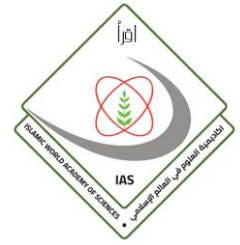


ISLAMIC WORLD ACADEMY OF SCIENCES

Newsletter



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BLUE PEACE MIDDLE EAST INITIATIVE 2023

HRH Prince El Hassan bin Talal



Most of the Levant and African countries are experiencing severe drought. Jordan has received 60% of yearly average rainfall. Africa fell short of 10% less cereal below the region average. Wheat harvest suffered the most, dropping to 16.6 million tonnes, 20% below the average (FAO 2023). Morocco output dropped to 3.3 million tonnes a sharp 60% decrease from the average. In Iraq and Syria, the discharge of Euphrates has dropped dramatically.

Our future will rely on non-static models for forecasting climate events as static models are no longer feasible. This requires adaptive and resilient/ holistic solutions and provisions that account for climate change. This will also offer new opportunities for cooperation in developing joint adaptation strategies that need to be taken seriously in order to sustain the purpose of initiative.

Climate change is not likely to get better, and we cannot close our eyes in front of this crisis- neither can we apply solutions from the past. But we need a new, innovative approach based on transboundary/regional cooperation (as no one, not even a country, can tackle these challenges by itself).

There is a need for regional research and outreach hubs that promote the sharing of data and ideas on potential sustainable solutions, community engagement, capacity building,

empowerment of diverse voices, and translation of research findings.

Relying on scientific evidence should be the main instrument and foundation for regional cooperation science is necessary for eater diplomacy, both as a means of building confidence and trust and as a way to promote cooperation and prevention of conflicts.

Today there are 263 river basins and an as-yet uncalculated number of aquifers that cross the political boundaries of states and can be defined as transboundary water resources. These shared river basins account for 45.3% of the total area of the planet's surface, which 40% of the world's population inhabits; this corresponds to approximately 60% of the world's river flow.

Identifying basin-wide WEF (Water, Energy, Food and Ecosystem) nexus opportunities will lead to the creation of incentives and confidence building within the region through thematic projects that ensure cooperation through regional win-win Nexus joint activities.

There is a need for a comprehensive Water-Energy-Food-Ecosystem Nexus approach as an important contributor to national and regional economies. This approach should be taken to a regional scope through the identification of economically viable and repeatable regional project implementation ideas.

The way forward will lead us to develop viable and socially acceptable solutions that rely on the complex interlinkages of the WEF nexus. In addition to analyzing tangible dimensions of water, soils, and inputs in agriculture, we must also consider human aspects, like food habits and risk perceptions. Only then it is possible to identify such solutions.

Our way forward should stimulate a broader, more diverse regional water dialogues that embraces political leaders and decision makers from WEF sectors.

MESSAGE FROM HRH PRINCE EL-HASSAN BIN TALAL ON: WATER, ENERGY, FOOD SECURITY ECOSYSTEM NEXUS (WEFE)



I would like to begin by expressing our gratitude to the “Turkish Water Institute-SUEN” for their efforts in hosting the Blue Peace Middle East Initiative as a coordination office since 2019. Furthermore, I would like to extend congratulations to INWRDAM for being entrusted by the managing committee as the coordination office for the initiative starting January 2023.

There is a need to build trust and use Water Diplomacy to transform the recent Declaration of Principles between the OIC member state countries into a benefit-sharing deal under the WEFE umbrella.

Water, food and energy security are challenges that drain the Levant region, especially after the Russian-Ukraine war. The Importance of Levantine cooperation is now more urgent than ever. We need to build a nation with complementarity to enhance the nation’s water, food and energy security. Achieving this cooperation and complementarity, will directly lead to economic and social stability.

Co-management of all countries in shared water resources is essential for a successful Levantine cooperation, given its water scarcity conditions and severe

climate change impacts. Until now, no multilateral agreements have been signed by co-riparian countries of Jordan River Basin and Euphrates-Tigris River that enable shared information on water allocations and quality for effective management.

The Jordan Rift Valley boasts distinctive geological features and a wealth of cultural heritage, yet it also confronts significant environmental threats, such as water scarcity, soil erosion, and pollution. To safeguard the valley’s natural resources and ensure the resilience of its ecosystem and the well-being of its inhabitants in the long run, we need to take action. The Blue Peace initiative can play a crucial part in this effort by fostering regional collaboration and dialogue among various stakeholders to promote sustainable water use, land management practices, and effective environmental protection measures. While the managing committee will need to address the question of how to heal the valley, I urge everyone to embrace the principles of cooperation, dialogue, and sustainability in pursuit of this shared goal.

In a region like ours that is well known of its human resources, The Blue Peace initiative can offer a platform for bringing together diverse actors and perspectives to create a more sustainable and peaceful future for our region through joint research programs. The joint research programs can deepen our understanding of the natural systems and ecological processes, which will support the development of regional evidence-based strategies for restoration and sustainability.

Relying on scientific evidence should be the main instrument and foundation for regional cooperation. Science is necessary for water diplomacy, both as a means of building confidence and trust and as a way to promote cooperation and prevention of conflicts.

We can foster a more holistic and integrated approach to environmental management that benefits all stakeholders by focusing not only on shared water resources but also on the boarder transboundary ecosystem. By adopting this approach, we ensure a comprehensive, effective and equitable environmental management policies and strategies that address and balance the interests of all stakeholders.

Since its establishment in 2021, Blue Peace Middle East has worked to build trust and encourage dialogue across borders. During a period when conflict and crises led to a breakdown of trust and dialogue across the region, the Blue Peace Middle East community continued to believe that cooperation over water could help build a peaceful future in the Middle East.

Over the past 12 years, the initiative has also supported a wide range of activities to promote its vision of a sustainable future for our region.

Today marks the beginning of a new phase for Blue Peace Middle East, bringing us one step closer to achieving our vision of building a peaceful future for the region through water cooperation.

In this new phase, water will only be part of a larger picture. Because we cannot build a sustainable future for the Middle East by looking at water on its own. We need to zoom out and look not just at how

we manage our water, but also how we source our energy, where our food comes from and the state of our ecosystems. All these elements are interconnected, and by recognizing these vital links we can also start thinking differently about how we manage our resources, not just on a national level but also regionally. This will require a huge shift in thinking for all of us. It will mean we need to open our minds, move away from thinking about water, food, energy and ecosystems as separate, isolated resources but as a unified whole. This is the challenge what Blue Peace Middle East has set itself: to help introduce new ways of thinking, provide new perspectives and, especially, new hope for our region.

IAS TO HOLD ITS 25TH SCIENTIFIC CONFERENCE IN ISLAMABAD, PAKISTAN



The Islamic World Academy of Sciences (IAS) and the Pakistan Academy of Sciences (PAS) in partnership with the Higher Council for Science and Technology (HCST), Jordan, are pleased to announce the holding of the 25th IAS international scientific conference.

The conference will address the topic of “*Water-Energy-Food-Ecosystem Nexus for the Security of the OIC Countries.*”

The conference venue will be at the Pakistan Academy of Sciences in Islamabad, during **22-24 July 2024**. Accommodation will be be the Legend Hotel in Islamabad.

WATER SUSTAINS LIFE, THE ENVIRONMENT AND ECONOMIC DEVELOPMENT

Adnan Badran FLAS, FAAS
President, Islamic World Academy of Sciences
and President, Arab Academy of Sciences*



Fresh water is tiny proportion of the water resources on earth, with salt water accounting for 97.5% of planetary waters and fresh water for only 2.5%. 70% of the fresh water is tied up in polar caps, glacial ice and groundwater at inaccessible depths. This means that 30% of available freshwater or only 0.75% of total water supplies are available to humans for various uses (Shiklomanov, 1997). Human water endowments, which are found in lakes, rivers and accessible ground, are but a tiny proportion of the total planetary water endowment. As documented by Vorosmarty et al (2010) and others that water endowment is distributed unevenly around the globe in both spatial and temporal terms. This means that there are times and places where water is especially scarce as well as times and places where it is reasonably plentiful. This is shown in Figure 1 where it can be seen that renewable fresh water is relatively scarce in the MENA and South Asia regions and relatively plentiful in the Americas, Australia and New Zealand. It is also important to recognize that there is significant variability within each region exhibited by water sparse and water rich locales.

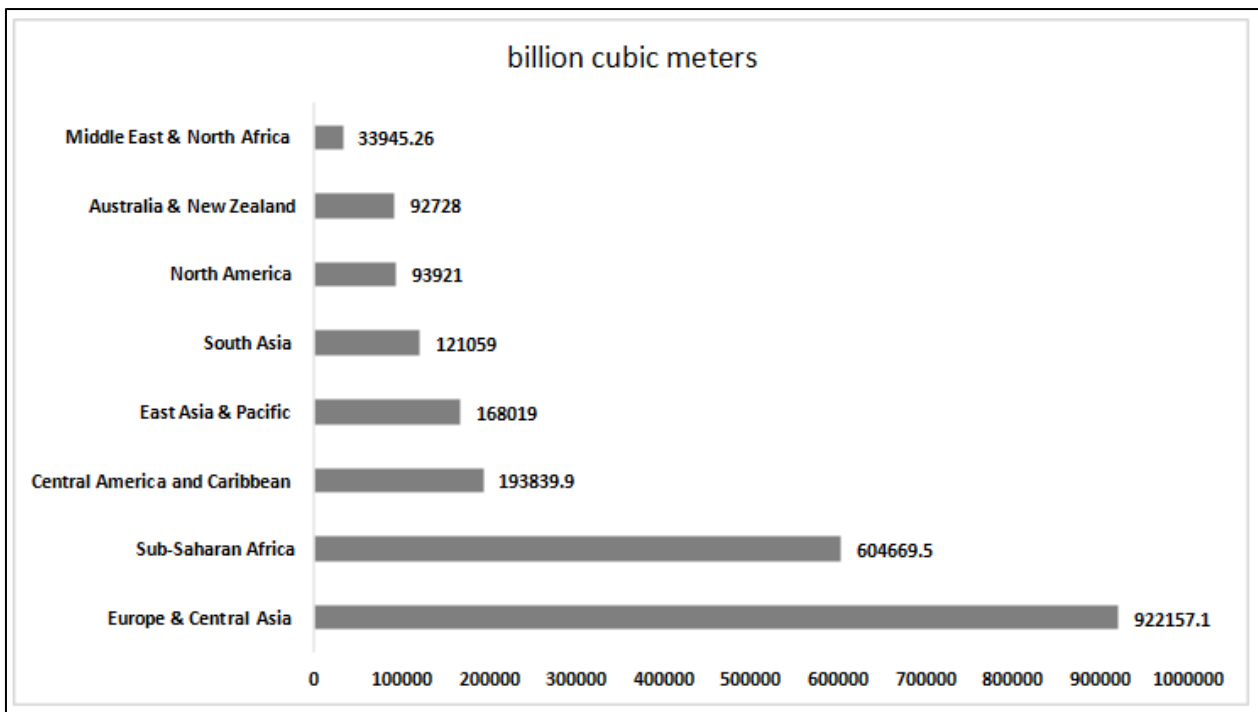
The importance of water in sustaining life, the environment and development has been acknowledged in the Dublin-Rio water principles (Assaf, 2010). In addition, Article 25 of United Nations Declaration of human rights stated in 1948, that:

“Everyone has the right to a standard of living adequate for the health and well-being of himself and his family, including food, clothing, housing and medical care and necessary social services and the right to security”.

Although water is not acknowledged explicitly, it is a crucially important part of the daily human diet and sustains life. It should be recognized that some efforts to manage water sustainably have unintended side effects that could have been predicted. A case in point is the treatment of water as a commodity, a practice that threatens the poor. Privatization of water resources has reduced the availability of fresh sanitary water. Two in three people survive on less than \$2 a day and are simply unable to pay for water for simple washing, cooking and sanitation needs. One proposal for dealing with the problem is to create an escalating price system based on the quantities of water used. Under this system, costs to the poor are minimal since they use small amounts. This proved to be an effective social package policy related to poverty.

