

The Development of Science and Technology in the Muslim World: Past and Present Issues with Possible Resolutions

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Abstract

The claim that Muslim scientists played a vital role in laying down the foundations of modern science and technology cannot be contested. Muslims benefited from the sciences of various civilizations such as the Chinese, Indian, Roman, Persian, and Greek. They then added their own original and significant findings, refreshing several branches of knowledge including physics, medicine, chemistry, and optics and passed it on to Europe. These endeavours by Muslim scientists spanned over centuries. Modern Europe seems to have taken over the task of developing science and technology, leaving Muslims behind. This situation warrants deliberation over the causes of the rise and fall of Muslim civilization, particularly in the realms of science and technology. This study attempts to highlight the achievements of contemporary Muslim scientists, identify reasons for the need for advancement of scientific research in Muslim nations, and suggest ways to overcome the hurdles impeding the creativity in Muslim minds towards the development of knowledge in its comprehensive sense. An analytical approach has been applied in this study to conclude objectively along with qualitative research methodology.

Keywords

science, technology, Muslim scientists, Islamic civilization.

Introduction

History stands witness that science and technology progressed incessantly at the hands of Muslim scientists for roughly 600 years (786–1350 CE). Muslim contributions in the fields of physics, chemistry, medicine, astronomy, and optics were so comprehensive that Europe

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hardly needed to come up with anything new. Muslim discoveries and innovations were taken verbatim by Europeans and taught in universities there until the modern scientific revolution. It seems today that the contribution of Muslims to science and technology has decreased significantly. The history of science and technology written in the modern age hardly mentions Muslim contributions to natural and physical sciences and credits only European scholars for the development of science and technology. This claim is untrue and does not represent the complete reality. A contemporary physicist and cosmologist Stephen Hawking (1942–2018), in his monumental work *A Brief History of Time*, has identified several contributions by Muslim scientists.¹ He has also alleged therein that these discoveries, originally made by Muslims, were stolen by European scientists. Today the contribution of Muslim scientists are not appreciated globally, but on the whole Muslim scientists continue to lag behind Europe. This study aims to observe the heyday of Muslim civilization, identifying real causes for the decline of Muslim science and technology, as well as factors for European advancement in science and technology, and suggesting ways to breathe life into the role of Muslims in the contemporary advancement of knowledge as a whole.

The Contribution of Muslim Civilization: A Brief Overview

The rise of the ‘Abbāsīd Caliphate in the middle of the eighth century CE marked the beginning of scientific culture not only for Islam but for the whole of mankind. There followed a period of intense study and cultivation of scientific learning. Knowledge did not come easily. In fact, probably nothing in human affairs requires greater use of the mind than science. Observation, collection of data, summarization, analysis, drawing inferences, and the formulation of conclusions, findings, and generalizations are a never-ending process.

The philosopher Abū Yūsuf Ya‘qūb b. Isḥāq al-Kindī (d. 260/873), for example, never hesitated to criticize the theories of Aristotle despite the great esteem in which he held him. He always attempted to justify his criticism through theoretical proof and then would attempt to prove his hypotheses by experimentation. The polymath Abū Muḥammad ‘Abd Allāh b. Aḥmad known as Ibn al-Bayṭār (d. 646/1248) collected many botanical samples from the world and correlated the plants of Greece

¹ Stephen Hawking, *A Brief History of Time: From Big Bang to Black Holes* (New York, NY: Random House, 2009).

and Spain with the flowers of India and Persia.² His work has been considered by the German botanist Ernst Meyer (d. 1858) a monument of the industry for his collection and description of more than 1400 plants.³

Traditional Islamic institutions of learning produced numerous great scientists and mathematicians such as Abū Rayḥān al-Bīrūnī (d. 442/1050),⁴ Muḥammad b. Mūsā al-Khawārizmī (d. 226/850),⁵ Muḥammad b. al-Ḥasan al-Karajī (d. 419/1029),⁶ and al-Samaw'al b. Yaḥyā al-Maghribī (d. 575/1180).⁷

