* Science Policy and Politics in the Islamic World

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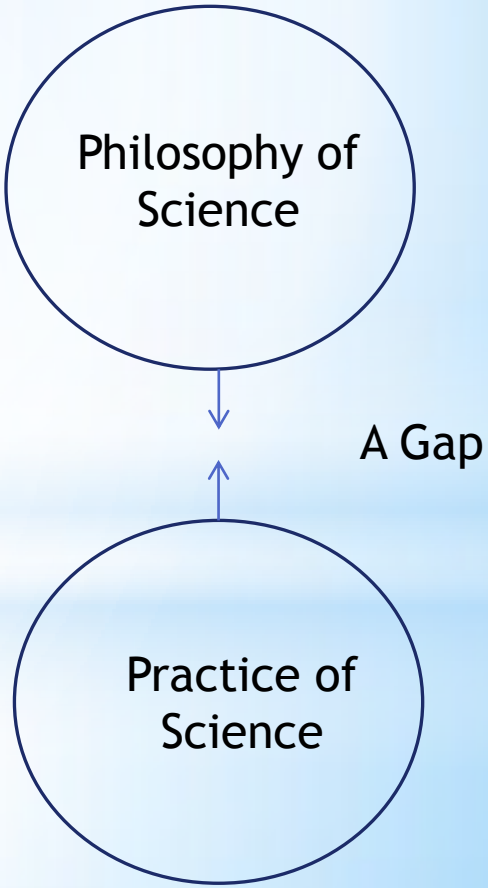
* Big Questions in Philosophy of Science?

* What is science?
* What is the scientific method?
  * Differentiation between scientific knowledge and other kinds of knowledge
* Why "do" science?
* What is the purpose of science?
  * Debate between knowledge for the sake of knowledge vs. knowledge for utility
  * Pasteur's Quadrant and other frameworks



* What is Science Policy? Why do we care?

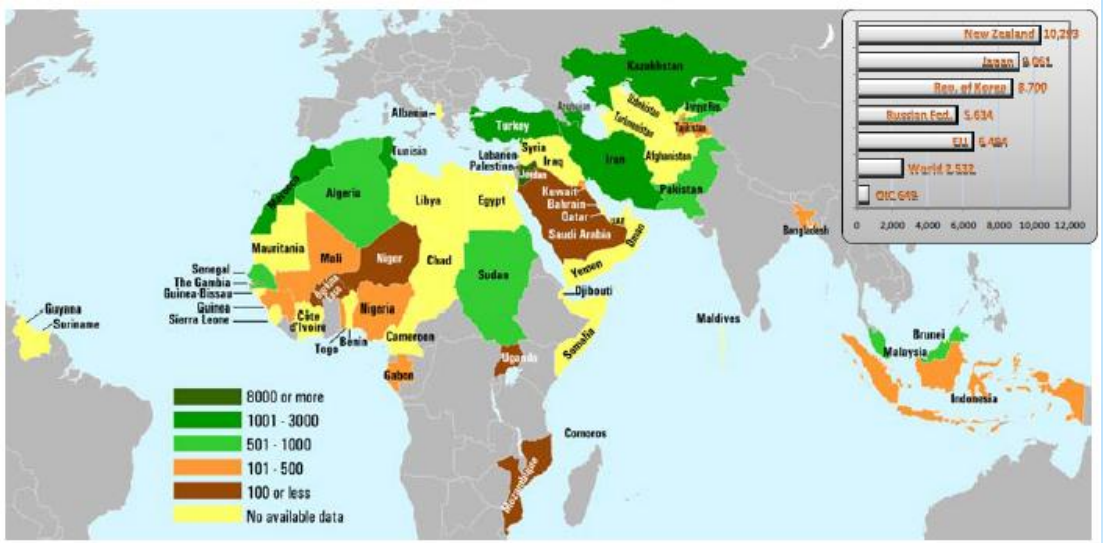
* Bridges the gap between philosophy and practice of science by addressing – at a pragmatic level – decisions
* Resource allocation:
  * What do type of research to fund? Who should decide? And how?
  * How much (and how fast) to fund it?
  * How and where to fund scientific research?
  * How do we measure cost and benefit of scientific research?
* Institutional challenges:
  * How to organise research? Different models of funding research
  * How to incentivise performance?
  * How to measure performance at a program and lab level?
  * Who to encourage collaborate with and how (and how much)?