As resources are decreasing in quality and quantity, water policies promoted by developmental agencies with governments have concentrated on comprehensive integrated ecosystem of water management. Expanding demands for domestic, agricultural, and industrial water uses have made water a scarce resource in some countries in Middle East where total water withdrawals exceed renewable water resources. In fact, most Arab countries are already below the water scarcity level (Plan Blue UNDP Database 2005-2009).

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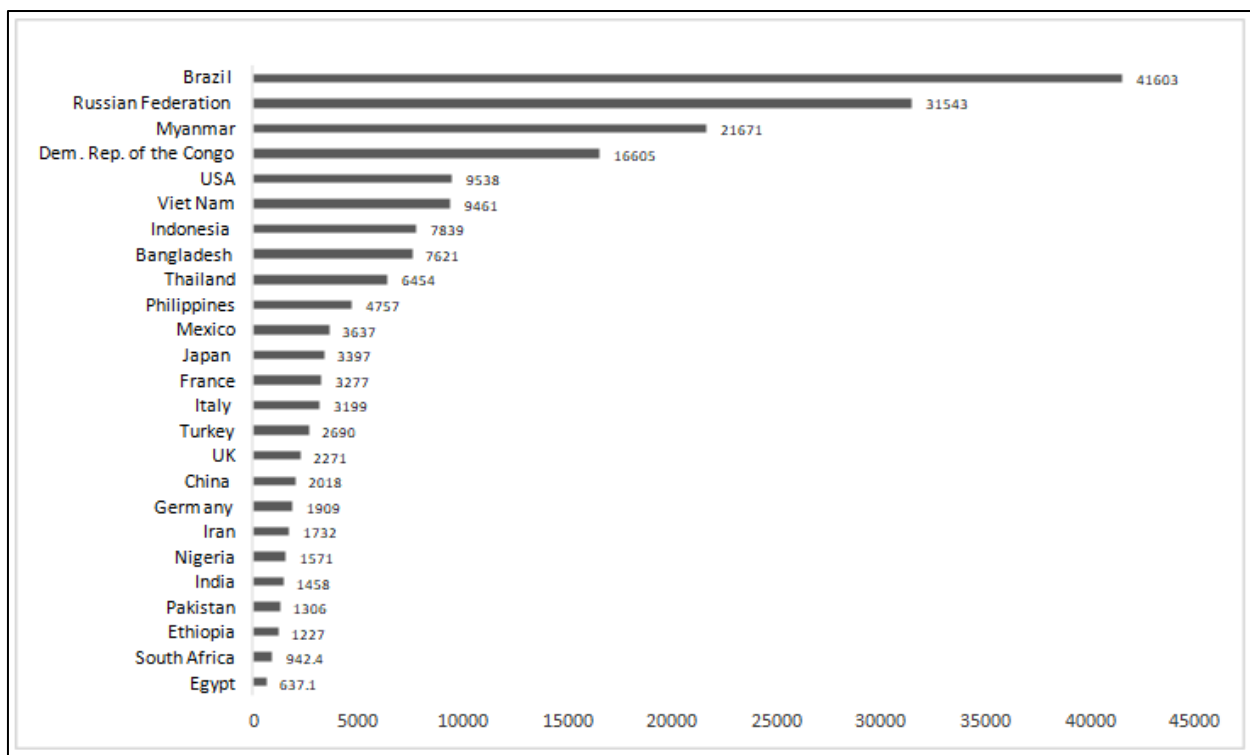
(Fig. 1): Renewable Internal Freshwater Resources Per Capita, by Region 2014 (FAO 2016).

Therefore, thoughtful, science-based water policies, strategies and management regimes are crucial if supplies, demands and allocations among stakeholders in a balanced fashion that incorporates fairness and efficiency.

Fresh Water Resources Are Becoming Less Available

The UN & UNESCO classify rich-water countries as those who secure 8000 m³ per capita per year. World average is estimated to be 6000 m³ per capita per year. Water scarce countries are defined as those with annual allocations below 1000 m³ per capita while allocation of below 500 m³ per capita per year constitute severe water scarcity. Annual per capita endowments of renewable water resources are shown for the 25 most populous countries in the world in Figure 2. Global per capita renewable fresh water

resources are declining at significant rates. Rayne & Forest (2013) reported “substantial reductions of global per capita stock of 54% between 1962 and 2011. There was a decrease of 75% in sub-Saharan Africa, 71% in the Middle East & North Africa (MENA), 64% in South Asia, 61% in Latin America and the Caribbean, 52% in East Asia & the Pacific, and 41% in North America”. At current rates of depletion, global per capita renewable internal fresh water resources are project to decline from levels observed for 1962 by 65% by 2020. Thirteen Arab countries are among the 19 most water scarce nations in the world. Per capita water availability of eight of those countries is below 200 m³, less than half of the level, which the UN defines as severe scarcity. Per capita annual renewable freshwater resources for the MENA region are expected to decline from 1962 values by 80% in the year 2020.



(Fig. 2): Total Renewable Water Resources per Capita for the 25 Most Populous Countries in 2014 (in 1000 cubic meters per person per year) (FAO 2016).

The reasons for this decline are many and the importance of each varies by region. Population growth, which has occurred in all regions, is an obvious reason. Declines in the availability of the water resource also account for diminishing per capita availability. The world-wide trend of declining water quality means that there is less water available for consumptive uses. Declining water quality reduces available supplies just as surely as drought. Lower per capita endowments also result over time when non-renewable resources of water are persistently utilized as long-term supplies. Fossil ground water and quantities of water that are over drafted from renewable aquifers are the most obvious examples of non-renewable supplies. Persistent withdrawal of such supplies depletes them to the point where demand pressures (that were previously supplied by non-renewable sources) fall on renewable sources that are physically substitutable. A final source of explanation is climate change, which has occurred in the past and is expect to occur in the future. This means that for

some regions water is less available than it was historically.

The picture that emerges, then, is one of intensifying scarcity. The fundamental cause of the intensifying scarcity is bound up in the fact that demands for water are growing at the same time that available supplies of water of appropriate quality are shrinking. Some of that scarcity is self-inflicted owing to the absence of effective water policies and management regimes. Some of that scarcity can be avoided by employing existing science in the making of policy and in the fashioning of improved techniques and technologies, which will permit water to be used both more efficiently and more extensively than it has been in the past. Commitments to programs of research and development will also be required if science needed as a basis for the public policies and innovative technologies that will be necessary to confront and manage the emerging global water crisis.

THE TRIANGLE: **ENERGY, WATER AND FOOD SECURITY NEXUS** **FOR THE MENA REGION**

Adnan Badran FLAS, FAAS*

President, Islamic World Academy of Sciences and President, Arab Academy of Sciences



The improvement of water management techniques and technologies needed to cope with the projected increase in water scarcity will require new water science as well as extensive use of existing water science. Future water policies will have to be well informed by science if they are to be effective. Many existing water policies are not based on sound science and are aimed at goals other than ensuring that water is used efficiently, protected from qualitative degradation and maintained for future generations. The potential of science to contribute to the resolution of current and foreseeable water problems is virtually unlimited. There are numerous examples.

At the global level, the developments from nano-science can help in a variety of ways. Development of more effective ways of cloud seeding; development of nano-membranes for cleaning polluted water and improvements in diffusion technology which will lower the costs of desalination are important examples. Development of small-scale solar technology can improve energy generation and thus

lower the costs of desalination. The importance of such a development can be illustrated by reference to the MENA region where solar energy falling on one square meter of surface annually is the BTU equivalent to one barrel of oil. Currently, the Arab region, with 5% of world population, produces 50% of desalinated water of the world (AFED 2010). Technology can help to extend the application of desalination and other water cleansing techniques to other areas throughout the world.

At the regional level, scientifically based management of shared water resources, whether surface or ground water, should be placed high on the agenda of countries with shared water basins. Effective bilateral and/or multilateral agreements should lead to stronger economic and political ties among countries with shared water-basins obviating the potential for conflict. The importance of dealing effectively with shared water is almost self-evident. This is particularly true in the MENA region where, “Of all renewable water resources...., two thirds originate from sources outside the region”. (AFED 2010, El-Quosy, 2009).

At the national level, science can contribute to the acquisition of knowledge about possible new water sources and about the application of techniques for using existing sources more efficiently. Thus, for example, agriculture accounts for 85% of water use in Arab region as compared with a world average of 70%. On-farm irrigation efficiency remains at 35% so there is clearly room for improvement at the farm level (AFED 2010). Science can also contribute to

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the development of new crop strains that had better tolerate both aridity and salinity. Rain-harvesting systems and efficiency improvements in science-based agricultural practices to achieve water savings should be emphasized. Other policy reforms leading to a new political economy of water management could focus on the acquisition of water “virtually” through imports of crops “from water-rich countries, while allocating scarce water resources to low-water consuming, high value crops that can generate foreign exchange”. (AFED 2010, page 61).

In this way, food security may be achieved through set of well-balanced trade and water management policies.

One potential new source of water is recycled wastewater. Wastewater generated by domestic and industrial sectors in the Arab region totals 10 km³/year, of which 5.7 km³ undergoes treatment. Of this volume of treated wastewater, only one third is reused. However, wastewater treatment plants currently handle waste loads that exceed their capacity limits. The untapped potential of wastewater should be the focus of appropriate policy interventions including national water management strategies for water reuse.

The importance of water science to fashioning solutions to the global water crisis; on the needs to build scientific competence and capacity and on issues related to making science-based water policy is that the existing water scarcity in the arid and semi-arid Arab countries lies at the extreme edge of the global water scarcity picture. Moreover, it offers to other parts of the world, particularly those that are arid and semi-arid, a picture of the future water situation likely to be visited if the current situation is neglected.

THE LAWS OF THERMODYNAMICS

M. Asghar FLAS^o



Abstract: this contribution presents the three laws of thermodynamics and treats the different contributions underlying the compatibility of quantum mechanics with the laws of thermodynamics.

1. Introduction

The relatively young field of quantum thermodynamics tries to reconcile the laws of quantum mechanics with the laws of the 200-hundred-year-old classical thermodynamics.

The three laws of thermodynamics are **(1)**:

a. Law of energy

Energy cannot be created or destroyed.

b. Law of entropy

The amount of entropy or disorder in an isolated system can never decrease. The thermodynamical entropy S is defined as:

$$S = Q / T, \quad (1)$$

where Q is the amount of heat in the system and T is its thermodynamical temperature. This definition of entropy was extended by Boltzmann through the concept of atomic energy levels to:

$$S = Q / T = \kappa_b \ln \Omega, \quad (2)$$

where κ_b is the Boltzmann constant; \ln , the natural logarithm; Ω , the system's macroscopic configuration with a defined energy consisting of a maximum number of the supposedly degenerate microscopic levels with the same energy as the macroscopic configuration corresponding to a given value of S . If the Ω contains only one microscopic level, then, from relation (2) with $\ln 1 = 0$, the value of entropy $S = 0$, and the system is sharply defined, and it does not suffer from any dispersion or disorder. As the number of microscopic levels in Ω increases, the corresponding value of S and hence, the disorder, goes up, too.

In SI units, the entropy S is expressed as (Joules per Kelvin) or (eV per Kelvin) = (J / K) or (eV /

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K), and $\kappa_b = 1.3806452 \times 10^{-23}$ (J/K), and $\kappa_b = 8.6173303 \times 10^{-5}$ (eV / K).

c. Law of thermodynamical absolute zero temperature

It is impossible to cool an object to the thermodynamical absolute zero temperature of -273.15°C or 0°K , because an infinite amount of work is needed to reach the absolute zero temperature. The effective coldest thermodynamical temperature reached experimentally in 2021 was $38 \times 10^{-12}^\circ\text{K}$.

Following the ideal gas formula: $(PV/T) = nR = \text{constant}$, the value of the absolute zero temperature can be obtained by measuring the volume V of a gas at constant pressure P or by measuring the pressure P of a gas at constant volume V as a function of temperature, and then, extrapolating the *expected linear experimental curve* as a function of temperature to its zero-value corresponding to the absolute zero temperature. Fig. 1, presents the case of pressure P variation as a function of temperature T for the three fixed volumes a , b and c of the gas. All the extrapolated curves end in zero value at $T = -273.15^\circ\text{C}$ or 0°K (Kelvin). The Kelvin temperature scale is named after the British scientist William Thomson ennobled as Lord Kelvin who studied the subject and proposed the absolute temperature scale in 1848.

