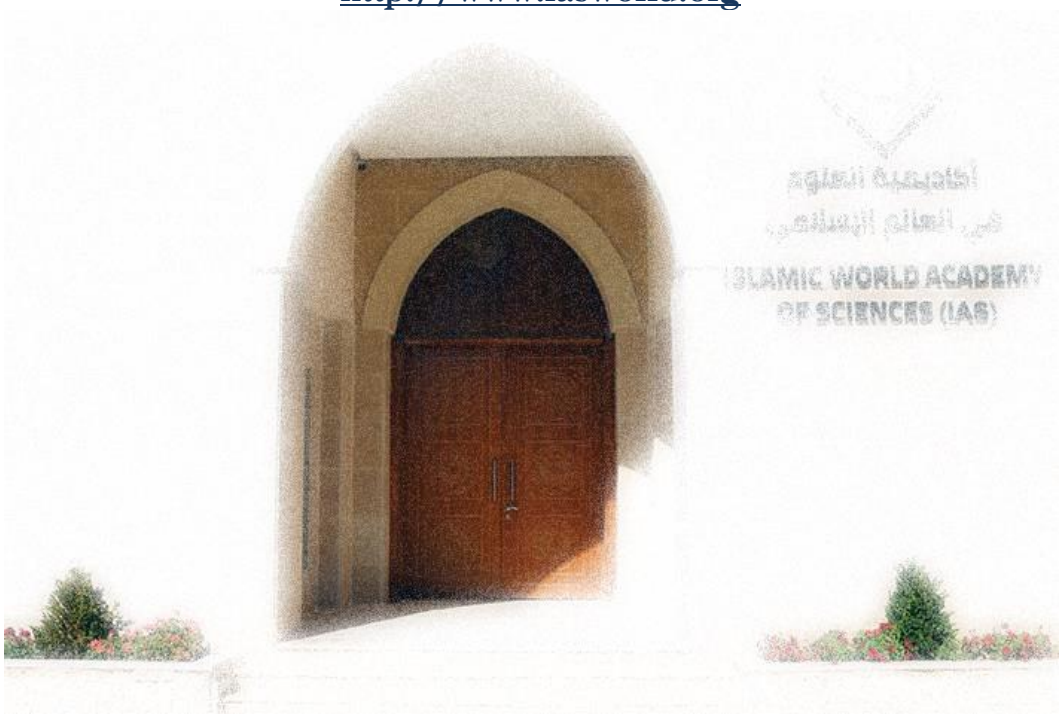

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