Muslim scientists made their mark in the medical sciences as well. Some of the prominent figures are Abū 'Alī Sīnā (d. 428/1037)⁸ and Muḥammad b. Zakariyyā al-Rāzī (d. 320/932),⁹ who was in charge of the first royal hospital in Iran. In the West, Abū 'l-Qāsim Khalaf b. al-'Abbās al-Zahrāwī (d. 403/1013),¹⁰ under the sponsorship of Caliph al-Ḥakam II, established the first surgical ward, performed cesarean operations, and was the first surgeon to use silk threads to stitch wounds.¹¹ The work of Ḥasan b. al-Haytham (d. 430/1040),¹² referred to as the father of modern

² A.Y. al-Hassan, ed., *The Different Aspects of Islamic Culture: Science and Technology in Islam; The Exact and Natural Sciences* (Paris: UNESCO Publishing, 2001), vol. 4, pt. 1, p. 73.

³ Robert Briffault, *Rational Evolution: The Making of Humanity* (Oxfordshire: Routledge, 2019), 193.

⁴ See George Sarton, *Introduction to the History of Science* (Malabar, FL: R. E. Krieger Publishing Company, 1975), 1:312–17.

⁵ See Ahmad Dallal, "Science, Medicine, and Technology: The Making of a Scientific Culture" in *The Oxford History of Islam*, ed. John L. Esposito (Oxford: Oxford University Press, 1999), 188.

⁶ See Behzad Ataie-Ashtiani and Craig T. Simmons, "The Millennium Old Hydrogeology Textbook *The Extraction of Hidden Waters* by the Persian Mathematician and Engineer Abubakr Mohammad Karaji (c. 953–c. 1029)," *Hydrology and Earth System Sciences* 24 (2020): 761–69, <https://doi.org/10.5194/hess-24-761-2020>; Susan Nichols, *al-Karaji: Tenth-Century Mathematician and Engineer* (New York, NY: Rosen Publishing Group, 2016).

⁷ See Roshdi Rashed, "Appendix I: The Notion of Western Science: 'Science as a Western Phenomenon,'" in *The Development of Arabic Mathematics: Between Arithmetic and Algebra*, trans. A. F. W. Armstrong (Dordrecht: Kluwer Academic Publishers, 1994), 332–49.

⁸ See Philip K. Hitti, *History of the Arabs from the Earliest Times to the Present*, 10th ed. (London: Macmillan, 1989), 370.

⁹ See Muḥammad b. Zakariyyā al-Rāzī, *al-Ḥāwī al-Kabīr fī 'l-Ṭibb*, trans. Seyed Mahmood Tabatabaei, vol. 1 (Tehran: Al-Hawi Pharmacy Institute, 1999).

¹⁰ Huma Ahmad, "Muslim Contributions to Science, Philosophy, and the Arts," April 1997, <http://www.jannah.org/articles/contrib.html>.

¹¹ See Karen Armstrong, *Islam: A Short History* (New York, NY: Random House, 2002).

¹² See "Ibn Al-Haytham and the Legacy of Arabic Optics," <https://www.light2015.org/Home/ScienceStories/1000-Years-of-Arabic-Optics.html>; Peter Adamson, *Philosophy in the Islamic World: A History of Philosophy without Any Gaps* (Oxford: Oxford University Press, 2016), 77.

optics, became the basis for Roger Bacon's (d. 1292) *Optics*.¹³

The development of modern science was not possible without the contribution of Muslim scientists and it is a fact that Muslim scientists through the process of "adoption" and "adaptation" contributed a lot and laid the foundations for modern science, particularly the method of scientific investigation. They were led to this through Islamic teachings and the introduction of new methods that were unknown to Greeks such as investigation, experimentation, observation, and measurement.¹⁴