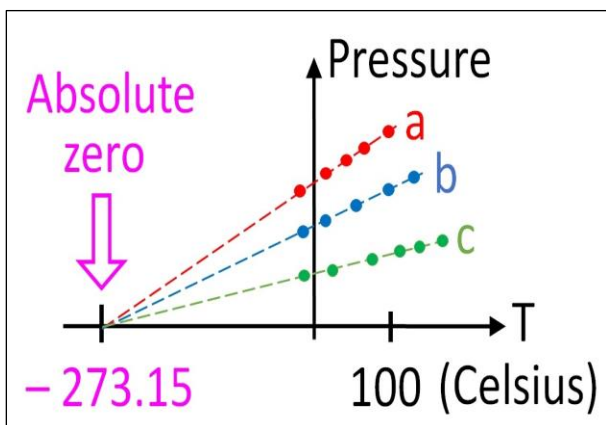


Fig. 1, The variation of gas pressure P as a function of temperature T for the three constant volumes a , b , and c of the gas. The linearly extrapolated curves as a function of temperature go to zero value at the absolute temperature $T = -273.15^\circ\text{C}$ or 0°K (Kelvin), (2).

2. Work to link quantum mechanics and the laws of thermodynamics.

Physicists working in the field hope that building thermodynamics via the laws of quantum mechanics would help to resolve the long-dated conundrum (puzzle) such as whether the thermodynamical concept of heat and efficiency apply to tiny electronic components and even atom-sized machines. Or stated this in a more pragmatic way: steam engines convert heat into work, could the quantum-rule-governed machines do the same thing?

The following points deal with the present situation of interaction between quantum mechanics and the thermodynamical laws:

- a. In the past decade, theorists have suggested that quantum systems tend to reach and maintain a state of equilibrium or maximum disorder even, when they have just a handful of components. The experimental work has confirmed this idea with a small number of atoms trapped by laser light in vacuum (3).
- b. In 2011, a collaboration showed that quantum correlations due to quantum entanglement, can be harnessed to produce mechanical work (4).
- c. More recently, it has been shown that the laws of quantum mechanics limit how fast heat can be extracted from an object, and that reaching the absolute zero temperature would take an infinite of time, thus, confirming that the third law emerges from quantum mechanics (5).
- d. Physicists have set up quantum heat engines that can turn heat into work at the quantum level (6).

3. Conclusions

There is significant evidence showing that the thermodynamical laws including the first law on conservation of energy, are compatible with quantum mechanics.

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CLOSING THE GAP OF STI

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I. Gap in Innovation and Digital Transformation:

Digital transformation requires trust, resilience, and innovation. There is no one-size-fits-all scenarios in adopting new technologies. Different corporations start at different stages of maturity in understanding digital transformation .But what should we do in order to seed and reinforce the culture of innovation and creativity in the workplace?

- Create a friendly environment where people can come together and discuss matters to create new ideas and new venues .
- Bring in people from various disciplines, and backgrounds. Mix engineers with people from business ,information and communications technology (ICT), and fine arts to promote startups of new companies for hardware ,software, and services. Through this, a network for fostering innovation and creativity in digital transformation will be developed.
- Start from the customer's needs and work a reverse-engineering scenario.
- Breakdown the information silos to enable the free exchange of data and accomplish transformation through an interdisciplinarity approach. Climate change, food security, and solving energy and water scarcity cannot be achieved except by dissolving the rigid walls among disciplines, and allowing cross-integration of data to complete your journey of digital transformation.
- With the disruption in supply chains globally, we need to build **resilience** into business models to withstand exogenous shocks such as the sudden COVID-19 pandemic.

Technology is a component of digital transformation for innovation and will produce a radical change toward excellence and efficiency. An extensive database enables the right decisions to be made. Europe now is lacking behind China in creating new ideas and innovation. Digital transformation requires leadership in disseminating a culture of creativity and innovation. To invite creative thinking, we should provide the space for thinking and exchange of data, and be inspired to generate innovative ideas. Variety will lead to diversity and innovative output. In the digital world, innovation and transformation are different but each can promote the acceleration of the other. A spark of innovation may lead to a new framework for a business plan or a strategy to implement technology and meet the demands of the consumer or improve operational efficiency. Digital transformation is not only technology ,it also involves data, process, business strategy, and people.

Although technology tools are important, it is more difficult to talk about how people can adapt to the digital transformation potential in order to open up innovation and creativity. As new technologies, like smartphones and internet-connected devices emerged, for example, the social media as innovators led to a transformation in how business could reach customers (Fig. 1) .

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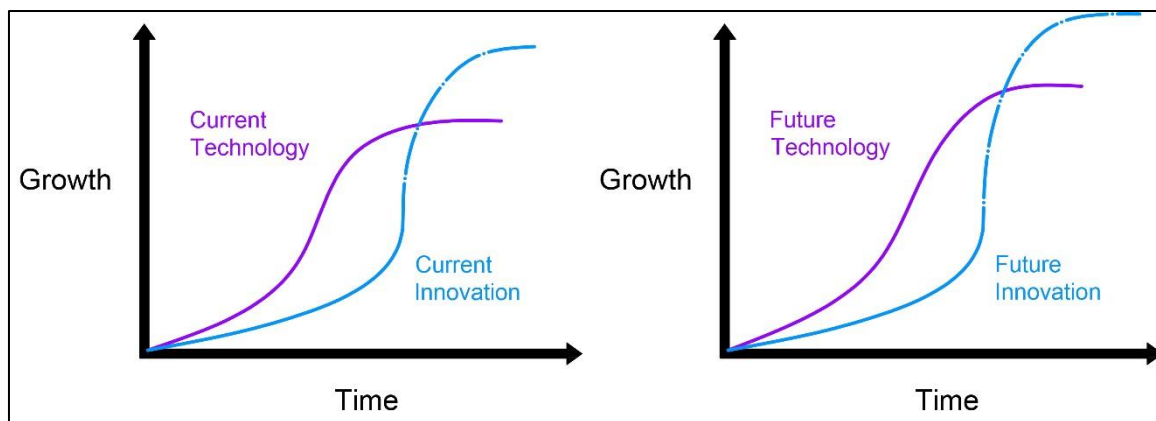


Fig. 1 Diffusion from technology to innovation.

II. GAP in R&D Expenditure:

1. United States is leading in R&D investment of 3.45% of their GDP, Japan comes next leading its expenditure on R&D of 3.26% of their GDP, followed by Germany, Finland, Iceland, China, France, UK as shown in fig. 2.
2. United Arab Emirates is leading the Arab world in R&D investment of 1.45% of their GDP in, Egypt comes next of 0.96% of their GDP spent on R&D, followed by Tunisia, Jordan, Algeria, Saudi Arabia, Oman, Kuwait, Iraq as shown in fig. 2.

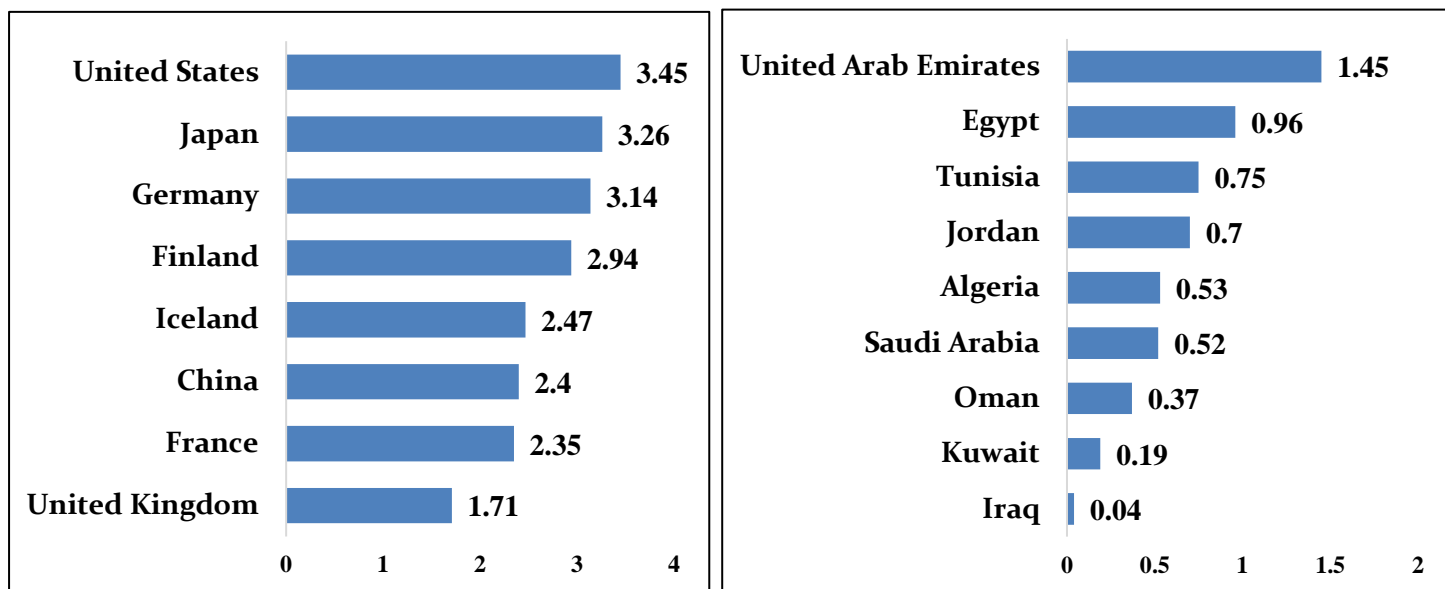


Fig. 2 R&D expenditures in Arab countries compared with more-developed countries (as a percentage of GDP) World Bank 2016-2020.

III. GAP in Number of Researchers:

1. Finland is leading the world in number of researchers (FTEs) 7,527 per million people, Iceland comes next 6,088, followed by Japan, Germany, United States, United Kingdom, Russia, China, South Africa, as shown in fig.3.
2. United Arab Emirates is leading the Arab World in number of researchers (FTEs) 2,443 per million people, next comes Tunisia 1,660, followed by Egypt, Jordan, Saudi Arabia, Oman, Kuwait, as shown in fig. 3.

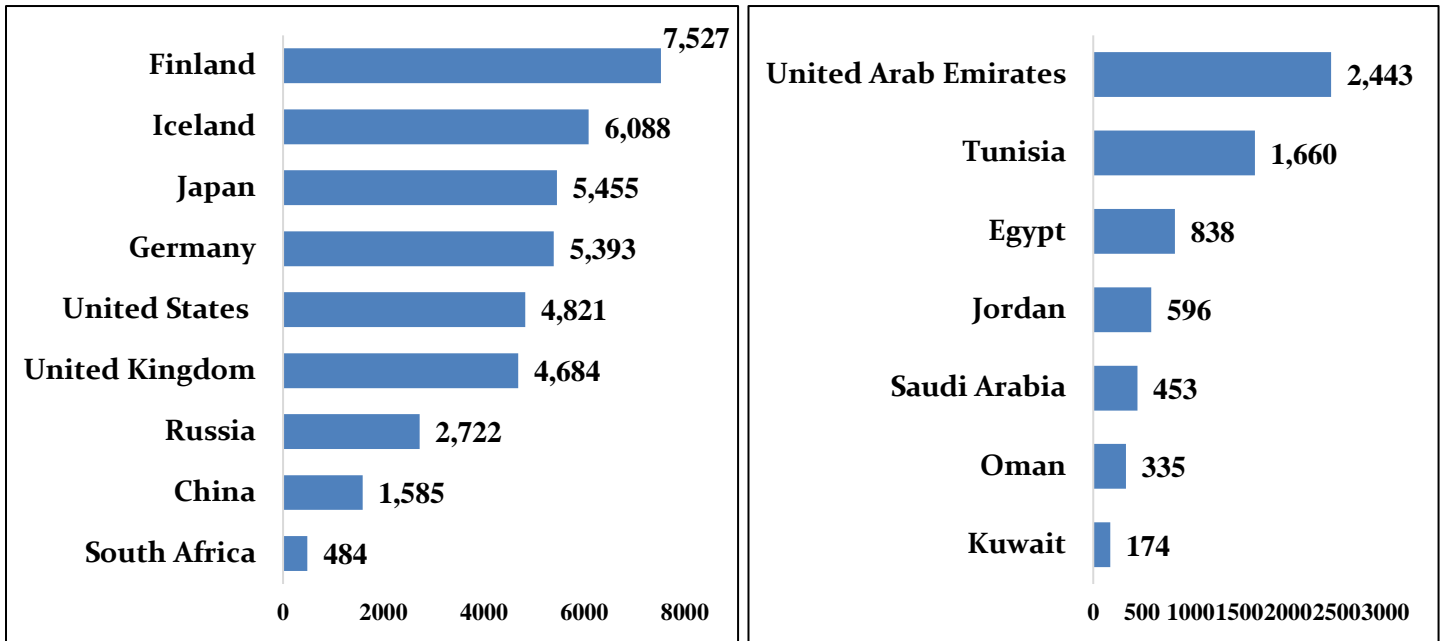


Fig. 3 Number of Researchers (FTEs) per million people in the Arab Countries compared with more-developed countries, World Bank 2017-2020.