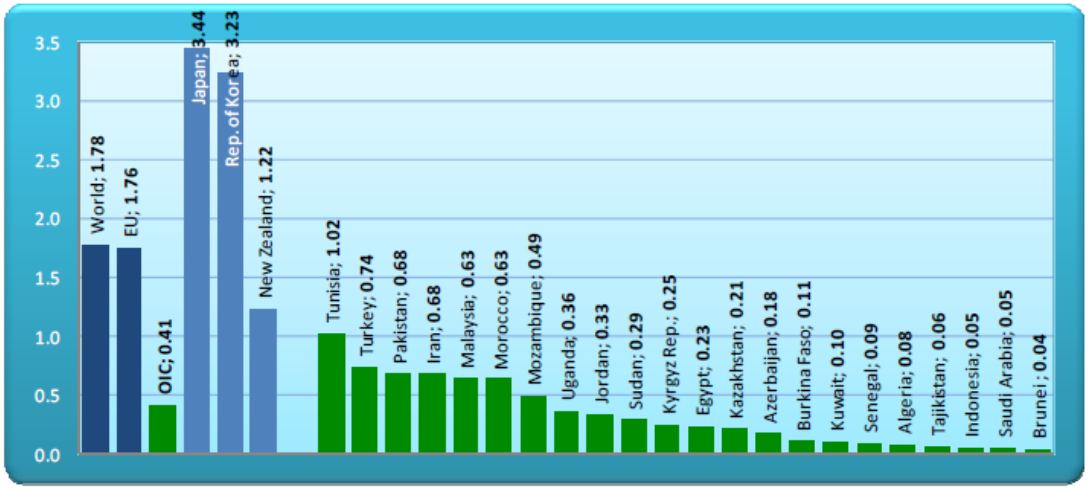
* What is Science Policy? Why do we care?

* Interface and transition issues:
  * How does one transition research from one ‘stage’ to another?
  * What is the optimal mix of basic & applied research, and development?
  * What about innovation? Whose job is it?
  * What kind of ‘framework’ be instituted to support academic entrepreneurship?
  * How does one encourage cross-disciplinary collaboration?
* Performance and effectiveness issues:
  * How does one measure performance and effectiveness?
  * What is the return on investment of research?

*OIC Science Statistical Snapshot: Inputs

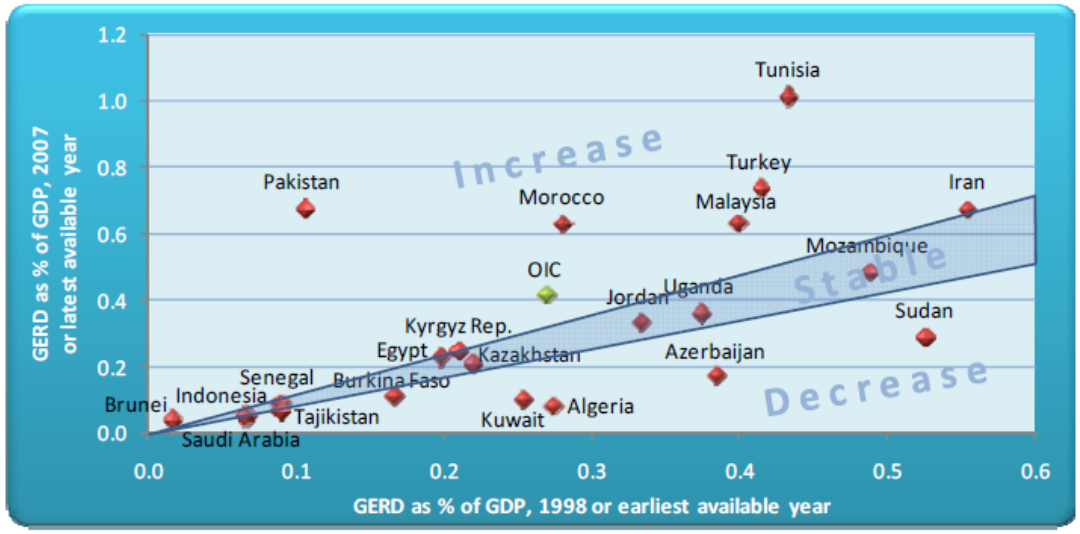
- *Researchers per million:
  - *OIC (649) vs. World (2532) and EU (6494)
  - *Only Jordan and Tunisia are above World Average
- *R&D Intensity:
  - *OIC less than 0.41%, World Average about 1.78%, Target: 1% /1.44%
  - *Qatar has committed significantly over last years
  - *Brunei (0.04%)!