The 'Abbāsīd Caliph al-Ma'mūn (r. 813–833) was also a great patron of learning. He established a research institution named the House of Wisdom (*Bayt al-Ḥikmah*) in Baghdad around the year 218/833.¹⁵ The House of Wisdom was fully funded by the state treasury and attracted a galaxy of scientists and scholars, particularly competent translators who played a vital role in the translation of texts from Greek, Sanskrit, and Persian. This was no doubt a real treasure of wisdom and knowledge in Baghdad. The Caliph al-Ma'mūn made one of the conditions of his peace treaty with the Byzantine emperor that some of the Greek manuscripts should be handed over to his capital and Egypt, the centre of Greek learning in the Alexandrian period.¹⁶ Gradually, Baghdad flourished as a commercial and intellectual centre.

After al-Ma'mūn, his successors continued the support given to scientists by the state for the pursuit of knowledge. These rulers established libraries and laboratories and hired scientists, most of whom were bureaucrats, whose job was to find answers to different scientific questions. These scientists took this on as a challenge, competing with each other to climb the ladder of power in the government.¹⁷ The rapid expansion of the Muslim empire was also a great source of scientific achievement, as wealth and knowledge transformed newly conquered areas into centers of knowledge like Baghdad, Cordoba, Damascus, and Alexandria.¹⁸ Similar views are expressed by Philip Hitti.¹⁹ He highlights

¹³ See "Ibn Al-Haytham and the Legacy of Arabic Optics," <https://www.light2015.org/Home/ScienceStories/1000-Years-of-Arabic-Optics.html>; Peter Adamson, *Philosophy in the Islamic World: A History of Philosophy without Any Gaps* (Oxford: Oxford University Press, 2016), 77.

¹⁴ Briffault, *Rational Evolution*, 191.

¹⁵ Hitti, *History of the Arabs*, 410.

¹⁶ Joseph A. Angelo, *Encyclopedia of Space and Astronomy* (New York, NY: Facts On File, 2006), 78; Colin Ronan, *The Ages of Science* (London: George G. Harrap, 1966), 59.

¹⁷ George Saliba, *Islamic Science and the Making of the European Renaissance* (Cambridge, MA: MIT Press, 2007).

¹⁸ Maurice Lombard, *The Golden Age of Islam* (Princeton, NJ: Markus Wiener Publishers, 2004), 157.

the fact that Muslims left a deep imprint on learning in medieval Europe, which led to a glorious era of knowledge and civilization.²⁰ The Fāṭimīd rule (established in 297/909 in North Africa) paid also considerable attention to the sciences, as well as other cultural and commercial activities.²¹ According to the nineteenth-century American historian Saul Padover, “North Africa, especially Egypt and Fustat, became the second-largest Islamic center and it would be more suitable to say these cities had become the epicenter of education, science, and culture because it performed the same activities like Baghdad.”²² Particularly, the Epistles of the Brethren of Purity contributed greatly to reconciling religion with science.²³ The Islamic world during this time was at its zenith of intellectual activity and advancement, providing a stark contrast to the Christian world of the time.

It is difficult to assign a terminus date to the “Golden Age” of science in the Muslim world as the extent and degree of decline was uneven.²⁴ Nevertheless, by the twelfth century CE, scientific activity in Islam had gradually lost its initial momentum and vitality and the torch of knowledge was passed from the hands of Muslims to the West. Scholars with lists of achievements such as those discussed above did not immediately disappear during the later centuries, but their appearance became increasingly rare.²⁵

There were also internal issues that led the Islamic world to fall behind in science and technology. One significant reason was the gradual loss of interest in studying scientific subjects in favour of obtaining religious knowledge. The most important reason for Islamic decline, however, was a change in the interpretation of Islam. When science flourished, it was related to philosophy and harmonized with the Qur’ān. Scientists approached the cosmos of the Qur’ān through its teachings. Traditional Islamic science could accept that of the Greeks

¹⁹ Hitti, *History of the Arabs*, 408–15.