IV. GAP in Publications:

1. China is leading the world in number of publications 744,042, next comes United States 624,554, followed by United Kingdom, India, Germany, Japan, France, Australia, South Africa, Finland, Iceland as shown in fig. 4.
2. Saudi Arabia is leading the Arab World in number of publications 36,301, next comes Egypt 34,575, followed by Iraq, United Arab Emirates, Morocco, Tunisia, Algeria, Jordan, Qatar, Lebanon, Oman, Kuwait, Sudan, Bahrain, Yemen, Syria, Libya.

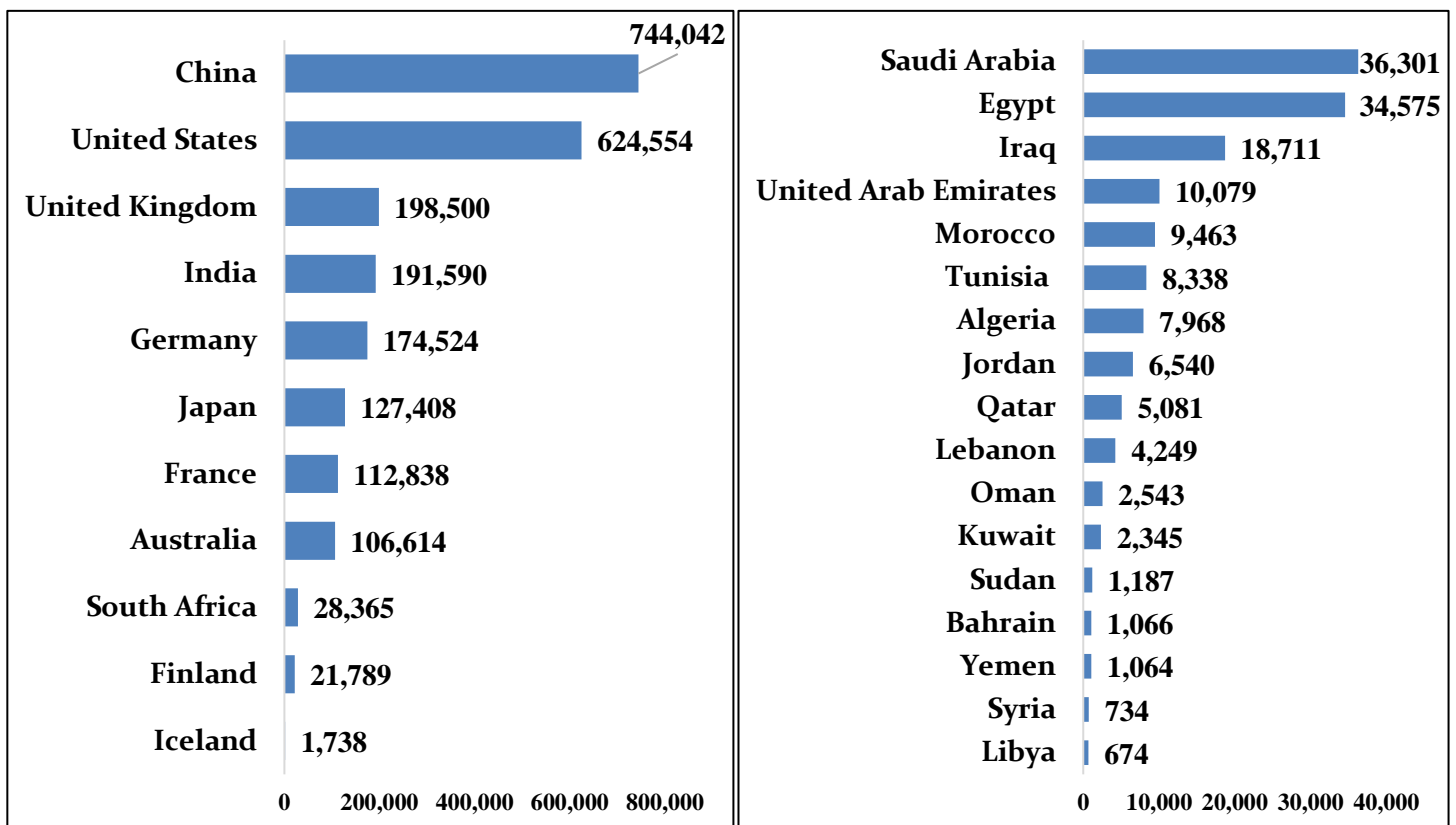


Fig.4 Number of published research papers in the Arab Countries compared with more-developed countries, Scopus 2020.

V. GAP in Impact (H-Index):

1. United States is leading the world impact in H-index 2,711, next comes United Kingdom 1,707, followed by Germany, France, Australia, Japan, China, Finland, India, Singapore, Brazil, Russia, South Africa, Mexico, Malaysia, Thailand, Pakistan, Indonesia, as shown in fig. 5.
2. Saudi Arabia is leading the Arab world impact in H-index 478, next comes Egypt, followed by United Arab Emirates, Lebanon, Qatar, Tunisia, Morocco, Jordan, Algeria, Kuwait, Oman, Iraq, Syria, Sudan, Bahrain, Yemen, Libya, as shown in fig. 5.

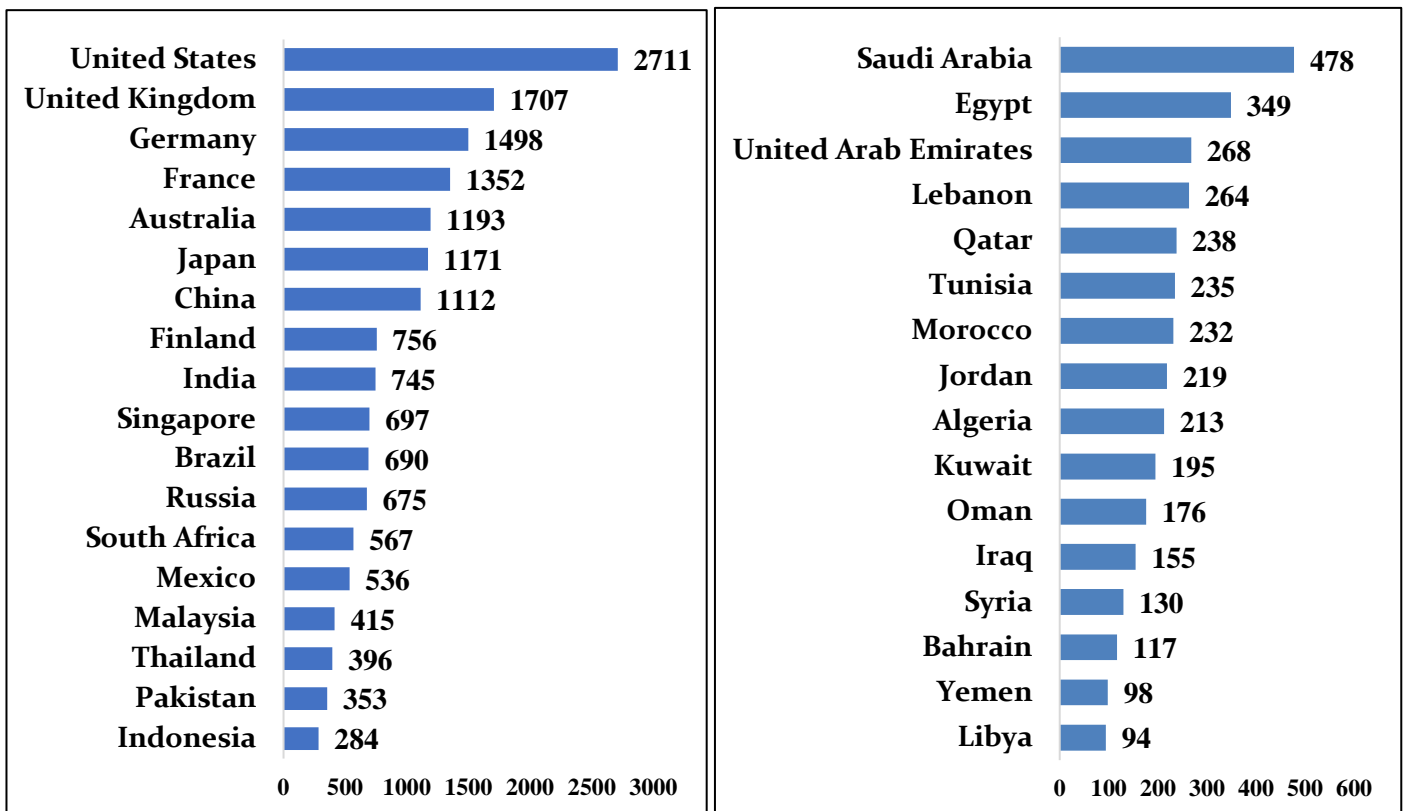


Fig. 5 H-index for Arab countries as compared with non-Arab countries (Hirsch-Impact, Scimago Journal Rank (SJR 2021)).

VI. GAP in Hi-Tech Exports:

1. Iceland is leading the World of 33.49% of high-tech percentage of manufactured exports, next comes China 29.96%, followed by United Kingdom, Australia, France, United States, Germany, Finland, South Africa, as shown in fig. 6.
2. United Arab Emirates is leading the Arab World of 8.96% of high-tech percentage of manufactured exports, next comes Tunisia 7.17%, followed by Oman, Morocco, Bahrain, Egypt, Lebanon, Jordan, Qatar, Saudi Arabia, Kuwait, as shown in fig. 6.

