Remarks on
Linking Education, R&D Institutes and Industry

(examples are more specific to Egypt , but many apply to AR)

Mohamed A. Abdou

SUMMARY OF OVERALL ASSESSMENT

- One primary measure for evaluating the overall performance of a S&T system in any nation is its impact on achieving the national goals. The overall assessment indicates that:

  Egypt's current S&T system has failed to substantially impact socio-economic development which is the nation's highest goal. **In particular, the Egyptian S&T system has failed to** become a scientific and technological power which could induce an effective transfer of technology and know how from advanced nations and bring about the creation of a solid national technological base; both of which are necessary foundations for successful socioeconomic development.

- However, there are many shining examples of success which should not be minimized. But, the concern here is with the overall performance and impact of the Egyptian S&T system as a whole.

EGYPTIAN S&T SYSTEM MAJOR ISSUES AND PROBLEMS

1. LACK OF AN EXPLICIT NATIONAL S&T POLICY
2. INEFFICIENT AND COMPLEX ORGANIZATIONAL STRUCTURE WHICH CAUSES CONFLICTS RATHER THAN CONDUCING HARMONY.
3. FINANCIAL RESOURCES ARE SERIOUSLY LIMITED
4. PHYSICAL AND INFORMATION RESOURCES ARE DEFICIENT
5. "LAISSEZ FAIRE" FUNDING POLICY AND SELECTION OF RESEARCH TOPICS IS LEFT TO INDIVIDUAL RESEARCHERS.
6. MOST R&D INSTITUTIONS ARE FUNCTIONING AS ACADEMIC UNITS RATHER THAN AS TECHNOLOGY CENTERS
7. TECHNOLOGY TRANSFER FOLLOWS A LAISSEZFAIRE POLICY WITH NO SIGNIFICANT ROLE FOR THE S&T INSTITUTIONS.
8. ONLY 15.7% OF S&T PERSONNEL ARE IN ENGINEERING AND TECHNOLOGY
9. FOREIGN FUNDS ARE NOT WELL COORDINATED
10. THE LINK BETWEEN R&D INSTITUTIONS , Universities AND INDUSTRY IS WEAK

THERE ARE TWO KEY ELEMENTS OF THE S&T SYSTEM

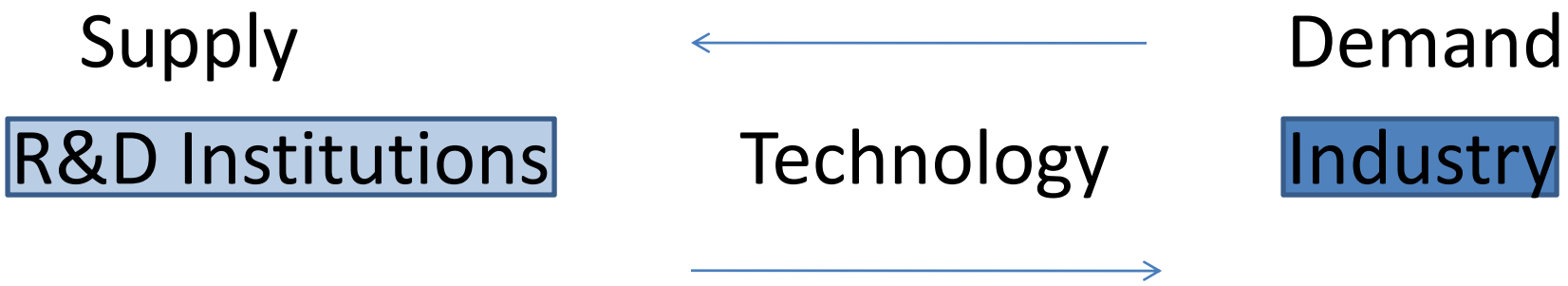
1. R&D INSTITUTIONS
2. INDUSTRY

R&D INSTITUTIONS ARE VERY WEAK

EGYPTIAN INDUSTRY IS VERY WEAK:

- Mainly produce low price and low quality products
- They invest little in training or in upgrading quality and productivity
- There is little search for new product or process technologies, methods of improving competitiveness and cutting costs;
- There is little awareness of the importance of quality to competitiveness
- There is little or no engineering design capability
- There is little technological effort beyond what is needed to operate imported technologies
- There is a lack of attention to exports; inability to compete in global markets

The S&T problem in Egypt is much broader than weakness in R&D Institutes



- R&D institutions do not provide a good supply of technological development.
- Industry is too weak to do its own R&D or to provide a demand for technological development.

Therefore The Major Issue is:

The Technological Capability of the Nation is very weak.

- This calls for a Much Broader Examination of the Problem and Developing Solutions in the Broader Context of National Problems.

Examination of National Egyptian Problems Reveals that Building a Technological Capability for the Nation is the Key to solving present Socio-Economic Problems.

National Problems:

1- Weak Exports.

2- Unemployment.

3- Environmental Problems.

    * Potable Water.

    * Pollution.

    * Industrial Waste.

4- Food Security.

5- Water Resources.

6- Energy.

7 - Desert Development.

8- Urban Development.

9- Coastal Zone Management.

10- Etc.

EXAMPLE OF HOW BUILDING A TECHNOLOGICAL CAPABILITY CAN SOLVE NATIONAL SOCIO-ECONOMIC PROBLEMS:

EXPORTS

- In today's world, producing and selling manufactured goods in the global international market has become a key to economic prosperity.
- It is ineffective to have an export policy that does not have an adequate technological capability as its foundation.