²⁰ Ibid., 602–15; Ali Mohammadi and Muhammad Ahsan, *Globalisation or Recolonisation? The Muslim World in the 21st Century* (London: Taha Publishers, 2002), 133.

²¹ Farhad Daftary, ed., *Mediaeval Isma’ili History and Thought* (Cambridge: Cambridge University Press, 2001), 117; Vladimir Alekseevich Ivanor, *A Guide to Isma’ili Literature* (London: Royal Asiatic Society, 1933), 15–17.

²² S. K. Padover, “Muslim Libraries,” in *The Medieval Library*, ed. James Westfall Thompson (New York: Hafner, 1965), 355.

²³ De Lacy O’Leary Dd, *A Short History of the Fatimid Khalifate* (Charleston, SC: Nabu Press, 2010).

²⁴ Aydin Sayili, *The Observatory in Islam and Its Place in the General History of the Observatory* (New York: Arno Press, 1981), 412.

²⁵ Ziauddin Sardar, *Science and Technology in the Middle East* (London: Longman, 1982), 19.

and develop it because certain Greek philosophies coincided with that of Islam. However, the approach to science gradually shifted, and claims arose that harmony between the Qur'ān and science was difficult and futile.²⁶

Organizations, Institutes, and Research Facilities in the Contemporary Muslim World

Muslims throughout history have without a doubt given the world great scientific theories and inventions over hundreds of years, but the current situation is quite the opposite. The Muslim world currently faces numerous issues that have resulted in poverty, backwardness, and ignorance. In the last few decades, however, there can be seen various reformations at the university level by many Muslim nations. In Pakistan, for example, the Higher Education Commission (HEC) has executed numerous educational schemes and established new universities according to world standards in all fields of knowledge. It has funded and given thousands of scholarships at the bachelor, master, and doctoral levels.²⁷ Other nations such as Qatar have undertaken various measures to upgrade their educational sector, and founded an Education City that houses international universities such as Texas A&M and Carnegie Mellon. Likewise, Saudi Arabia has made many efforts to raise its educational standards. The Saudi government has made significant investments in foreign scholarship schemes and created universities like the King Fahd University of Petroleum & Minerals (KFUPM). In the academic year 2018–2019, KFUPM reached the 200th position in the QS World University Rankings,²⁸ making it one of the most prestigious educational organizations in the region working for the economic and technical development of the country.²⁹ In Malaysia, the education sector has also been upgraded through the development of many research institutions, the prime focus of which is to enhance the development of STEM (Science, Technology, Engineering, and

²⁶ Eric Chaney, "Religion and the Rise and Fall of Islamic Science," 24–27, <https://scholar.harvard.edu/files/chaney/files/paper.pdf>.

²⁷ The Higher Education Commission, Pakistan, <https://www.hec.gov.pk/english/scholarshipsgrants/pages/default.aspx>.

²⁸ <https://www.topuniversities.com/university-rankings/arab-region-university-rankings/2019>.

²⁹ Nidhal Guessoum and Athar Osama, "Report of Zakri Task Force on Science at the Universities of the Muslim World," in *Science at the Universities of the Muslim World*, ed. Nidhal Guessoum and Athar Osama (London: The Muslim World Science Initiative, 2015), 38, http://muslim-science.com/wp-content/uploads/2015/11/Science_at_Universities_of_the_Muslim_World.pdf.

Mathematics) fields and to promote critical thinking among the youth. Similarly, the United Arab Emirates has developed many science and technology institutions like the Petroleum Institute and Khalifa University of Science and Technology. These and many other facilities have a critical role to play in science-based development in the Muslim world.