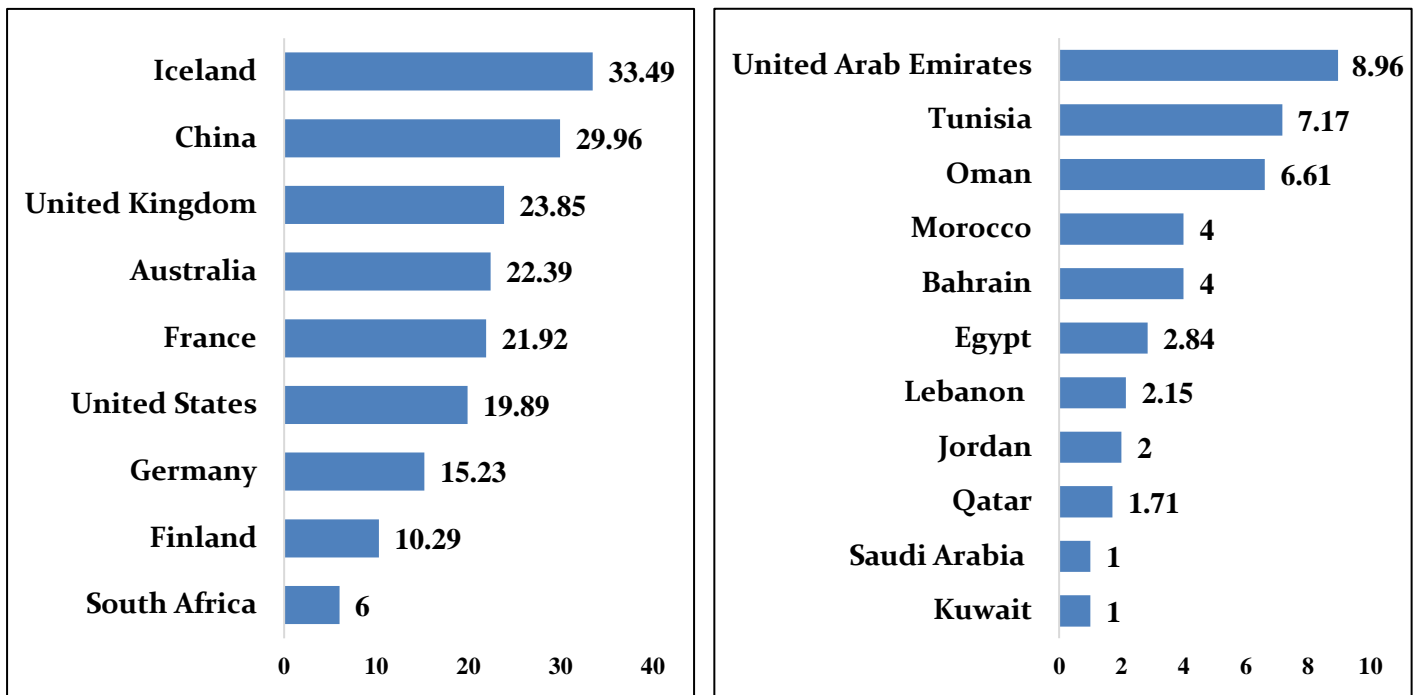


Fig. 6 The ratio of high technology in total exports (% of manufactured exports) of Arab countries compared with more-developed countries, 2019-2020.

VII. GAP in Patents for Non-Residents:

1. United States is leading the World of patents for non-residents 327,586, next comes China 152,342, followed by Japan, Korea, India, Canada, Australia, Germany, Brazil, Mexico, Russia, United Kingdom, France, Finland, as shown in fig. 7.
2. Morocco is leading the Arab World of patents for non-residents 2,438, next comes Saudi Arabia 2,274, followed by United Arab Emirates, Egypt, Qatar, Algeria, Oman, Jordan, Tunisia, Bahrain, Kuwait, Syria, Yemen, Sudan, as shown in fig. 7.

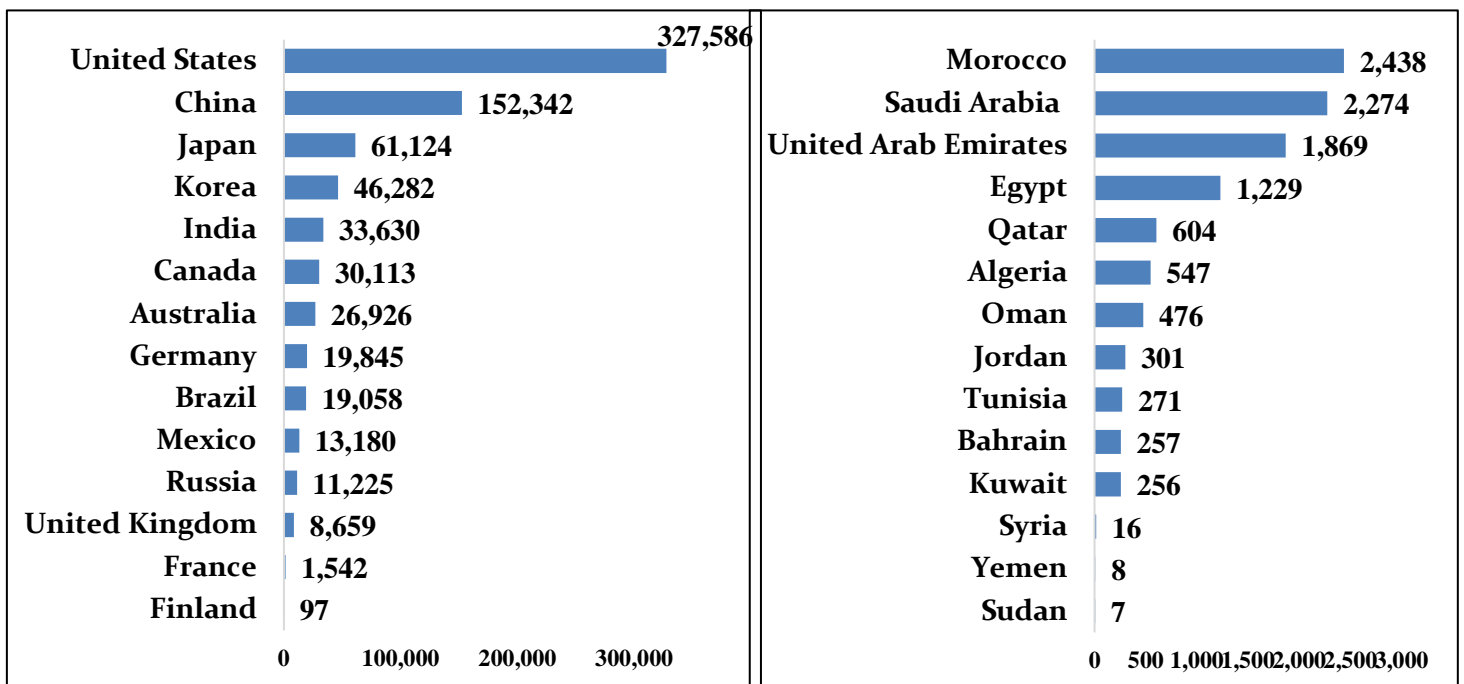


Fig. 7 Patents for non-residents in Arab countries compared with non-Arab countries. World Bank (2018-2020).

BIOPHYSICS RESEARCH AND NOBEL PRIZES

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Ali A. Moosavi-Movahedi



Niku Mohebalizadeh

Abstract:

Biophysics is an interdisciplinary science that take a deep and multifaceted look at biological and natural phenomena and paleontology. The root of biophysics lies in the basic sciences and fundamental sciences, which deals with the molecular, cellular, organ and systemic discovery of biological and natural phenomena. This science is equipped with accurate tools and data science tools in the form of computing and artificial intelligence, which examines the past and present phenomena and has a very clear eye on the future of science research. Therefore, the achievements of biophysics have received valuable Nobel prizes in the field of Chemistry (23 cases), Physics (1 case), Physiology or Medicine (11 cases) in the last sixty years. A large part of the diagnostic tools in science and medicine have included the Nobel Prize, which has been in the field of biophysical research.

Keywords: Biophysics, Nobel Prizes, Accurate measurement tools, Deep science, Disease early recognition

Introduction:

Biophysics as an interdisciplinary science uses the theories and methods of physics and other basic sciences to study biological phenomena at the molecular, cellular, tissue, and organ scales. Today, research achievements in the field of biophysics are very important for expanding the boundaries of knowledge. Biophysics is linked to a wide range of disciplines, including;

Biochemistry, molecular biology, physical chemistry, physiology, nanotechnology, bioengineering, computational biology, biomechanics, evolutionary biology and systems biology, artificial intelligence, physics, chemistry, mathematics, and other disciplines can be mentioned. Due to the importance of the achievements in the last sixty years, many prizes, including the Nobel Prize, have been awarded in this field of science. The Nobel Prize is awarded to outstanding research that breaks new ground in science. Biophysics research has been associated with Nobel Prizes in Chemistry, Physics, Physiology or Medicine, which are briefly described below:

1-Simply one click: Simple answers are best. Nobel Prize 2022 in Chemistry to Caroline R. Bertozzi, Morten Meldahl and Kay Barry Sharpless were awarded for the development of click chemistry and biological orthogonal chemistry. Sharpless and Meldal conducted research in the field of click chemistry. Bertozzi connected click reactions to the world of biological sciences and used it for bio-orthogonal reactions.

2-Capturing life in atomic detail: An image is the key to understanding. Scientific advances are often based on the successful visualization of objects invisible to the human eye. Jacques Dubochet, Joachim Frank and Richard Henderson received the 2017 Nobel Prize in Chemistry for developing an effective method for producing three-dimensional images of life molecules (cryo-electron microscopy).

3-Development of the world's smallest machines: Miniaturization of technology could lead to a scientific revolution. The 2016 Nobel Prize in Chemistry was jointly awarded to Jean-Pierre Sauvage, Sir James Fraser Stoddart and Bernard L. Feringa for the design and synthesis of molecular machines thousands of times thinner than a human hair. Molecular machines will be used in the development of sensors and energy storage system.

4-A great honor for small bodies: For a long time, light microscopy was held back by one supposed limitation: that it could never achieve resolution better than half the wavelength of light. The 2014 Nobel Prize in Chemistry was awarded to Eric Betzig, Stefan W. Hell, and

William E. Moerner was awarded for the development of super-resolved fluorescence microscopy. The pioneering work of these researchers has brought the optical microscope into the nano dimension.

5-How to represent the world in the brain? How does the brain create a map of the space around us? And how do we navigate our way through a complex set?

John O'Keefe, May Britt Moser and Edward I. Moser received the 2014 Nobel Prize in Physiology or Medicine for the discovery of nerve cells in the brain that enable the sense of location and orientation.

6-Computer models reflecting real life:

Today, the computer is as important a tool for chemists as the test tube. The 2013 Nobel Prize in Chemistry was awarded to Martin Karplus, Michael Levitt and Arieh Warshel for the development of multiscale models (based on classical physics and quantum physics) for complex chemical systems.

7-How, where and when are vesicles transported? A major transport system in cells

The 2013 Nobel Prize in Physiology or Medicine was awarded to James E. Rothman, Randy W. Schekman and Thomas C. Sudhof was awarded due to the discovery of molecular mechanisms regulating the transport of vesicles in eukaryotic T cells.

8-Smart receivers: The body is a regulated system of interactions between billions of cells. Each cell has tiny receptors that enable it to sense its environment, so it can adapt to new situations. The Nobel Prize 2012 in Chemistry was awarded to Robert J. Lefkowitz and Brian Kobilka for the study of G protein-coupled receptors.

9- The mystery of pseudo-crystals: Previously, chemists interpreted the order in crystals as a periodic and repeating pattern. The 2011 Nobel Prize in Chemistry was awarded to Dan Schechtman for the discovery of pseudo crystals. Interatomic distances in a quasi-crystal are related to the Fibonacci sequence. The Fibonacci sequence is also regular even though it never repeats itself because it follows a mathematical law. The order in quasi-crystals is not the same as when it is a periodic crystal.

10- Chemical bases of life: The story begins with hot springs and the sea. Microorganisms from these environments were used to isolate strong ribosomes. The goal was the crystallization of ribosomes. The 2009 Nobel Prize in Chemistry was jointly awarded to Venkatraman Ramakrishnan, Thomas A. Steitz and Ada E. Yonath, was awarded for studying the structure and function of the ribosome. Accurate knowledge of the binding site of antibiotics to the ribosome helps scientists to design and produce new and more efficient drugs.

11-Immortality: How chromosomes can be completely copied during cell division and how they are protected from destruction. The 2009 Nobel Prize in Physiology or Medicine was awarded to Elizabeth H. Blackburn, Carol W. Greider and Jack W. Szostak was awarded for discovering how chromosomes are protected by telomeres and telomerase enzyme.

12-Jellyfish green light: Green fluorescent protein is a guiding star for tools in the life sciences. The 2008 Nobel Prize in Chemistry was awarded to Martin Chalfie, Roger y. Tsien and Osamu Shimomura for the discovery and development of green fluorescent protein (a green substance in jellyfish as a tool to visualize specific cellular actions).