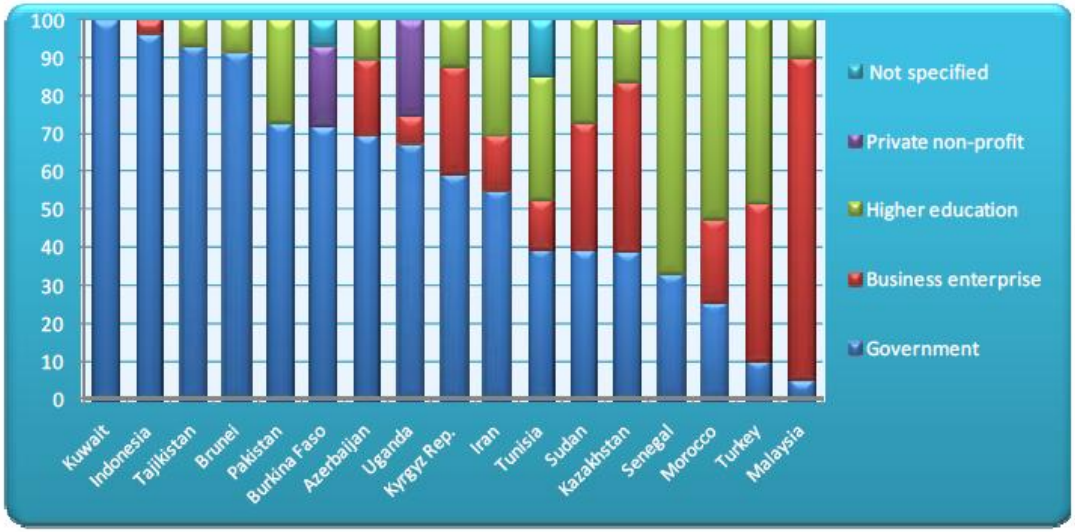




*OIC Science Statistical Snapshot: Structure

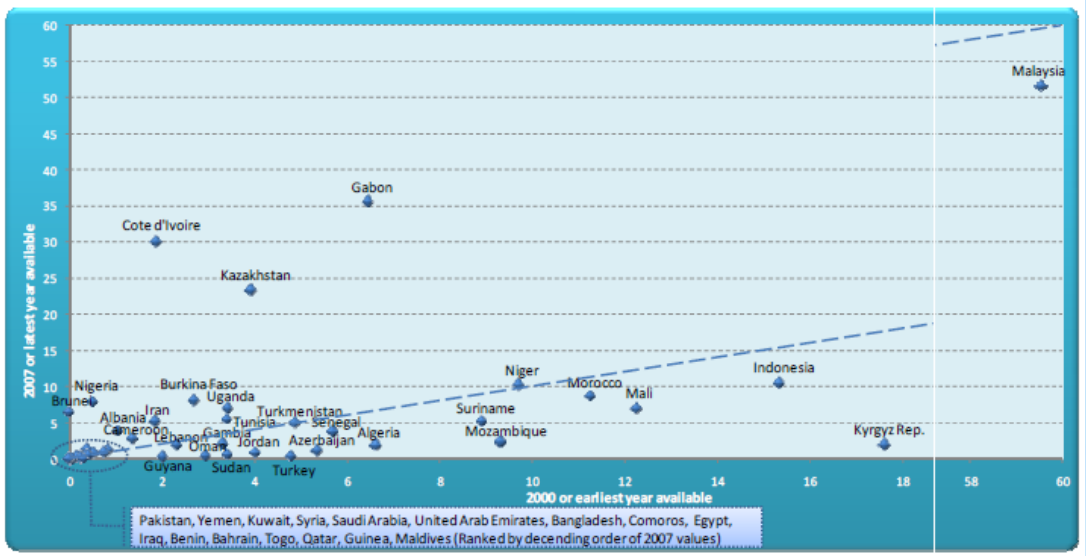
- *Trends in R&D Intensity:
  - *Pakistan, Tunisia, Turkey, Malaysia, Morocco stand out as major investors
  - *Growth rate 0.14 percent points over decade
- *Distribution by Sector:
  - *Majority R&D is performed and funded by Government (11/17-50%)