Some Major and Noteworthy Organizations

There are currently several promising institutes throughout the Muslim World that have dedicated themselves to the creation of knowledge. Some of these are listed below, but there is a dire need for more institutes, organizations, and research facilities like these, whose aim should be to attract brilliant minds from all over the world to explore the field of science under the teachings of the Qur'ān to help benefit humanity.

Islamic World Academy of Sciences (IAS) in Amman, Jordan

It is a non-profit organization that encourages science and technology.³⁰

Committee on Scientific and Technological Cooperation (COMSTECH) in Mecca, Saudi Arabia

COMSTECH is an associate organ of the Organization of Islamic Cooperation (OIC) which was established for the promotion and cooperation of science and technology activities among OIC member states.³¹

Science, Technology and Innovation Organization (STIO) in Mecca, Saudi Arabia

The STIO was developed during the thirty-fourth Islamic Conference of Foreign Ministers (ICFM). Its main goals include promoting cooperation, encouraging member states to incorporate science, technology, and innovation into formulating and implementing their development strategy, as well as maximizing the utilization of scientific talent and technological potential of the private and public sectors for research and development.

³⁰ “Resolutions on Science and Technology and Innovation; Higher Education; Health; Water and Environment Sectors,” adopted by the 46th session of the Council of Foreign Ministers (CFM), Abu Dhabi, UAE, March 1–2, 2019, 25, <http://www.oic-oic.org/docdown/?docID=4455&refID=1250>.

³¹ *Ibid.*, 15.

Islamic Organization for Medical Sciences (IOMS) in Mecca, Saudi Arabia

IOMS was formed to clarify the Islamic point of view about medical issues and collect Islamic medical heritage to determine how it can be applied to contemporary medical practices.

The Islamic Development Bank (IsDB) in Jeddah, Saudi Arabia

IsDB is a multilateral development finance institution that is focused on Islamic finance located in Jeddah, Saudi Arabia. The bank has initiated a generous science, technology, and innovation fund to support OIC member countries.

The World Academy of Sciences (TWAS) in Trieste, Italy

TWAS was launched in 1983 by a well-known group of scientists from all over the world, with the Pakistani laureate Dr. Abdus Salam as its head. The academy offers over 600 fellowships every year to scientists from all over the world for doctoral and postdoctoral research.³²

Contributions of Contemporary Muslim Scientists

One of the purposes of this study is to identify and highlight the most prominent Muslim scientists who are not always given the recognition that they deserve. Only a few are listed here, but many more can be found on the website muslim-science.com.³³

Ahmed Zewail (Egypt, inorganic chemistry)

He was the first scientist from Egypt to win the Nobel Prize in Chemistry in 1999.

Aziz Sancar (Turkey-US, biochemistry)

He made contributions to the study of nucleotide excision and photolyase repair in bacteria and was awarded the Nobel Prize in Chemistry for his work.³⁴

Atta-Ur-Rahman (Pakistan, organic chemistry)

He received many awards like Tamgha-e-Imtiaz (1983), UNESCO Prize

³² <https://twas.org/twas-voice-science-south>.

³³ <http://muslim-science.com/>.

³⁴ Kara Rogers, "Clarified Information on Sancar's Contributions to Mechanistic Discoveries Underlying Nuclear Excision Repair," *Encyclopedia Britannica*, <https://www.britannica.com/biography/Aziz-Sancar>.

(1999), Nishan-e-Imtiaz (2002), Sitara-e-Imtiaz (1991), Austria Order of Merit (2007), Hilal-e-Imtiaz (1998), and Fellow of the Royal Society, London.³⁵

Wasiq Bokhari (US, robotics)

He is the founder of QBotix, one of the ten most innovative robotics companies in the world.³⁶

Maryam Mirzakhani (Iran-US, mathematics)

She won the Nobel Prize for Mathematics in 2014 and became the first and so far only woman to win the Fields Medal in recognition of her “outstanding contributions to the dynamics and geometry of Riemann surfaces and their moduli spaces.”