13- DNA voice: They are sandwiched between genes and the molecular machinery that allows the silent information wrapped in DNA to speak. They in turn work to select, transmit, read and decode the DNA code, producing the components needed for life. Transcription, the copying of a strand of DNA to produce a strand of RNA, is a central operation in biology. The 2006 Nobel Prize in Chemistry was awarded to Roger D. Kornberg was awarded for his studies in the field of molecular basis of eukaryotic transcription.

14- Montage for life: Primary self-replication requires the concentration of molecular components, either on a surface or in a volume. In a sea of water and ions, the phospholipid bilayer performs an effective self-assembly and separates the organized activity from the surrounding environment and extracts energy from the environment. How does a cell allow one type of ion to pass through a lipid and exclude others? And how does deionized water

penetrate? The Nobel Prize in Chemistry in 2003 was awarded to Peter Agre for the discovery of cell membrane channels and the other half to Roderick Mackinnon for the structural and mechanical studies of ion channels.

15-Magnetic miracle: MRI imaging of human internal organs with precise and non-invasive methods is very important for diagnosis, treatment and medical follow-up. The 2003 Nobel Prize in Physiology or Medicine was awarded to Paul Lauterbur and Peter Mansfield for their discovery of magnetic resonance imaging. Paul C. Lauterbur discovered the possibility of creating a two-dimensional image by introducing a gradient to a magnetic field, and Sir Peter Mansfield developed the use of gradients in a magnetic field.

16-Revolutionary methods for biological molecules: all living things; Bacteria, plants and animals contain the same types of large molecules, macromolecules, which are responsible for life. The 2002 Nobel Prize in Chemistry is divided into two fields: mass spectrometry (MS) and nuclear magnetic resonance (NMR). John B. Fenn and Koichi Tanaka for mass spectrometry and Kurt Wuthrich for nuclear magnetic resonance have helped in various ways in the further development of these methods to accept biological macromolecules.

17-Genetic regulation: In parallel with the new generation of cells, cell death is a natural process to maintain the appropriate number of cells in the tissue. The 2002 Nobel Prize in Physiology or Medicine was awarded to Sydney Brenner, H. Robert Horvitz, and John E. Sulston was awarded for their discovery of genetic regulation of organ development and programmed cell death. In fact, this group was able to identify key genes regulating the growth of organs and programmed death in a nematode as an experimental model, and they have shown that the relevant genes exist in higher species, including humans.

18-Mind control: signal transmission in the nervous system;

The 2000 Nobel Prize in Physiology or Medicine was jointly awarded to Arvid Carlsson, Paul Greengard, and Eric R. Kandel for their discovery of a type of signal transmission in the

nervous system between nerve cells called slow synaptic transmission. Carlson's work led to the discovery of dopamine as a neurotransmitter in the brain that is important for the ability to control movements. Paul Greengard was a pioneer in receptor-mediated phosphorylation and dephosphorylation of brain proteins, and Kendall was searching for ways to modify the efficiency of synapses.

19-Slow motion: The Nobel Prize in Chemistry in 1999 was awarded to Ahmad Hassan Zewail for his studies on the transition states of chemical reactions using femto-spectroscopy (10⁻¹⁵ seconds). To show that with a fast laser it is possible to observe how the atoms of a molecule move during a chemical reaction. Zewail technique can be described as the fastest camera in the world.

20-Energetic compound catalysis: Life requires energy. How do living organisms obtain and use energy? Half of the 1997 Nobel Prize in Chemistry went to Paul D. Boyer and John E. Walker was split, to clarify the mechanism underlying the synthesis of adenosine triphosphate and the other half to Jens C. Skou was awarded for the first discovery of sodium and potassium ion transfer enzyme and ATPase enzyme.

21-Atomic trap: At room temperature, the atoms and molecules that make up air are moving in different directions at a speed of about 4,000 kilometers per hour. The 1997 Nobel Prize in Physics was awarded to Steven Chu, Claude Cohen-Tannoudji and William D. Phillips was awarded for developing methods to cool and trap atoms with laser light. They cool gases down to about microkelvin temperatures and develop flotation of the cooled atoms in a variety of atomic traps.

22-Signal converter: G protein-coupled receptors represent the largest family of plasma membrane-bound receptor proteins involved in many cellular and physiological functions. The 1994 Nobel Prize in Physiology or Medicine was awarded to Alferd G. Gilman and Martin Rodbell for the discovery of G proteins and the role of these proteins in signal transmission in the plasma membrane of eukaryotes.

23-PCR and site-directed mutagenesis: The 1993 Nobel Prize in Chemistry for contributions to the development of DNA-based chemical methods was awarded to Kary B. Mullis for his discovery of the polymerase chain reaction that enabled methods such as DNA fingerprinting (PCR) and half to Michael Smith for contributions. His foundation was given in the creation of oligonucleotide-based mutagenesis, its location and development for protein studies.

24-Magnetic Music: When matter is placed in a magnetic field, some atomic nuclei, such as the nucleus of a hydrogen atom called a proton, behave like microscopic compass needles. The 1991 Nobel Prize in Chemistry was awarded to Richard R. Ernst for his contributions to the development of high-resolution nuclear magnetic resonance spectroscopy methodology. Ernst took NMR to new dimensions, where it eventually became the most powerful tool in chemical analysis.

25-Life begins with a change in membrane potential. When the sperm merges with the egg cell at the moment of fertilization, the ion channels are activated. The 1991 Nobel Prize in Physiology or Medicine was awarded to Erwin Neher and Bert Sakmann for their discovery of the function of single ion channels in cells. They developed the patch-clamp technique. This technique is unique in that it records how a channel molecule changes its shape and thereby controls the current in a time interval of a few millionths of a second.

26-Hidden Treasure Lock Key: For a long time, it was thought that access and crystallization for structural studies of these important proteins buried inside the membrane were impossible. What seemed impossible was finally achieved by Hartmut Michel, Johann Deisenhofer and Robert Huber, for which they received the Nobel Prize in Chemistry in 1988. The first ones who managed to discover the full details of how to make a membrane bound protein and revealed the structure of the molecule atom by atom.

27-Image of the building blocks of life: Life is a chemical phenomenon. The Nobel Prize in Chemistry was awarded to Aaron Klug in 1982 for the development of crystallographic electron microscopy and structural elucidation of

biologically important nucleic acid-protein complexes. Kellogg's method allows to determine the structures with high resolution of functionally important molecular seeds.

28-Nucleic acid: The Nobel Prize in Chemistry was awarded in 1980, half to Paul Berg for his fundamental studies on the biochemistry of nucleic acids, with respect to recombinant DNA, and the other half jointly to Walter Gilbert and Frederick Sanger for their contributions to sequencing. base was donated in nucleic acids.

29-Enzymatic chemistry: The key to life is enzymes. Everything that humans do occurs through enzymatic reactions. The 1972 Nobel Prize in Chemistry was awarded, half to Christian B. Anfinsen for his work on ribonuclease, particularly on the relationship between amino acid sequence and biologically active compound, and half jointly to Stanford Moore and William H. Stein was awarded for their help in understanding the relationship between the chemical structure and the catalytic activity of the active center of the ribonuclease molecule.

30-Natural Weapon: We all owe a huge debt to antibodies. 1972 Nobel Prize in Physiology or Medicine to Gerald M. Edelman and Rodney R. Porter were awarded for their discoveries about the chemical structure of antibodies.

31-The role of genetics in protein synthesis: The instructions for making proteins are in our DNA. The 1968 Nobel Prize in Physiology or Medicine was jointly awarded to Robert W. Holley, Har Gobind Khorana and Marshall W. Nirenberg was awarded for interpreting the genetic code and its function in protein synthesis.

32-An eye for structure: The ability of scientists to manipulate data and "see" structure is critical. The Nobel Prize in Chemistry was awarded to Dorothy Crowfoot Hodgkin in 1964 for determining the atomic structures of important biochemical substances using X-ray crystallographic techniques.

33- Identification of complex protein structure: The Nobel Prize in Chemistry was awarded in 1962 to Max Ferdinand Perutz and John Cowdery Kendrew for their studies on the structure of globular proteins.

34- The secret of life: How can a molecule that has been simple and ineffective for a long time hold the secret of life?

Erwin Schrödinger's idea that physics could help solve the mysteries of biology was the spark that led many researchers to try to unravel the mysteries of the book of life, the structure of DNA. In 1962, the Nobel Prize in Physiology or Medicine was awarded to Francis Harry Compton Crick, James Dewey Watson and Maurice Hugh Frederick Wilkins, for their discoveries about the molecular structure of DNA and their importance for the transmission of information in living materials.

35-Insulin protein structure: The Nobel Prize in Chemistry was awarded to Frederick Sanger in 1958 for his work on the structure of proteins, especially insulin. Sanger's work on insulin enabled chemists to synthesize synthetic insulin.

Conclusion:

Biophysics helps to understand complex biological processes, develop new technologies, advance medicine, and improve our understanding of the natural world. Despite all these issues, this science faces challenges such as the complexity of biological systems, massive data analysis, integration of different scales of analysis. Advances in technology, computational methods, and interdisciplinary collaborations are and will be opportunities that pave the way for these challenges. Interdisciplinary collaboration opens the mind to new possibilities. When we bring together scientists from across disciplines and fields, something amazing happens: a whole new way of thinking about a topic that no one has considered before. Getting out of your comfort zone in meeting people outside the scientific field will help the researcher grow. It should be remembered that a team always presents a more comprehensive picture of research. Interdisciplinary collaboration leads to creativity and innovation. Working with different disciplines expands the researcher's network and makes him a stronger professional. As summarized in this text, many Nobel Prizes have been the brilliant result of team research. One of the significant advantages of interdisciplinary collaboration is that it crosses traditional boundaries of academic disciplines or schools of thought in accordance with new needs and emerging specialties. In this way, it is necessary that the **scientists of the Islamic World**

Academy of Sciences as well as scientists from other nations have organized the strategic meetings to determine the topic for joint cooperation and to define the important unknown questions of science for human development and the welfare of humanity with the research possibilities existing and cooperation to develop interdisciplinary sciences and the results of this cooperation to be published in high impact literature.

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QUANTUM MECHANICS AND BIODIVERSITY AND CLIMATE CHANGE

Mohamed Thariq Hameed Sultan¹, Shah Nor Basri² and Siti Aisyah Muhammad³



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1.0 Introduction to Biodiversity

Biodiversity refers to the variety of life on Earth, including the diversity of species, ecosystems, and genetic variation within species. It encompasses the total range of organisms living in a particular ecosystem or habitat, including plants, animals, fungi, and microorganisms, as well as the ecological processes and interactions that occur among them. Biodiversity is essential for the health and functioning of ecosystems, and it provides important benefits to human societies, including food, medicine, and ecosystem services such as climate regulation,

water purification, and soil formation. However, human activities, such as habitat destruction, pollution, and climate change, are causing significant declines in biodiversity around the world, which poses a major threat to the well-being of both wildlife and human communities.

Biodiversity can have both positive and negative effects on climate change. On the one hand, healthy ecosystems with high levels of biodiversity can help mitigate climate change by storing carbon dioxide and other greenhouse gases, regulating the water cycle, and providing other ecosystem services that help stabilize the climate. For example, forests absorb and store large amounts of carbon dioxide from the atmosphere, and wetlands can help regulate flooding and erosion caused by extreme weather events.

On the other hand, the loss of biodiversity due to human activities can exacerbate climate change. When habitats are destroyed or degraded, the plants and animals that live there may die or migrate, leading to changes in the local and global carbon cycle, which can accelerate climate change. For example, deforestation contributes to the release of carbon dioxide into the atmosphere, which contributes to global warming. In addition, the loss of species diversity can make ecosystems more vulnerable to extreme weather events and other climate-related impacts.

Overall, protecting and restoring biodiversity is important for both mitigating and adapting to the impacts of climate change. By maintaining healthy ecosystems and reducing human impacts on the natural world, we can help protect the planet's biodiversity and build resilience to the effects of climate change.

2.0 Introduction to Ecosystem

A healthy ecosystem with high levels of biodiversity refers to an ecosystem that contains a wide variety of different species of plants, animals, fungi, and microorganisms, and that functions well in terms of ecological processes and services. In such an ecosystem, the different species are interconnected and depend on each

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other in complex ways, forming a web of life that is resilient and adaptable to change.

