What is what in S & T and Higher Education in the Arab Region for 2006

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1 ABSTRACT

Emphasis on quality and relevant higher education and building capacity in S&T have become a benchmark for development in an interdependent competitive world – economy. Market forces for quality, new materials and innovations have put a lot of pressure on science and technology to react positively to demands, particularly in the frontier areas of science. Although, the Arab region is spending 5.4% of its GDP/year on public universities, compared to 5.0% in industrialized countries and 3.8% in developing countries. Tertiary students represent 25% of eligible population, higher than developing countries. However, the quality and relevance of the delivery of higher education is low and not competitive. It lacks creativity and entrepreneurship.

Also, the expenditure on R & D has declined from 0.4% to 0.2% of Arab GDP, compared to world average of 1.7% world GDP. Arab scientific papers total 1.1% of world production. 90% of Arab R & D is still done by public sector.

The Arab region is still structured around turnkey technology and characterized by low investment in building endogenous capacity in R & D, and producing its own technology.

Below is a self-explanatory PowerPoint presentation that attempts to describe the status of S&T in the Arab world, and to propose a possible course of action for decision-makers to follow to try to correct the situation.

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Arab Region at a crossroads

- Building Capacity
  - Merit-based systems to promote excellence
  - Quality education linked to the marketplace
  - Creativity and innovation
  - Science-based education
  - Delivery of entrepreneurs
  - R&D linked with industry: Creating demands

Figure 1. Arab Region at a crossroads.

Merit-based systems to promote excellence

- Nurturing excellence through scholarship from childhood to career development
- Special education for gifted students
- Promote leadership
- Inspire excellent students into careers in research and development (R&D)
- Boost morale for building skills and excellence
- Avoid isolation and marginalization
- Awards and prizes to excel

Figure 2. Merit-based systems to promote excellence.

Quality education linked to the marketplace

- Continuous assessment of education delivery at every stage of development
- Use of international yardstick for rating institutional and disciplines of education
- Join international agencies of accreditation and quality standards of outputs of education (i.e. QAA in Britain, abbat, etc.)
- Aptitude test of graduates at the university level for rating individuals and institutions to create competition
- Decentralized governance to create competition among educational institution
- Encourage private quality-learning schools and universities

Figure 3. Quality education linked to the marketplace.
Creativity and innovation
- Change of schooling from disseminators to facilitators of knowledge
- Learning to structure knowledge from avalanche of information
- Learning to learn, to think, to analyze, and solve problems - to create the analytical mind
- To develop the inquisitive mind to discover the unknown
- To integrate ICT in the learning process
- Self-learning and long-life learning
- To transfer knowledge into application and technology

Figure 4. Creativity and innovation.

Science-based education
- Brain-intensive, knowledge-driven
- Renovate educational system
- Motivate bright students to take up careers in science
- Science for all
- Assistantships, fellowships and training
- North-South and South-South post doctoral programs
- Brain-gains into brain-bank to work on South problems for building capacity and excellence

Figure 5. Science-based education.

Entrepreneurs
- Stimulate educational environment to create entrepreneurs
- Provide co-op education
- Access to incubators of creative ideas
- Graduation projects
- Provide time and space to nurture entrepreneurial trends
- Provide access to information through networks
- Access to venture capital

Figure 6. Entrepreneurs.
R&D linked with industry: Creating demand

- Create business parks around the university campus with bio-community
- Contractual research: university – bio-community
- Create patents and registration procedures for R&D delivery
- Create culture of research for solving problems
- Provide incentives and rewards

Figure 7. R&D linked with industry: Creating demand.

Expenditure on Higher Education

- Arab Region average USA $2,400 per student (Spain $14,400)
- Arab region spends 5.4% of GDP per year on public universities compared to 5.0% in industrialized countries and 3.8% in developing countries
- Arab region tertiary students represent 25% of eligible population; higher than developing countries
- There is now gender balance in higher education
- Private sector has taken the initiative to create private colleges and universities to help the public sector in financing higher education

Figure 8. Expenditure on Higher Education.