Suggested Mechanisms for the Advancement of Science and Technology in the Muslim World

Science and technology are among the most effective tools required to develop a society, changing the way people communicate and interact with one another. The development of technology provides a base for advancement in all spheres of life such as health, education, economy, and infrastructure. To reduce poverty and raise the living standards of their people, Muslim countries must focus on science and technology. Unfortunately, Muslim countries continue to lag in science and technology compared to those in the West, despite the fact that Muslims in the past were the torchbearers of new scientific discoveries.

One of the major purposes of this study is to discuss the problems being faced by the Islamic world today with regards to the development of the scientific approach and to propose different measures that could improve this situation. In this area, an important report was recently published by Nidhal Guessoum and Athar Osama. It is worth noting that Athar Osama is the founder and CEO of the Pakistan Innovation Foundation (PIF). In this edited report entitled *Science at the Universities of the Muslim World*, the contributors provided information about the condition of science and technology in the Muslim world and shared information about the budget allocated to high-quality research and scientific development during the last few years in Muslim countries.

³⁵ Muhammad Iqbal Choudhary, “Professor Atta-ur-Rahman: Towering Scientific Achievements,” *Natural Product Research* 27, nos. 4-5 (2013): 298-301, tandfonline.com/doi/pdf/10.1080/14786419.2013.766053.

³⁶ <https://www.solarpowerworldonline.com/suppliers/qbotix/>.

The State of Science at Muslim Universities

Universities have always been centres of excellence that impart quality education, especially in scientific knowledge. Unfortunately, this bedrock of a knowledge society has been neglected in the Islamic world. For example, the 2014/2015 edition of Times Higher Education World University Rankings had only ten universities from the Muslim world in the top 400. Most universities in the Muslim world are neither sufficiently funded nor are properly managed and controlled. Most of these universities have practically been downgraded to small teaching shops instead of great centres of intellectual activity.³⁷

This has improved in recent years, with 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 a positive sign towards the development of higher learning in the Muslim world. Of the ninety-six listed universities, twenty-two belong to Turkey followed by Iran with eighteen; Pakistan with ten; Malaysia and Egypt with nine each; Saudi Arabia with five; the UAE and Indonesia with four each; Jordan and Morocco with three each; Tunisia with two and Algeria, Bangladesh, Kuwait, Lebanon, Nigeria, Oman, and Qatar with one each.³⁸ The recent “Report of Zakri Task Force on Science at Universities of the Muslim World” has also revealed that during the recent twenty years and among fifty-seven OIC countries, there are only twenty countries that together have produced more than ninety per cent of scientific output in the OIC. From the period 1996–2005 to 2006–2015, some of these twenty countries have increased their scientific production significantly.³⁹ In Pakistan, for example, there are 150 HEC-charted universities, but as per Shanghai ranking, regrettably, none of these universities have made a place in the list of the top 500 global universities.⁴⁰

The question remains, however, as to why Muslim countries continue to lag the West in intellectual achievement? The answer could

³⁷ Guessoum and Osama, “Report of Zakri Task Force,” 38.

³⁸ Mohsen Rezaeian, “Muslim World’s Universities: Past, Present and Future,” *World Family Medicine Journal: Incorporating the Middle East Journal of Family Medicine* 14, no. 7 (2016): 39–41.

³⁹ Guessoum and Osama, “Report of Zakri Task Force,” 39.