  - *Some figures may be misleading here

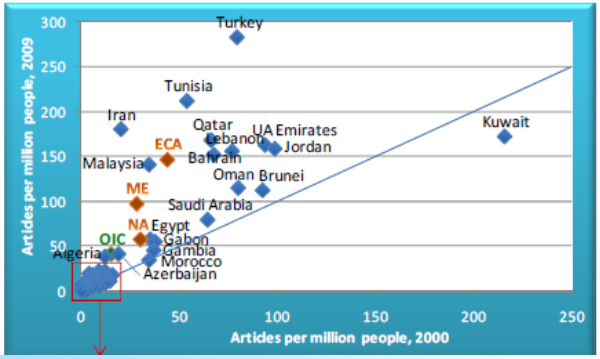


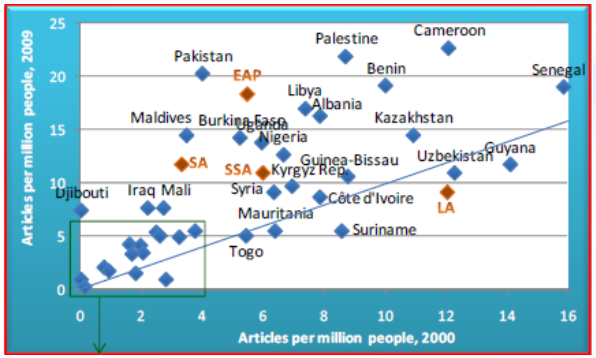


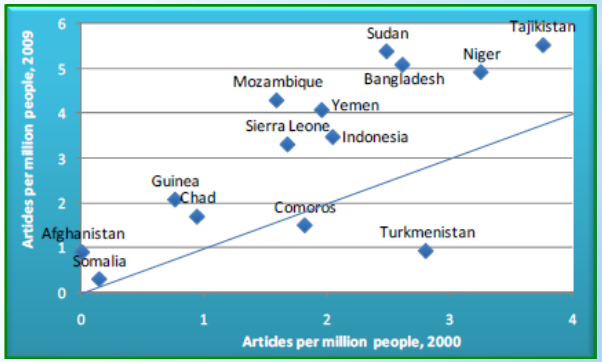
*OIC Science Statistical Snapshot: Outputs

- *High Technology Exports:
  - *Malaysia and Indonesia stand out
  - *With $64 billion, Malaysia provides 86.5% of all OIC HTEs
- *Published Papers