A healthy ecosystem is one that is relatively stable and able to maintain its functions and services over time. For example, a forest ecosystem with high levels of biodiversity might support a wide range of plant and animal species, from tall trees to small shrubs, insects, birds, and mammals. Each of these species contributes to the ecosystem in different ways, such as by providing habitat, food, or pollination services. The forest ecosystem might also provide other services, such as storing carbon, regulating the water cycle, and preventing soil erosion.

In contrast, an unhealthy ecosystem with low levels of biodiversity might be one that has been heavily impacted by human activities such as deforestation, pollution, or habitat fragmentation. In such an ecosystem, the loss of species diversity can lead to imbalances and disruptions in the ecosystem's functions and services, making it less resilient and adaptable to change.

Overall, maintaining healthy ecosystems with high levels of biodiversity is important for the health and well-being of both wildlife and human communities. By protecting and restoring biodiversity, we can help ensure that ecosystems continue to provide the services and benefits that we rely on, while also supporting the long-term sustainability of our planet.

3.0 Loss of Biodiversity

The loss of biodiversity due to human activities refers to the ongoing reduction in the variety of life on Earth, which is primarily caused by human actions such as habitat destruction, pollution, overexploitation of natural resources, and climate change.

Habitat destruction is one of the leading causes of biodiversity loss, as human activities such as deforestation, urbanization, and land-use changes have resulted in the loss and fragmentation of natural habitats such as forests, wetlands, and grasslands. This loss of habitat reduces the amount of available space for different species to live and breed, and it can lead to the decline and even extinction of some species.

Pollution is another major factor contributing to biodiversity loss, as human activities such as industrial production, agriculture, and transportation release toxic chemicals and other pollutants into the environment, which can harm or kill wildlife and their habitats. For example, pesticides used in agriculture can poison pollinators such as bees and butterflies, while oil spills can devastate marine ecosystems and the species that depend on them.

Overexploitation of natural resources, such as overfishing or overhunting, can also lead to the loss of biodiversity. When a particular species is exploited beyond its capacity to reproduce or replenish its population, it can become endangered or extinct. Climate change is another major threat to biodiversity, as rising temperatures and changes in weather patterns can alter ecosystems and disrupt the life cycles of different species.

Overall, the loss of biodiversity due to human activities is a major environmental problem that poses a threat to the health and well-being of both wildlife and human communities. To mitigate this loss, it is important to reduce our impact on the natural world by adopting sustainable practices and protecting and restoring ecosystems and their biodiversity.

3.1 Habitat Destruction

Habitat destruction refers to the process by which natural habitats are degraded, fragmented, or completely destroyed due to human activities such as deforestation, urbanization, agricultural expansion, and mining. This process can have devastating consequences for biodiversity, as it reduces the availability of suitable habitats for many plant and animal species, leading to declines in population sizes, and in some cases, extinction.

One of the primary causes of habitat destruction is deforestation, which involves the clearing of forests for timber, agriculture, or urbanization. Forests are some of the most biologically diverse ecosystems on Earth, home to millions of species of plants and animals. When forests are cleared, many species lose their homes, and the habitats that remain are often too small and fragmented to support the same level of biodiversity as the original forest.

Another cause of habitat destruction is urbanization, which involves the conversion of natural habitats into cities, suburbs, and other developed areas. Urbanization often results in the loss of important habitats such as wetlands, grasslands, and forests, as well as the fragmentation of remaining habitats, which can isolate populations of species and reduce gene flow between them.

Agricultural expansion is also a major driver of habitat destruction, as large areas of land are cleared for crops or pasture, often using practices such as slash-and-burn agriculture that are unsustainable and can lead to soil erosion, loss of biodiversity, and reduced productivity over time.

Mining is another activity that can result in the destruction of natural habitats, as it involves the extraction of minerals and other resources from the Earth's surface. Mining can cause soil erosion, water pollution, and habitat destruction, and it can also lead to the displacement of human communities that depend on the affected areas for their livelihoods.

Overall, habitat destruction is a major threat to biodiversity and the long-term sustainability of ecosystems. To address this problem, it is important to reduce the impact of human activities on natural habitats, protect and restore degraded ecosystems, and promote sustainable land-use practices that are compatible with the conservation of biodiversity.

3.2 Pollution

Pollution is another major driver of biodiversity loss, and it refers to the release of harmful substances into the environment that can have negative impacts on living organisms and their habitats. Pollution can come from many different sources, including industrial activities, transportation, agriculture, and waste disposal.

Industrial pollution is a major contributor to biodiversity loss, as factories and other industrial facilities release a variety of toxic chemicals and pollutants into the air, water, and soil. For example, heavy metals such as lead, mercury, and cadmium are commonly released by industrial activities, and they can accumulate in the tissues of animals and plants, leading to toxic effects such as neurological damage, reproductive problems, and reduced growth and survival rates.

Transportation is another source of pollution that can have negative impacts on biodiversity. The emissions from cars, trucks, and other vehicles contribute to air pollution, which can harm human health and the health of wildlife. Additionally, oil spills from ships and other vessels can have devastating impacts on marine ecosystems, as the spilled oil can kill or harm many species of marine life and damage their habitats.

Agricultural pollution is also a major contributor to biodiversity loss, as the use of pesticides, fertilizers, and other chemicals in agriculture can harm wildlife and their habitats. For example, pesticides can kill pollinators such as bees and butterflies, and fertilizer runoff can cause algal blooms in rivers and lakes, which can deplete oxygen levels and harm aquatic life.

Finally, waste disposal is another source of pollution that can have negative impacts on biodiversity. Landfills and other waste disposal sites can release toxic substances into the environment, which can harm wildlife and their habitats. Additionally, plastic waste is a major problem for marine ecosystems, as plastic debris can entangle and suffocate marine animals and damage their habitats.

Overall, pollution is a major threat to biodiversity, and it is important to take steps to reduce our impact on the environment and promote sustainable practices that protect wildlife and their habitats. This includes reducing our use of toxic chemicals and pollutants, promoting sustainable transportation and waste disposal practices, and adopting more environmentally friendly agricultural practices.

3.3 Overexploitation

Overexploitation of natural resources is another major driver of biodiversity loss, and it refers to the unsustainable use of natural resources such as fish, timber, and minerals. When resources are overexploited, they can become depleted or even disappear, which can have negative impacts on biodiversity and the long-term sustainability of ecosystems.

One of the most well-known examples of overexploitation is overfishing, which involves catching fish at a rate that exceeds their ability to reproduce and replenish their populations.

Overfishing can lead to declines in fish populations, which can have ripple effects throughout marine ecosystems. For example, declines in predator fish populations can lead to an increase in their prey populations, which can in turn lead to a decline in the populations of other species that the prey depend on.

Timber harvesting is another activity that can lead to overexploitation of natural resources. When forests are logged at a rate that exceeds their ability to regenerate, the forests can become depleted, which can lead to declines in biodiversity and the long-term sustainability of ecosystems. Additionally, clearcutting can result in the loss of important habitats such as old-growth forests, which are home to many species of plants and animals.

Mining is another activity that can lead to overexploitation of natural resources. When minerals and other resources are extracted from the Earth's surface at a rate that exceeds their ability to regenerate, the resources can become depleted, which can lead to declines in biodiversity and the long-term sustainability of ecosystems. Additionally, mining can cause habitat destruction, soil erosion, and water pollution, which can harm wildlife and their habitats.

Overall, overexploitation of natural resources is a major threat to biodiversity, and it is important to promote sustainable practices that protect the long-term health of ecosystems. This includes regulating fishing and logging practices to ensure that they are sustainable, promoting responsible mining practices, and promoting sustainable land-use practices that are compatible with the conservation of biodiversity.

4.0 Conclusion

Biodiversity is crucial for the health and functioning of ecosystems and provides important benefits to human societies, including food, medicine, and ecosystem services such as climate regulation, water purification, and soil formation. However, human activities such as habitat destruction, pollution, and climate change

are causing significant declines in biodiversity around the world, which poses a major threat to the well-being of both wildlife and human communities.

Maintaining healthy ecosystems with high levels of biodiversity is essential for the health and well-being of both wildlife and human communities. Healthy ecosystems are relatively stable and able to maintain their functions and services over time, providing a wide range of benefits to both wildlife and human communities.

The loss of biodiversity due to human activities is a major environmental problem that poses a threat to the health and well-being of both wildlife and human communities. Habitat destruction, pollution, overexploitation of natural resources, and climate change are the primary drivers of biodiversity loss. To mitigate this loss, it is important to reduce our impact on the natural world by adopting sustainable practices and protecting and restoring ecosystems and their biodiversity.

Biodiversity can have both positive and negative effects on climate change. Healthy ecosystems with high levels of biodiversity can help mitigate climate change by storing carbon dioxide and other greenhouse gases, regulating the water cycle, and providing other ecosystem services that help stabilize the climate. On the other hand, the loss of biodiversity due to human activities can exacerbate climate change, leading to changes in the local and global carbon cycle and making ecosystems more vulnerable to extreme weather events and other climate-related impacts.

Overall, protecting and restoring biodiversity is important for both mitigating and adapting to the impacts of climate change. By maintaining healthy ecosystems and reducing human impacts on the natural world, we can help protect the planet's biodiversity and build resilience to the effects of climate change.

THE ARAB ACADEMY OF SCIENCES (AAS) HOLDS A CONFERENCE ON: HIGHER EDUCATION IN THE ARAB WORLD: DIGITAL TRANSFORMATION



Participants in the Arab Academy of Sciences Conference in Beirut 19-20 April, 2024, entitled: “Higher Education in the Arab World: Digital Transformation”.

The conference was cosponsored by the Arab Academy of Sciences, University of Petra, University of Jordan, and Sohar University in Oman. In cooperation with the American University of Beirut and the Australian University of Kuwait.

AAS Conference Overview:

1. The presentations today offered a comprehensive overview of digital transformation (DX) in higher education institutions.
2. It outlined current DX implementations including the integration of administrative and e-services into teaching and learning contexts, along with future plans emphasizing user experience enhancement, bridging the digital divide, and AI integration.
3. Additionally, we discussed the significance of DX in Arab states for advancing innovation, collaboration, and knowledge-based economies.
4. Arab states must work together and collaborate to advance the higher education sector in today's digitized era.
5. There is a pressing need to develop not only national strategies for DX but university strategies that should be in line with national strategies for DX.
6. At the University level, DX strategies must also cascade into departmental levels for strategies to be successful.
7. A comprehensive strategic framework with Key Performance Indicators were also put forward that can be used by universities wanting to integrate DX.
8. Having a DX culture is a precursor for change; this also includes the need for organizational management and a shared approach.
9. Having a DX culture is a precursor for change; this also includes the need for organizational management and a shared approach.
10. We also debated over how ChIt is critical that we are aware of the ethical implications when using DX and ensure universities develop the proper guidelines to mitigate any potential for bias.
11. Without collaboration between universities and industries, we will not be able to succeed in progressing DX.
12. We delved into the challenges and strategies for successful integration of AI and computer literacy, as well as recommendations for DX adoption in developing countries.
13. GPT is revolutionizing education and that no single education model fits all.
14. Today, DX was explored beyond just its technological dimension. DX has a transformative potential in higher education and plays a pivotal role in shaping the future of learning of our graduates and programs. Innovation is about how technology is used to empower students and turn them into life long learners using personalized learning techniques.
15. We have been exposed to a number of case studies about DX adoption. It is important and very much worthy to learn from those cases and to adopt modified versions of them based on our circumstances.

MARWAN: BOOSTING CONNECTIVITY IN MOROCCO



Left to right: Redouane Merrouch (CNRST/MARWAN), Yahya Tayalati (UM5), Shaber Zyoud (Ministry of Higher Education and Scientific Research, Palestine), Helga Spitaler (GÉANT), Yousef Torman (ASREN), Farida Fassi (Mohammed V University, Morocco), Mohamed Gouighri (Ibn-Tofail University, Morocco), Mustafa Al Zoubi, (SESAME, Jordan).

MARWAN, the Moroccan Research and Education Network, recently welcomed a significant demand-driven upgrade from 1G to 10G from Rabat to London where it peers with the pan-European GÉANT network with onward traffic to other R&E networks around the world.