⁴⁰ Dzulkipli Abdul Razak, “Science Education in Universities in the Muslim World: No Longer Contented to merely be Bystanders!” in *Science at the Universities of the Muslim World*, ed. Nidhal Guessoum and Athar Osama (London: The Muslim World Science Initiative, 2015), 101, http://muslim-science.com/wp-content/uploads/2015/11/Science_at_Universities_of_the_Muslim_World.pdf.

lie in funding. Muslim countries spend less than one per cent of their GDP on research and development and their contribution to the world's scientific literature is also below one per cent. For instance, in 2005 Harvard University alone produced more scientific papers than seventeen Arab countries combined.⁴¹ Muslim countries also still have a small number of researchers per capita. For example, UNESCO (UN Educational, Scientific and Cultural Organization) data shows that "Muslim countries have 600 researchers per million people on average, compared with 1,000 in Brazil, 4,000 in Spain, and 9,000 in Israel."⁴² Other UNESCO and World Bank data has shown that, "a group of 20 representative OIC countries spent 0.34% of their overall gross domestic product on scientific research between 1996 and 2003, just one-seventh of the global average of 2.36%." Muslim countries also have fewer than ten scientists, engineers, and technicians per 1000 of the population, compared with the world average of 40, and 140 for the developed world. Between them, they contribute only about one per cent of the world's published scientific papers.⁴³ Indeed, the Royal Society's *Atlas of Islamic-World Science and Innovation* reveals that scientists in the Arab world (comprising 17 of the OIC countries) produced a total of 13,444 scientific publications in 2005–some 2000 fewer than the 15,455 achieved by scholars at Harvard University alone.⁴⁴

Another problem is access to education. For example, many young citizens of Arab and African countries are still deprived of primary school, with participation rates below sixty per cent in some Muslim countries. Women, in particular, fare much worse.⁴⁵

However, many Muslim countries have undertaken serious attempts in the recent past to improve this neglected area. Arab countries, for example, have established universities and higher education institutes to raise standards. Saudi Arabia, The UAE, and Qatar are among the leading countries in this regard. Malaysian universities have also been upgraded

⁴¹ Ameenah Gurib-Fakim, "Are Universities of the Muslim World Helping Spread a Culture of Science through Society?" in *Science at the Universities of the Muslim world* ed. Nidhal Guessoum and Athar Osama (London: The Muslim World Science Initiative, 2015), 71, http://muslim-science.com/wp-content/uploads/2015/11/Science_at_Universities_of_the_Muslim_World.pdf.

⁴² <https://www.scidev.net/global/r-d/news/science-muslim-world-research-funding.html?>

⁴³ Jim Al-Khalili, "Science in the Muslim World," *Physics World* 23, no. 4 (2010): 22.

⁴⁴ *The Atlas of Islamic World Science and Innovation: Final Report* (London: Royal Society, 2014).

⁴⁵ Stephanie Hepburn and Rita J. Simon, "Women's Roles and Statuses the World over," *Gender Issues* 23, no. 2 (2006): 62–68.

along with the establishment of new ones. Finally, Pakistan's Higher Education Commission has taken concrete steps in the field of higher education research; HEC is actively involved in creating new universities, up-gradation of existing institutes, and providing huge funding/scholarships for faculty development. These initiatives are still comparatively new and will take time to create an overall impact on the prevailing situation of scientific culture in the Muslim world. However, these steps are a clear indication of the seriousness of the Muslim world which will yield fruits in due course of time.

Suggestions for Improvement: Overcoming Political Conflicts

Education, science, and technology are offshoots of a stable and peaceful society. In the past, Muslims were superior and prosperous because of their unity and brotherhood. Once they split apart, all their grace and glory diminished.⁴⁶ If they want to regain their historical past, they will have to unite again by overcoming their disagreements. The Muslim world has over fifty member states, or more than one-fourth of the UN membership. The Muslim world is a solid landmass from Morocco in the west to Indonesia in the east. Five out of six of the world's main waterways lie in Muslim countries: the Persian Gulf, the Suez Canal, the Bosphorus Strait, Malacca, and Gibraltar: only the Panama Canal is a major transport waterway located outside the Muslim world. Several Muslim countries have strong military forces such as Turkey, Iran, Egypt, Indonesia, and Pakistan, which is also the only Muslim state with a declared nuclear capability.⁴⁷ Together, these countries have the capacity to act as an influential bloc. In addition, the Muslim world has been granted the best of the world's natural and human resources, but their mutual conflicts, civil wars, and terrorism have led them nowhere. Many Islamic countries such as Syria, Iraq, Libya, Afghanistan, and Iran have been victims of political unrest and disagreement. This scenario of conflict and civil war has affected these societies as well as the whole region. To come out of this bleak situation, Muslim states will have to put aside their differences and promote unity by holding to the rope of Allah, a core teaching of Islam. The resolution of mutual differences will turn the Islamic world into a peaceful society that will encourage scientific learning and activities.⁴⁸ Islamic nations, therefore, need to