Case Study (1): Caution - metrics, mediocrity, normal science

- A ‘phenomenal’ chemistry institution and a ‘star scientist’
- International Centre of Excellence in ‘Natural Products Chemistry’
  - Established in 1970s with German collaboration
  - Several grants to buy equipment, Research culture, incentives, fellowships for students
  - PhDs and papers - hundreds and thousands
- What are we doing here?
  - Technicians of Science…
- Contribution?
  - “Our achievement is that we exist”
- Great model for the 1970s, failed to migrate and mature

*Institutional Landscape of OIC Science

*Organisation of Islamic Cooperation (OIC)

*OIC Standing Committee of Scientific and Technological Cooperation (COMSTECH)

*Islamic Academy of Sciences (IAS)

* Islamic Scientific Educational and Cultural Organisation (ISESCO)

* Science Technology and Innovation Organisation (STIO)

* Islamic Development Bank (IDB)

* Prominent National Institutions with International Mandates

* Other Institutions:
  * Bibliotheica - Egypt
* Funding Bodies:
  * Qatar Foundation (QF)
  * Kuwait Foundation for Advancement of Science (KFAS)#
* Awareness Building:
  * Arab Science and Technology Forum (ASTF)
  * Foundation for Science, Technology, and Civilization (FSTC) - 1001 Innovations
  * Khwarzimic Science Society (KSS)
  * Muslim-Science.Com

* Case Study (2): COMSTECH & STIO

* Ministerial Standing Committee of OIC created to promote scientific and technological cooperation
  * 57 Science Ministers are its members created as a policy body
* Created in 1981 at Pakistan's initiative and based in ISB
  * Coordinator General: M. A. Kazi (-1995), Atta ur Rahman (1996-2012), Javaid Laghari (2012-)
* Membership is Mandatory, Funding is Voluntary
  * COMSTECH's Budgetary Challenges
* Resorted to grant-making, training, networking
  * Very little focus on policy
* Serious questions about performance
* Turf battles with other bodies regarding mandate
* STIO has been created with its own set of difficulties

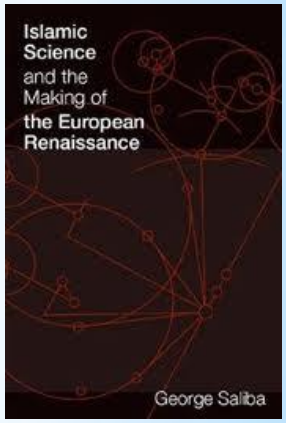
These institutions suffer from a number of challenges

* Lack of clear vision and direction
  * 'Muddling through': Vision 1441 and TYPOA
* Lack of cooperation and coordination
  * Turf wars
  * Personality dependence
* Lack of funding for collaborative efforts
  * Linked to no 'social contract' and culture of delivery
* Lack of ambition
  * Too timid – set up for mediocrity
* Regional and national rivalries
  * Ex: Inter-Islamic R&D Fund

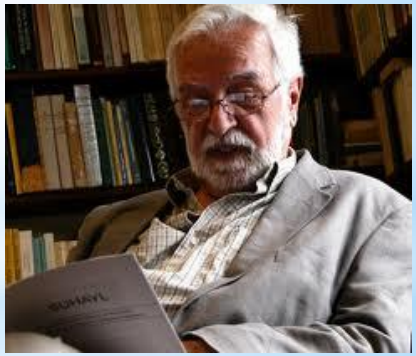
* Big Picture: Challenges in OIC Science

* Institutions and Incentives
  * Go as back as political decline of the Muslim Empire and a shared history of colonisation
  * Left behind at a major turning point Saliba (2010)
* Culture of scientific discovery and critical inquiry
* Path dependence
  * Low existing body of knowledge and critical mass issues
* 'Resource Curse'
  * Either too much or too little money
  * Kills incentive to do science, innovation, and entrepreneurship
* Too narrow a disciplinary focus
  * 'Outsourced' our thinking to the West and consulting firms

