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A rebirth of science in Islamic countries?

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Section 3: Regional Focus

A rebirth of science in Islamic countries?

Andrew Plume

Useful links:

Royal Society report: "A new golden age?"

<http://royalsociety.org/a-new-golden-age/>

Royal Society Atlas of Islamic World Science and Innovation

<http://royalsociety.org/aiwsi/>

The Islamic Golden Age a period that spanned the 7th to the 13th centuries A.D. saw a flourishing of scholarship in the Umayyad and Abbasid Caliphates, which at their greatest extent stretched across North Africa and the Middle East. Contrary to traditional views of Islamic science in this era as a mere preserver of ancient knowledge from Greek and Roman sources, the Golden Age is now understood by scholars to have laid the foundations of modern science hundreds of years before the Scientific Revolution that began in Europe in the 16th century. The Islamic Golden Age produced important empirical discoveries in optics, astronomy, chemistry, mathematics (including the invention of algebra) and medicine and Muslim doctors even invented a form of medical peer review, in which visiting physicians filed their patient case notes with a panel of local doctors, who then reviewed the standard of care.

Shifting sands: Reawakening a scholarly tradition

The Golden Age eventually ended as a result of instability brought about by the Crusades from the West and Mongol invasions from the East. After centuries in the doldrums, is it now possible that a new wind has begun to blow in favor of "Islamic science" (that is, scientific research originating from the "Islamic world"; see below)?

The map of the Islamic world has shifted since the days of the Caliphs. Since 1969, the Organization of the Islamic Conference (OIC) has represented the interests of self-identifying Muslim nations of the world. Membership currently stands at 57 countries, and for the purposes of this article these will be considered as defining the modern Islamic world.

In the Golden Age, Baghdad was the political capital and seat of learning of the Abbasid Caliphate. At its intellectual heart was the "House of Wisdom". This library and translation institute was destroyed in the Mongol sacking of Baghdad in 1238, during which priceless manuscripts were thrown into the River Tigris in such quantities that the waters were said to have run black with the ink from their pages.

Today, Baghdad remains the center of scientific production in Iraq, with the University of Baghdad accounting for almost 20% of the 1,281 articles produced in Iraq in the period 2004–08. However, today's premier knowledge-producing institute across all OIC countries is the University of Tehran in Iran, with well over 1,500 articles published in the journal literature covered in

Scopus. Although only inaugurated in 1934, the University of Tehran draws on a tradition of higher education stretching back over many centuries.

Iranian science in focus

Of all of the OIC countries, Iran best exemplifies the renewed spirit of scientific enquiry (as previously featured in Research Trends in December 2009). Indeed, measures of both input and output into the research system are showing very positive trends: Gross Expenditure on Research and Development (GERD) rose from 0.55% to 0.67% of Gross Domestic Product (GDP) between 2001 and 2006, ranking it among the strongest performers in the OIC on this statistic in recent years (see Table 1).

Table 1 – GERD as a percentage of GDP for selected OIC countries in most recent year for which data are available.

Source: UNESCO Institute of Statistics, Science & Technology Reports.

Country	Year	GERD as a percentage of GDP
Tunisia	2005	1.02
Turkey	2007	0.72
Pakistan	2007	0.67
Iran	2006	0.67
Morocco	2006	0.64
Malaysia	2006	0.4
Malaysia	2006	0.64
Mozambique	2006	0.53
Uganda	2007	0.39
Sudan	2005	0.29
Kyrgyzstan	2007	0.23
Egypt	2007	0.23
Kazakhstan	2008	0.22
Azerbaijan	2007	0.17
Burkina Faso	2007	0.11
Senegal	2005	0.09
Kuwait	2007	0.09
Algeria	2005	0.07
Tajikistan	2007	0.06
Indonesia	2005	0.05
Saudi Arabia	2007	0.05

In terms of output, Iran has progressed from a low base of publications in the international journal literature of just 5,034 in 1996 to 20,244 in 2008. This 18-fold relative increase outstrips that of any other country in the OIC (see Figure 1). Moreover, Iran has matched this increase in output with an increase in field-weighted citation impact over the same period, as have several other OIC member states (see Figure 2).

Collaboration between Islamic countries

In 2010, The Royal Society published a landmark report entitled “A new golden age? The prospects for science and innovation in the Islamic world”. Drawing on the Society’s extensive network of Fellows and partners worldwide, this report provides an evidence-based exploration of the current status of research in OIC states (also including publication and citation data from Scopus). It concludes that “There is much to suggest that a new renaissance of Islamic world science could be occurring. And there are also many challenges. If the Islamic world is to again prosper and flourish, far greater investment in people, cultural attitudes as well as in physical and intellectual infrastructure must be encouraged. It must also be underpinned by greater international outreach and collaboration.”