Broad Recommendations

- Make building a Technological Capability the highest national priority
- Rebuilding and Restructuring of the R&D institutes must focus on the National Goal of Building the Technological Capability.
- Building a Technological Capability must be the foundation for Socio-Economic Development.
- Develop a new effective S& T Policy as an INTEGRAL part of a more effective Socio-Economic Policy.

Recommendations (cont'd)

Redirect the Practice of the Egyptian R&D institutions from that of Career Development to that of S& T Centers that focus on serving the purpose of acquiring, understanding, absorbing, adapting and diffusion of technology for the industrialization of Egypt for the 21st Century.

What is Needed for S&T?

1. S&T Policy:

   Goal
   Objectives
   Strategy

2. ACTION Plan

Requirements for Effective Implementation of an S&T Policy

- Strong political will and political commitment at highest level
- A clear Vision of future of country:
    a) Identify opportunities in global economy
    b) Develop comparative advantage based on QUALITY, COST and SCHEDULE
    c) Integration of local, regional & global markets
- Develop quality management capacity at all levels:
    a) Senior government
    b) Managers of R&D Institutes
    c) Private sector management
- Adequate integration of S&T Policy with economic development policies and sectorial policies
- Importance of equity and social participation
- Change of mindset and of attitudes to develop agile institutions and promote innovation:

It's people that count

Suggested S&T Policy Framework (Structure)

- Goal
- Objectives
- Strategy
- Action Plan

Goal of S&T Policy

Provide Egypt with technological capabilities as the basis for the socio-economic development of the country

Strategic Components of Suggested S& T Policy

1. Strengthen capacity to formulate and implement S&T Policy
2. Increase investment in S&T and efficiency in the management of National S&T Budget
3. Increase effectiveness of R&D Institutes
4. Develop appropriate human resources
5. Promote innovation and technology transfer at enterprise level
6. Promote integration of S&T with Egyptian culture and values, seeking to develop learning (agile) institutions and innovative persons (change of Mind Set)

Need for a Systemic (Integrated) Approach:

Dynamic interaction and synergism among six strategic components, requiring an integrated approach.

Making R&D Institutes More Effective: Changes taking place around the world

- Increasing emphasis on technology development vs. research
- Increasing market orientation via end-users participation in governance of institutes (from Stakeholders => to Shareholders)
- New emerging forms of Public/Private cooperation in focused areas of national objectives
- Funding is increasingly contract-based
- Success criteria is closely related to technology marketing and creation of enterprises
- Developing countries that have successfully integrated technology strategy, commonly are based on:

    a) technology adaptation rather than technology creation

    b) decentralization from large multi-sectorial institutes to smaller more specialized institutes

Results:

Assure greater market-orientation and efficiency in Technology R&D Institutes

R&D Institutes in Egypt: Three Major Policy Recommendations

- To increase effectiveness of R&D Institutes establish *Joint Venture* with private sector, or privatize, *when possible.* R&D Institutes must be autonomous in managing their programs.

- Change Funding Strategy for R&D Institutes:
  a) Assure government support for only the Core Budget (percentage may vary)
  b) R&D Institutes should compete for projects from other funds managed by MST, or through contract research and services from industry
  c) Government should subsidize demand, not subsidize supply: This implies creation of credit lines and co-funding mechanisms to finance projects
  d) Allow institutes to charge overhead

- Open-up closed systems of R&D Institutes:
  a) Avoid in-breading in graduate training
  b) Facilitate mobility of resources (reward performance)
  c) Encourage exchange of staff between R&D Institutes and Industry
  d) Deregulate and deburocratize environment

Development of Human Resources

- Establish an Office of Training and Education in the Ministry of Science and Technology
- Provide short courses on Industrial Management for middle and upper level management in Industry and in R&D Institutes
- Provide vocational training in selected areas of manufacturing to technicians in industry
- Recruit expatriates in collaborative research, training, and technological development projects
- Reform engineering curriculum in the universities

Promote Innovation and Technology Transfer at Enterprise Level

- Technology transfer from abroad is a must for speeding up industrialization process
- Remove legal, financial and other obstacles that currently hamper foreign direct investment
- Develop absorptive capacity of enterprises through reverse engineering, subcontracting, training, etc.
- Correct weaknesses of the patent system, particularly by strengthening enforcement mechanisms
- Provide tax incentives for private sector investment in R&D and technological services

Summary of Recommendations

A - General Recommendations

- Make technology development the basis of a more effective socio-economic policy
- The cause of technology development must be championed by the Government at its highest level
- Establish a Ministry of Science and Technology with responsibility for R&D and technology transfer from abroad
- Make a nation-wide strategy with well-targeted efforts in High, Medium and Low Technology industries
- Increase investment In S&T to 1 % of GDP (within five years)
- Stimulate investment of private sector in R&D through appropriate Tax Incentives and deregulation
- Launch a nation-wide long-term campaign for rooting S&T within Egyptian culture and values

Summary of Recommendations

B - Specific Recommendations

- R&D Institutes:
  * Strong technology orientation in support of industry
  * Autonomy and incentives for financing 50 % of their costs through competing for projects, and . through contract research and sell of services
  * Appropriate procedures for staff recruitment, promotion and reward
- Human Resources:
  * Development of engineering and technical training through improvement in curricula
  * Short term technical training through private sector initiatives
  * Special program for tracking and attracting expatriates
- Technology Transfer
  * Eliminate administrative and legal obstacles
  * Develop absorptive capacity of local industry
  * Improve patent system by strengthening aspects related to enforcement