* Case Study (3): Incentives and Institutions are key



* A fundamental book to understanding the causes of rise and decline of sciences in the Muslim World
  * Looks at scholarship in astronomy across space and time
* Several important findings:
  * Nature of Translation Movement
    * House of Wisdom in Baghdad
  * Muslim contributions to Astronomy
    * Aristotle → Copernicus and Galileo
  * Incentives and Motivations for doing science
  * When did the decline start?
    * Influence of Imam Ghazali on the decline of science
* Challenges similar research in other domains be carried out



* Despite these, there is interest and commitment to science…

* Turkey and Iran
  * Lead the Islamic World and have shown considerable improvements over the last decade
* Egypt, Malaysia and Pakistan
* Saudi Arabia
  * KACST Funding, KAUST, Princess Noura University
  * Massive HR and Talent Drive: > 100,000 Saudis studying abroad
* Qatar
  * Ambition to become Regional Education Hub
  * Doha Education City (7 US Universities, plans for 13 more)
  * QSTP – Commercialisation Hub
* Tunisia, Egypt, UAE present challenges but also opportunities

*Case Study (4): Pakistan's Higher Education Investments

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OPINION

Pakistan's reform experiment

In 2002, Pakistan began an ambitious overhaul of its higher-education system. The successes and failures of the experience hold lessons for other countries, say **Athar Osama** and co-authors.

After decades of neglect, in 2002 Pakistan set out to dramatically reform its higher-education system. The reforms were designed to reverse years of chronic underfunding, to invest in the academic workforce and to revitalize a moribund research enterprise. This ambitious agenda generated immense public interest and controversy. Although it is too early to judge the outcome of the experiment, it is already clear that some initiatives were more successful than others.

Highs include more research papers, more PhDs and greater visibility for Pakistani research. The lows include an absence of external peer evaluation and of rigorous impact metrics. At times the speed and scale of reform outpaced the ability of Pakistan's universities to adapt. And the top-down nature of the revamp also led to distrust among faculty members. An important lesson for would-be reformers is that greater participation and openness may increase credibility and sustain support for reforms.

Higher education in Pakistan has been a story of neglect for much of the country's 62 years. Outside a few pockets of excellence, many of the institutions have been marked by mediocrity and a lack of motivation. Rather than contributing to the creation of new knowledge, they have been institutions of rote learning and feeder schools for foreign universities.

After rising to power in 1999, the military government of General Pervez Musharraf undertook a series of reforms. This coincided with broader international support from development and donor communities for investment in higher education. The public–private Task Force for Higher Education was set up in 2001 to review Pakistan's higher-education situation and recommend options for improvement.

The task force made some startling discoveries[1]. In Pakistan, only 2.6% of 17–23 year olds were enrolled in an institution of higher education compared with 6.2% in India, 12.7% in Iran and 68% in South Korea. Of those few, only about 30% went to universities with the rest attending two-year colleges. The total public funding of 41 public-sector universities was a meagre Rs3.9 billion per annum (US$55 million in 2001 dollars). This amounted to a mere 0.1% of the country's gross domestic product[2].

SUMMARY

- Big investment in higher education in Pakistan over the past 7 years
- Papers and PhDs up, engineering and maths show biggest improvement
- Education commission needs an independent review of its policies

The national annual allocation for university research was only Rs40 million[1].

Chronic underfunding of higher education was just one of the challenges identified. Other concerns were a lack of political will for meaningful reform, a lack of appreciation for the role education can play in development, ineffective governance systems, political interference in university administration, weak institutional leadership and, at the university level, a lack of performance culture and accountability.

March of progress

The task force made a series of recommendations, including calling for a huge jump in public funding for universities from Rs3.9 billion in 2001–02 to Rs21.7 billion in 2005–06 (ref. 2). An action plan was taken forwards by the Higher Education Commission (HEC), which replaced the University Grants Commission.

Starting in 2003, the HEC launched programmes in human-resources development, research and physical infrastructure, and reforms of curriculum, governance and pedagogy (see 'Pakistan's key initiatives — progress so far'). Human resources took the lion's share of investment, and often received the strongest criticisms. Inevitably, some programmes were better designed and executed than others.