On the issue of outreach and collaboration, there is evidence that the OIC is starting from a reasonable base of collaborative publication among member states in the journal literature, as Figure 3 shows. In the figure, lines join countries with collaborative ties, and the thickness of the lines reflect the proportion of a nation’s total output that is produced in partnership with the other country. Lines that run clockwise out of a country are indicative of the proportion of that country’s total output that is produced in partnership with the target country. For example, Turkey and Azerbaijan share a strong collaborative relationship as indicated by their proximity on the map, but this connection is relatively stronger for Azerbaijan (with a thick line running clockwise from Azerbaijan to Turkey) than for Turkey (with a thin line running clockwise from Turkey to Azerbaijan), since Turkey also collaborates with several other countries on the map).

This network analysis reveals hubs of collaboration, such as Egypt, and less connected outliers, such as Iran and the Kazakhstan–Uzbekistan pairing. Broadly speaking, the OIC nations collaborate along geopolitical lines, but the map throws up

some interesting connections. For instance, the linkage between Pakistan and Cameroon, which forms a bridge between the African OIC members and the rest of the map, consists of just 45 papers published in the period 2004–08, 34 of which were written by Professor Muhammad Iqbal Choudhary at the University of Karachi and various co-authors at the University of Yaoundé I (principally on medicinal/natural products chemistry of indigenous West African plants). This example highlights an important point: scientific collaboration is frequently driven by the efforts and personalities of individual researchers, and not by governmental or international scientific organizations.

Figure 1 – Publication output (articles, reviews and conference proceedings only) for selected OIC countries, indexed to output in 1996. **Source:** Scopus.

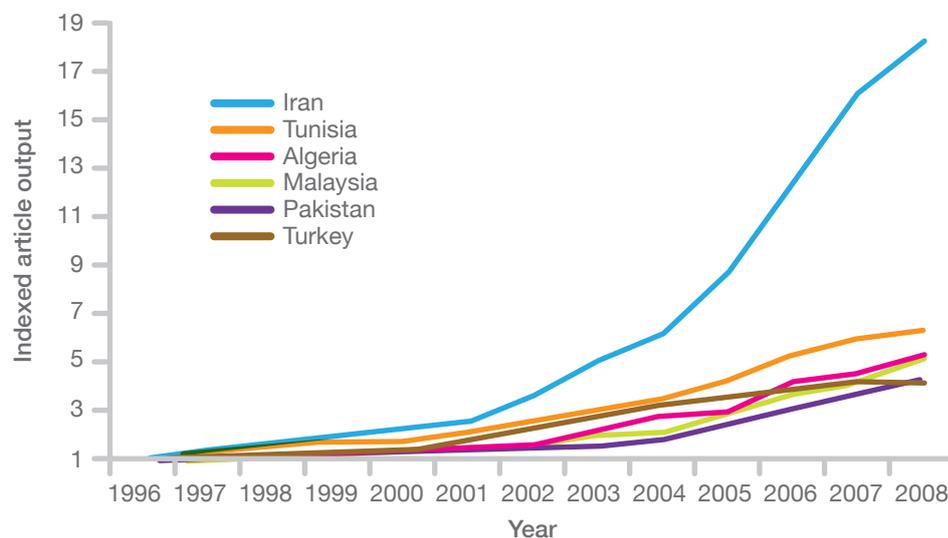


Figure 2 – Field-weighted impact for selected OIC countries calculated on five-year periods ending in the years shown (that is, 2008 represents publications and citations in the period 2004–08 inclusive). Field-weighted impact accounts for differing citation practices between different fields of research and the relative spread of a country’s activity in these fields, and is relativized to a world aggregate of 1.00. **Source:** Scopus.