The upgrade, sponsored by the EU-funded AfricaConnect3, marks the start of a new era for research and education (R&E) collaborations between the local Moroccan scientists, researchers and students and their worldwide peers, thanks to the high-speed and affordable connectivity. It is an important milestone for MARWAN and the entire Moroccan R&E community in preparation for the start of the MEDUSA submarine cable project. The project will bring long-term high-capacity connectivity (at an access capacity of 200Gbps) to Algeria, Egypt, Morocco and Tunisia through the European Commission's grant investment and foster ties with the European peer organizations eventually contributing to alleviating the digital divide.

Morocco was the first country in the South Mediterranean region to interconnect with the global R&E network in 2004 via the EUMEDCONNECT project. MARWAN was created in 1998 and runs under the Centre National pour la Recherche Scientifique et Technique (CNRST). In 2022, the network migrated to the latest topology (MARWAN 5) and today connects more than 250 higher education and research institutions through 42 links covering 45 cities in Morocco. Since its inception, MARWAN has been a driver for Moroccan universities and research centres to develop new services in education, technology transfer and scientific research, increasing the uptake of their service portfolio, including High Performance Computing (HPC), eduroam, identity federation, IPv6, digital certificates, eduVPN, content caches and software repository mirrors.

“Connecting MARWAN to GÉANT has always been a priority for researchers in Morocco. The upgrade to 10 Gbps is an opportunity for our researchers to become even more involved in scientific collaboration with their European counterparts. It is also a key step to prepare

ourselves to be part of the MEDUSA project under the best possible conditions.” says Redouane Merrouch, Director of MARWAN.

Among MARWAN’s member institutions, Mohammed VI Polytechnic University (UM6P) hosts the largest supercomputer in Africa, also known as “Africa’s most powerful supercomputer”, Toubkal. The 3.15 petaflops supercomputer was launched in February 2021 and is hosted within the new Africa Supercomputing Centre, supported by the University of Cambridge. With more than 69,000 cores and 8,000 terabytes of combined storage capacity, this is another tool that will help conduct research for institutions not only in Morocco but across the continent.

In October 2022, MARWAN and the pan-Arab organization ASREN brought together in Marrakech university professors, scientists and ministerial officials to discuss the role of NRENs in sustaining and supporting the needs of R&E institutions. It was at this conference that one of the leading high-energy physicists in Morocco, Prof. Yahya Tayalati, stressed that his team had significant bandwidth constraints and needed at least a 10G international connection to efficiently carry out their research and experiments. Such capacity is also a pre-requisite for UM6P to become a Tier 2 center of the Worldwide LHC Computing Grid (WLCG) and to pro-actively take part in CERN’s ATLAS experiments.

“The recent upgrade of the network marks a significant milestone in the landscape of scientific research in Morocco. This substantial increase in data transfer capabilities paves the way for closer collaboration with major international research centers, such as CERN. Indeed, Morocco is now preparing to host a dedicated Tier2 node for the ATLAS experiment at the HPC center of the university Mohammed VI polytechnic, one of CERN’s flagship projects in the field of particle physics. With this state-of-the-art infrastructure, Moroccan researchers will have access to a continuous flow of data from the Large Hadron Collider (LHC), enabling them to actively contribute to the analysis and interpretation of experimental results. This promising synergy enhances Morocco’s scientific prominence on the international stage and offers exciting new prospects for future generations of physicists and engineers.” says Prof. Yahya Tayalati, UM5.

Another application that is set to be boosted by the connectivity injection is the Hyper-Kamiokande Collaboration. The collaboration, based in Japan, focuses on studying neutrinos, which, despite their incredibly small mass, are key to understanding the big mystery of the matter in the universe. Morocco’s participation in the construction phase has been key in providing the much needed higher-performance neutrino detectors to improve the potential physics discoveries. The project sees the involvement of over 500 researchers from 99 institutions and 20 different countries, with Morocco and four of its universities (UM6P, UH2, UM5 and UII) being the only ones from the African continent.

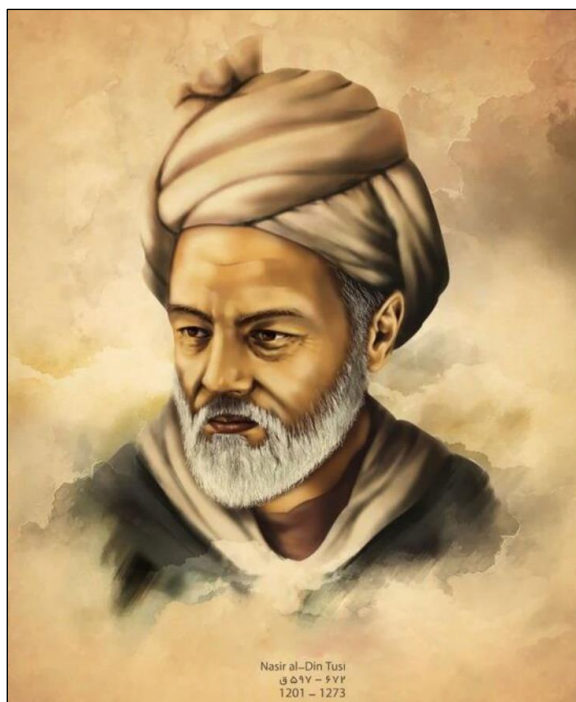
The transformative role of connectivity upgrades and international collaborations was also emphasized by Dr. El Jarrari at European Investment Bank (EIB) MED conference, held in Barcelona in July 2023. Dr. El Jarrari is a distinguished female physicist who currently works for the European Council for Nuclear Research (CERN) and hails from Morocco. She holds a PhD in high-energy physics from Mohammed V University in Rabat and has made significant contributions to the international ATLAS collaboration at the Large Hadron Collider at CERN. The collaboration produces over 10,000 TB terabytes of data annually, which is accessible to all participating countries. However, to carry out a successful research program, a considerable internet bandwidth is necessary. During her speech, Dr. El Jarrari she highlighted the transformative impact that the MEDUSA project would have on enhancing connectivity in the Mediterranean region in advancing research, innovation, and global cooperation. She also emphasized the crucial role of fostering international scientific collaborations in addressing complex challenges and paving the way for a more connected and prosperous future for the Mediterranean community.

For more information about MARWAN, visit the website: www.marwan.ma

Source: <https://africaconnect3.net/marwan-boosting-connectivity-in-morocco/>

NASIR AL-DIN AL-TUSI: THE LEGACY OF A RENAISSANCE SCHOLAR IN THE ISLAMIC GOLDEN AGE

Prepared by: International Office of Iran Academy of Sciences



Nasir al-Din al-Tusi (1201 – 1274) AC, also known as Khwaja Nasir al-Din al-Tusi, was a revered Persian polymath who made substantial contributions to various fields of science and philosophy during the Islamic Golden Age. Born in the city of Tus, Khorasan at 1201 AC. Nasir al-Din al-Tusi's intellectual curiosity and thirst for knowledge propelled him to become one of the most influential scholars of his era.

Al-Tusi's early education primarily focused on Islamic theology and jurisprudence, but his burgeoning interest in mathematics and astronomy soon became his primary focus. Under the mentorship of prominent scholars of the time, including Kamal al-Din Ibn Yunus and Fakhr al-Din al-Razi, al-Tusi quickly established himself as a prodigious talent.

One of al-Tusi's most noteworthy achievements was his groundbreaking work in trigonometry, where he introduced the concept of trigonometric functions as we recognize them today. His seminal treatise on trigonometry, known as the "Treatise on the Quadrilateral," laid the groundwork for modern trigonometry and left a lasting impact on the development of mathematics within the Islamic world and beyond.

In addition to his mathematical pursuits, al-Tusi made significant contributions to astronomy, playing a pivotal role in the advancement of the Maragha

Observatory, a renowned center of astronomical research in the Islamic world. His observations and calculations refined astronomical models of his time and set the stage for future advancements in the field.

Nasir al-Din al-Tusi, an esteemed astronomer, is credited with inventing the Tusi-couple, a geometrical technique designed to study the latitudinal motion of inferior planets. This innovation, introduced in 1247 AC, supplanted Ptolemy's equant and later influenced Nicolaus Copernicus in his seminal work, *De Revolutionibus*. Al-Tusi's legacy includes the *Treasury of Astronomy* and the *Ilkhan Tables*, finalized in 1272, which accurately depict planetary movements. Additionally, al-Tusi's astronomical instruments, such as the astrolabe, played a crucial role in Islamic astronomy. He was the first to propose that the Milky Way was composed of small, clustered stars, a hypothesis later validated by Galileo.

Apart from his scientific endeavors, al-Tusi was a prolific writer and philosopher, producing a plethora of works covering ethics, metaphysics, and logic. His philosophical treatises, including the "Ethical Philosophy" and the "Nasirean Ethics," are revered as seminal works in the realm of Islamic philosophy, leaving a lasting imprint on the intellectual tradition of the Islamic world. Nasir al-Din, a prolific author of the Islamic Golden Age, penned over 150 books in Arabic and Persian, spanning a wide array of subjects, including Islamic theology. Notable among his works are his Arabic translations of ancient luminaries like Archimedes, Euclid, and Ptolemy.

Despite facing numerous challenges in a tumultuous period of Islamic history al-Tusi remained resolute in his pursuit of knowledge, embodying the spirit of intellectual curiosity and dedication to learning that epitomized the Islamic Golden Age.

In recognition of his significant contributions to the advancement of knowledge, al-Tusi was bestowed with the prestigious title of "Khwaja," reserved for scholars of exceptional merit. His enduring legacy continues to inspire scholars and researchers worldwide, serving as a testament to the enduring impact of the Islamic Golden Age.

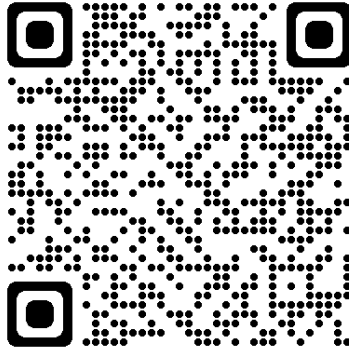
Al-Tusi passed away on June 26, 1273, in Baghdad at the age of 73.



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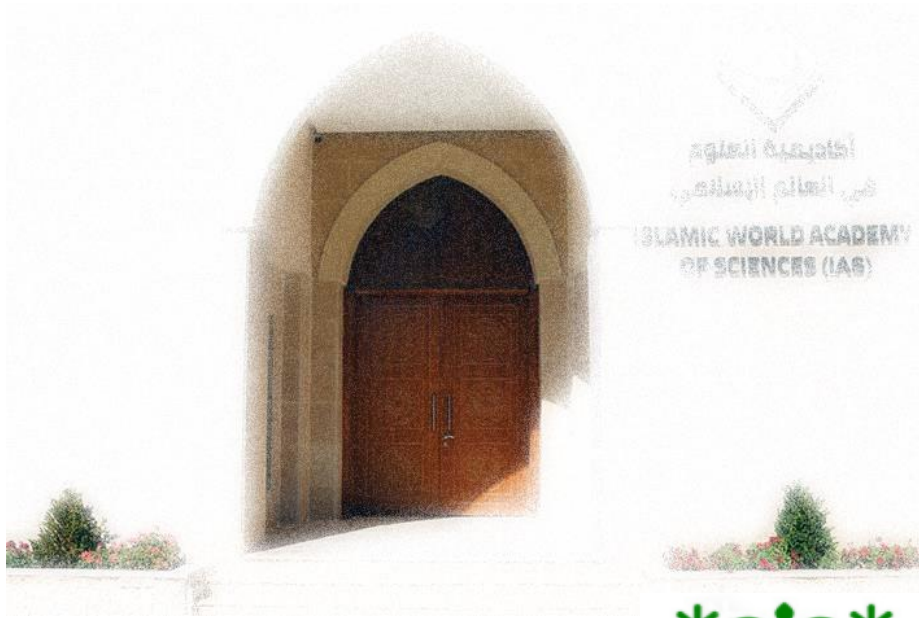
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