For example, a foreign PhD fellowship programme has sponsored more than 2,000 scholars to study abroad. To date, the host countries seem to be happy with the quality of these students, although the programme's impact will depend on Pakistan's ability to attract back and reabsorb the scholars.

By contrast, the domestic PhD fellowship programme has had a bumpier start. Here the goal was to create 5,000 new PhDs at local universities over 5 years — from a baseline of a few hundred PhDs in previous years. In this instance, the HEC's critics argue that undue emphasis has been placed on quantity rather than quality. Two factors are at the root of the

PAKISTAN'S KEY INITIATIVES — PROGRESS SO FAR

Human resources (faculty) development	
Foreign PhD fellowships	2,825 scholarships awarded for study abroad in 20 host countries
Foreign Faculty Hiring Programme (FFHP)	Internationally comparable salaries offered to attract foreign faculty members — often Pakistanis working abroad — to take temporary appointments at a public university. 289 foreign professors have joined
Tenure Track System (TTS)	Internationally comparable salaries offered to faculty members to enter into a performance contract under the tenure track stream; adoption is marginal
Domestic PhD fellowships	To date, 3,516 PhD scholarships awarded — 179 PhDs completed
Research and physical infrastructure	
National Research Programme for Universities (NRPU)	A peer-reviewed research-grant programme for 3-year projects; 644 projects approved (approval rate: 47%) between 2002–08
Pakistan Education and Research Network (PERN)	High-speed internet connectivity to 95 universities to enable research collaboration and video-conferencing
National Digital Library (NDL)	Free electronic access to 45,000 e-books and 23,000 full-text journals across more than 250 institutions
Curriculum, governance and learning innovation	
Curriculum reform	Curriculum of 97 disciplines updated; graduate courses increased to 4 years
Quality assurance	Quality Enhancement Cells established in 30 universities
Governance	Criteria for appointment of university vice-chancellors established; governance and leadership training for university leaders
Learning innovation	Programmes to train faculty members in innovative teaching methods

Source: HEC data (especially ref. 5)