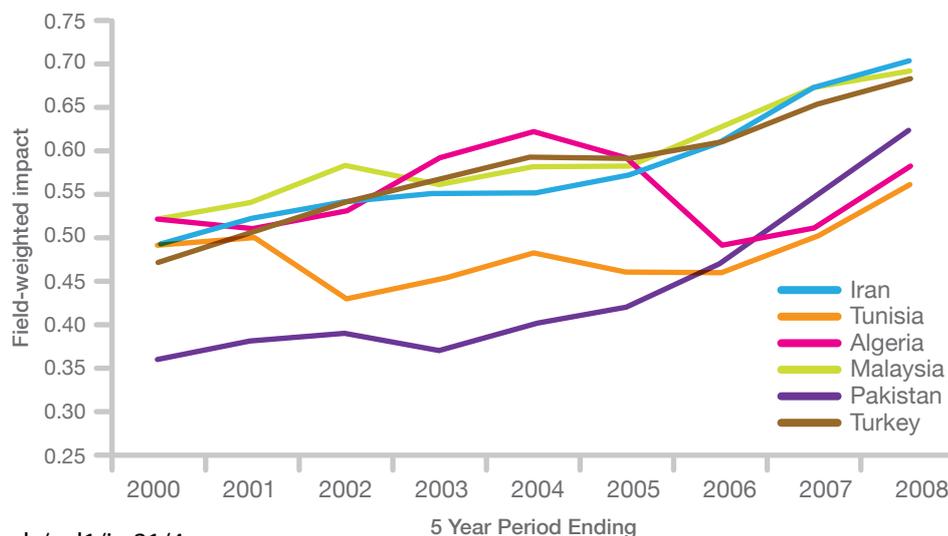
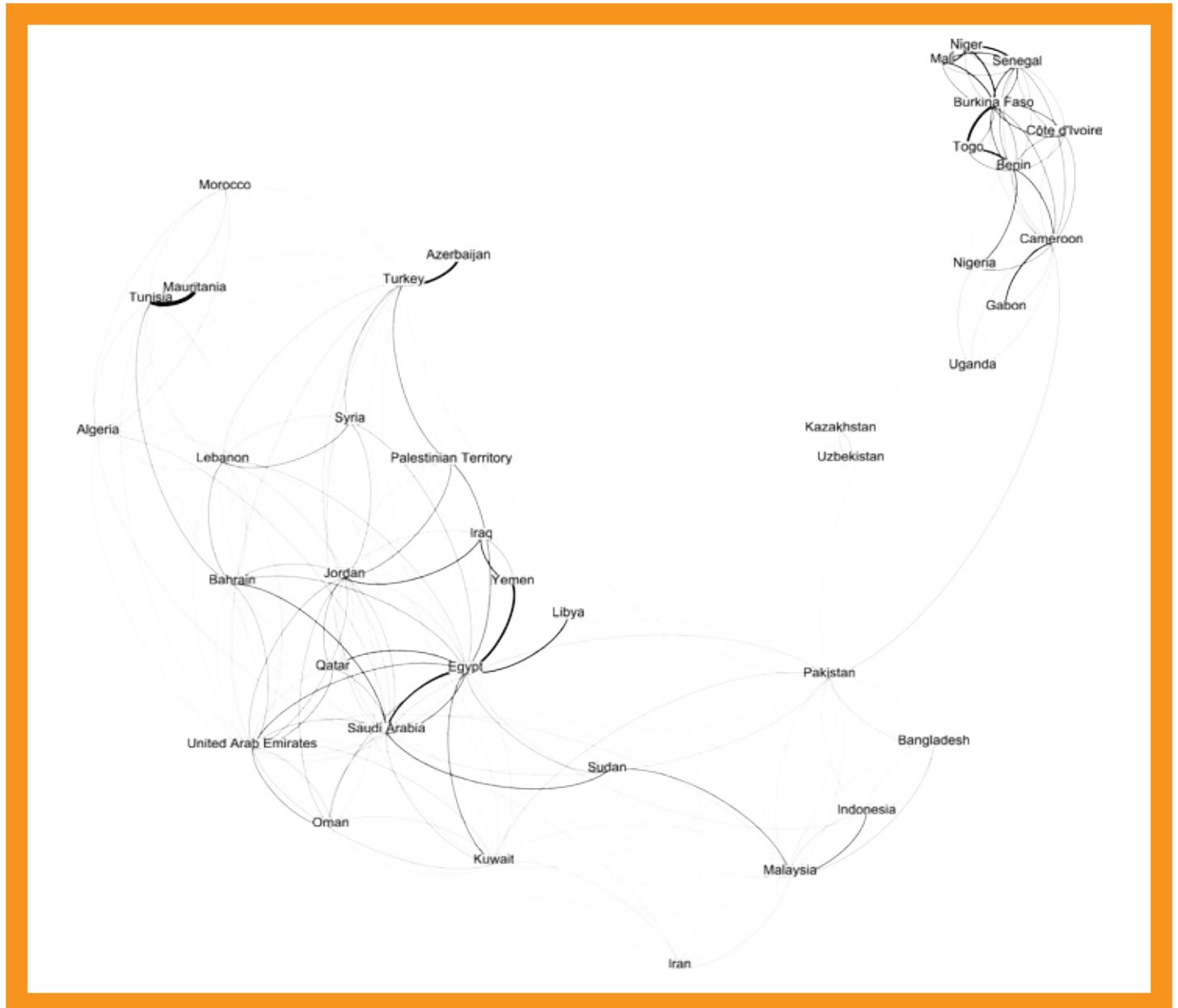


Figure 3 – Collaboration map of selected OIC countries in the period 2004–08 inclusive. Collaborative patterns between countries are represented based on numbers of jointly authored research papers (with a threshold of 25 papers). The data were visualized in Gephi using the Force Atlas algorithm, which treats the network of lines as a system of interconnected springs and seeks to satisfy the tension of all lines simultaneously in a 2-D rendering; as such, countries sharing a collaborative relationship tend to group together, while those that do not are placed further apart. **Source:** Scopus.



Dame Louise Johnson FRS, University of Oxford and Chair of the Royal Society’s Advisory Group on the Atlas of Islamic World Science and Innovation comments: “There are a number of developments taking place across the Islamic world that reinforce the potential for an expansion in the capabilities for science and innovation. The identification and characterization of natural products with beneficial properties for medicine and

industry is one such area. Working with partners from across the Islamic world, the Atlas of Islamic World Science and Innovation seeks to provide a robust analysis of the potential opportunities and challenges facing science across the Islamic world. This project will also explore and promote new opportunities for partnership and exchange, ideals that were key to the flourishing of science in the first ‘golden age’.”

Further reading:

1. Al-Khalili, J. “When Baghdad was centre of the scientific world”, The Guardian (26 September 2010).