Drawbacks of higher education in the Arab region

- Universities lack autonomy, competition and merits
- No clear admission policy
- Lack of quality faculty member
- Rigid curricula and regulations which kill creativity and innovations to meet changing needs in e-economy
- Shortage of e-learning and integrating ICT
- No bridging with professional experience and workplace
- Lack of R&D
- Lack of incubators and business parks to bridge with the industry
- Outputs of education are of low quality and relevance

Figure 9. Drawbacks of higher education in the Arab region.
Investment in Science

- Arab Declined from 9.4% to 0.2% world share and 0.2% of GDP
- Arab Investment is US$1.7 billion
- Arab R&D, education and health combined less than expenditure on military needs
- Israel invests 4.4%, Sweden 3.8%, EU 1.9% and has set a target 2% by 2010, India 0.5% and has set a target of 3% by 2007
- 1.7% of world GDP was devoted to R&D, OECD spends 30% of world share in R&D
- Brazil, Costa Rica, COSE spends 0.9% of GDP on R&D

Figure 10. Investment in Science.

R&D expenditure as % of GDP 1996 - 2003

Figure 11. R&D expenditure as % of GDP 1996-2003.

R&D expenditure as % of GDP 1996 - 2003

Figure 12. R&D expenditure as % of GDP 1996-2003.
Who funds what in R&D?

- **R&D in the Arab region**
  - 3% private sector
  - 27% universities
  - 70% govt. sector

- **R&D in the OECD**
  - 70% private sector
  - 3% non-profit sector
  - 17% universities
  - 10% by govt. sector

Figure 13. Who funds what in R&D?

Who funds what in R&D?

- **R&D in the US**
  - 75% by enterprise sector
  - 25% by government and universities

- **R&D in Korea**
  - 78% by enterprise sector

- **R&D in China**
  - 69% by enterprise sector

- **R&D in Japan**
  - 73% by enterprise sector

- **R&D in Sweden**
  - 78% by enterprise sector

- **R&D in Israel**
  - 71% by enterprise sector

Figure 14. Who funds what in R&D?

Arab scientists and engineers

- Arab research scientists and engineers per million population surpasses only Africa (124 FTE)
- Developing countries average of 313 scientists per million population
- University scientists over-occupied with teaching loads and little left to science
- Most scientists in Egypt are in agricultural and health sectors
- Arab scientists have not yet taken on the third wave of brain-intensive ICT and K-economy
- Research groups are made of MSc and PhD holders, and expenditure go to salaries and wages

Figure 15. Arab scientists and engineers.
Researchers in the Arab region

Figure 16. Researchers in the Arab region.

Scientific and Technical publications

- An indicator of SCI is cited scientific papers per million inhabitants: 0.02 in Egypt, 0.07 in Saudi Arabia and 0.53 in Kuwait as compared to 43 in USA, 30 in Switzerland and 38 in Israel.
- Scientific papers originating from the Arab world do not exceed 1.1% of world total.

Figure 17. Scientific and Technical publications.


Figure 18. Scientific and Technical journal articles published (1996-2005).

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Figure 19. Scientific and Technical Journal Articles Published (1996-2005).

Figure 20. Scientific and Technical journal articles published in 2005 per million people.

Figure 21. Scientific and Technical Journal Articles Published in 2005.
Technology output of the Arab region as compared to others

- Technology output expressed in registered patents
- Indicators show low level of innovative technology produced by Arab region
- Turn-key technology still acquired due to rising revenues of oil exports
- Domestic indigenous technology is low
- Egypt, Kuwait and Saudi Arabia are ahead of other Arab states

Figure 22. Technology output of the Arab region as compared to others.

Share of High Technology Exports out of Total Manufactured Exports (2004)

Source: United Nations Statistics Division Commodity Trade (COMTRADE) Database

Figure 23. Share of High Technology Exports out of Total Manufactured Exports.

Conclusion

- Arab region should allocate 6% of its GDP for education by 2010
- Arab region should allocate 1% of its GDP for investment in R&D by 2010
- Reform is required in education from childhood (KG) to higher education with emphasis placed on learning how to think, to analyze, solve problems, structure knowledge and build skills
- Strengthen science, mathematics, languages and computing at early age to build logics and induce creativity and innovation
- Reform policies and legislations to promote quality teaching and research in frontier areas of science
- Promote centers of excellence

Figure 24. Conclusion.