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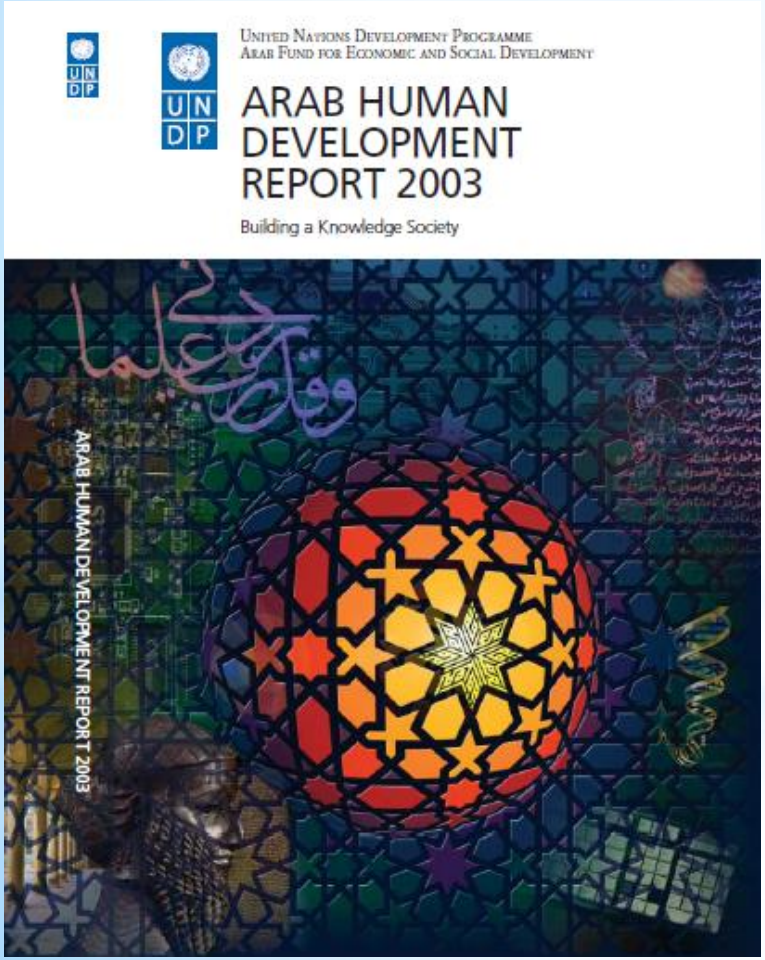
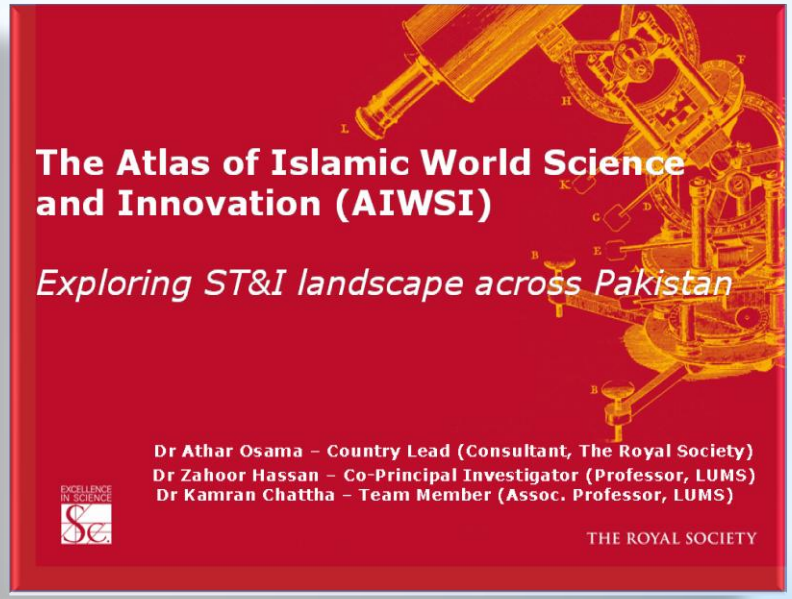
PAKISTAN'S ACADEMIC PUBLISHING PERFORMANCE

	Pre-reform (1998–2002)			Post-reform (2003–07)		
	Total papers	% of world	Relative impact*	Total papers	% of world	Relative impact
Biology and biochemistry	134	0.05	−77.5	282	0.09	−60.9
Chemistry	725	0.14	−75.9	1,582	0.26	−71.3
Computer science	9	0.02	−80.0	50	0.09	−69.3
Economics and business	16	0.03	−81.3	17	0.03	−88.5
Education	6	0.05	−66.0	7	0.05	−64.2
Engineering	**165**	**0.06**	**−55.9**	**518**	**0.14**	**−10.1**
Mathematics	**27**	**0.04**	**−70.2**	**66**	**0.08**	**20.8**
Physics	409	0.09	−58.9	729	0.14	−44.9
Plant and animal science	474	0.21	−68.8	863	0.34	−67.6
Social sciences, general	67	0.05	−12.9	117	0.07	−27.9

Source: Science Watch/Thomson Reuters. *Percentage a paper is cited more or less than an average paper in the discipline.

* Navigating these interesting times will require critical inquiry and reflection





*Road Ahead: Challenges and Prospects

* What is the optimal path for this reform / revival agenda?
  * How fast can this 'leapfrogging' happen?
  * Can 'models' and institutions be transplanted?
  * Can we 'buy our way' out of the problem?
* Culture of openness, curiosity-driven inquiry, debate and dissent, freedom of thought, are important
  * This will require political changes but also more holistic approach to teaching science (multi-disciplinarity, philosophy of science, etc.)
* Fundamental Question: Can the Islamic World create a scientific renaissance without achieving all of the above?
* A number of questions are difficult to answer
  * A grounding in and a careful use of public policy will help