⁴⁶ Ibid.

⁴⁷ Mohammed Ahsen Chaudhri, "Pakistan and the Muslim World," *Pakistan Horizon* 10, no. 3 (1957): 156-66.

⁴⁸ Ghulam Sarwar, "Pakistan and the Muslim World," *Pakistan Horizon* 34, no. 1 (1981): 74-80.

cooperate and stop fighting each other. By doing so, this will be a great way to reawaken the incredible Golden Age in their states.

The following is a list of some basic solutions:

1. Muslims should learn from Islam's past of openness, tolerance, progress, and critical thinking to drive the universities and education systems of today.
2. They should create a better understanding of how science and technology can change the state of Muslim nations. Local scientists need to be given the opportunity to grow and work at home, without feeling the desire to migrate to other countries and take their talents elsewhere.
3. Combining efforts can also change the situation in Muslim nations if they involve coordinated research to aid every Muslim state to figure out how technology can be best utilized. Modernity should not be shunned as a product of colonialism, but rather embraced as a necessity.
4. Being independent in terms of how to utilize science and technology will make it easy for Muslim nations to shun any form of intrusion.
5. All Islamic nations should share resources without any conflict and find ways to grow economically, socially, and technologically. This means pooling financial resources and developing joint research funds.
6. These nations should also strive to work hard in the pursuit of knowledge and technological development by providing proper education and training to their people. The youth of each Muslim country are particularly important here, with skill development, updated education methods, and a drive to remove prejudices and extremism at the top of the list of priorities.
7. The establishment of joint industrial ventures in the science and technology sectors will also aid in building confidence among its peoples.

With regard to the last point, Ali Haider Noorani has recently suggested, "Another way by which the Muslim society can progress in science, is by developing a unified scientific union. All the great scientists in the Muslim world can come together and work unitedly on major projects. With this, they can progress and showcase their combined talent on a much larger platform and promote diversification and critical thinking while encouraging competition."⁴⁹

⁴⁹ <http://muslim-science.com/featured-essay-4-muslim-society-can-progress-towards-science/>.

Conclusion

Muslims possess a glorious past in the fields of science and knowledge creation. They have been playing the role of torchbearers for other nations in the world of knowledge. Unfortunately, today Muslims have not only failed to lead the world, but they are also lacking in the required will and commitment to improving their present status. Their renaissance in science and technology is linked to strong dedication and resolution. The basic objective of this research was to highlight the importance of science and technology and its necessity in the current Muslim world. The major benefit of this study is the provision of a mechanism for advancement in science and technology for Islamic countries, including Pakistan.

To bring back their golden past, Muslims will have to set education on top priority and allocate enough funds to ensure its success. Basic/formal education paves the path for higher technical research and development. Therefore, Muslim states, on one hand, should establish a network of educational institutions to improve literacy rates as well as form research centres for higher education in all disciplines related to science and technology. Excellent job opportunities and a conducive work environment for highly qualified researchers will also help in developing the culture of sustainable scientific research. Last but not least, Muslims must realize that reason is to knowledge as the eye is to vision; they all are integral, and we cannot separate reason from knowledge. We must realize that we are facing an intellectual crisis in the Muslim world because we stopped reasoning. The day Muslims start reasoning and questioning, it will surely be a marvelous day that will see Muslims well on their way to success.

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