One Way Ticket to Science

TWAS 11th General Conference & 20th General Meeting
Durban, South Africa, 20-23 October 2009

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We are lucky and fortunate that we as humans, have selected science as our choice in the roadmap of our endeavor toward development. As scientists, we see things others cannot see. We wonder in the world of the unknown, to discover and create knowledge and make it available to our fellow homosapiens. We work for sustainable environment, for creating-work opportunities, basic needs in nutrition and health and after all, ensuring the quality of life.

However, this cannot be achieved without ensuring, capacity-building science institutions, for excellence in teaching, for excellence in research, for excellence in outreach programs, to reach the unreached, and include the excluded. We build science, and education of science, for peace development and democracy, no marginalization, no discrimination, equal opportunities and benefits, for all.

Building “the state of the art” scientific institutions for teaching, research and extension, to bring the society forward through science to new horizon, releasing its full potential toward fulfillment, requires inducive environment of how to think, analyze and resolve, in order to create the “K”, incubate, and derive technology and innovations.

In building science institutions around the “S”, I have chosen four pillars which I was engaged in, to bring endogenous development for the developing world, capitalizing on the brain, to release its potential and realize a genuine
investment in human resources, through science and education.

Building higher learning institutions, universities, based on quality and relevance to meet the needs, and to create demands; institutions who are capable to deliver excellence in term of graduates, and R & D, to deliver entrepreneurship. I will represent four universities; two public and two private, which I founded and cofounded to become leading institutions in the country.

**Firstly:**

In 1966, we were lucky to start the first faculty of science in the country, at the University of Jordan. To start from zero, it means that you create "the state of the art" institution for teaching and research. We were five faculty members, who earned their doctorates from the West, mostly from pronounced universities in the U.S. we put the vision, the mission, and the objectives:

a. Merit-based Institutions for admission and strict policy for recruitment of faculty members, for fellowships abroad, for promotion and tenureship.

b. The faculty to be built around four basic sciences, Math, Physics, Chemistry, and Biology based on quality and relevance, in teaching and research. Later, geology (earth science) & computer science to be added.

c. Fund-raising scheme was put in place to finance infrastructure of the academic teaching, and research programs. Requirements in term of space, related to function were provided, to house the four basic sciences.
d. Another fundraising scheme was launched from UNDP country programs for five years to build the undergraduate programs; followed by another five years to build the graduate programs in math, physics, chemistry and biology.

e. Curricula, teaching and research labs and fellowship programs were set for 70 merit-based graduates to be trained for PhD. abroad in highly distinguished universities mostly in the U.S. and Britain, to meet the future demand for staffing development.

f. Foreign component was brought in, to bring excellence to the faculty through Fulbright, DAAD and other exchange programs.

g. The Faculty adopted the semester-credit system based on 132 credit hours and the instructional media was in English. Admission policy to every discipline was limited to 30 students' maximum intake (120 totals). Rigorous freshman-screening, tutorials and academic advisors for every ten students were adopted. Remedial courses were given after hours. Quality, was the mode of the faculty.

We were lucky at the time that the university was headed by President Majali, who is a founding TWAS fellow, a visionary person who promoted excellence and decentralization and who launched the applied sciences as medical sciences (medicine, dentistry, pharmacy, nursing and allied health sciences with 550 beds teaching hospital), followed by engineering sciences, then agricultural sciences, which all were born from the faculty of science. Once basic science was based on excellence, any applied science will continue to be excellent. Without real science, there is nothing to apply.
**Difficulties: 1st obstacle** we met that, the intake of students from high school was poor in quality due to outdated science curricula and were traditional students based on memorization, lacking creativity, enquiry and analytical mind. The gap between end of high school (Tawjihi) and start of university science (freshman) was huge.

Negotiation with the Education Ministry lead to curriculum development in math, physics, chemistry and biological sciences (BSCS) the task was completed; textbooks, lab manuals and teaching guides were prepared for the whole secondary cycle.

**2nd obstacle** we met, outdated teachers in science stream, who are unable to teach modern curricula of basic sciences. Again, another negotiation with the Ministry of Education, to train all science teachers at high schools in skills and pedagogy. 32 credit hours diploma in science skills & pedagogy teaching was set during summers at the faculty of science.

Within five years, complete overhaul of national science as content and pedagogy has evolved to an international standard in all secondary schools of Jordan.

I’m saying this because education is a process, all elements in the chain of educational environment have to be taken into account for excellent delivery of science. Curriculum development and inviting textbooks which ignite enquiry and critical thinking, lab manuals which train students from experiments leading to consolidation of science theorems, teacher guides and teaching aids, continuous educations, training and retraining of science teachers have to be done, formally and informally.
Secondly:
In 1976, a royal commission was setup to start a comprehensive university in the North where 1/3 of Jordan's populations live in rural area. I was appointed a founding president.

We set the following objectives to the task:
1. "State of the art" capacity building institution based on quality and relevance, and meeting the increased demand on higher education, in undergraduate and graduate programs.
2. Research-base institution.
4. To deliver R & D and link with business and industry.
5. Independent and autonomous.
6. Bridging with other quality universities.
7. Life-long education.
8. Outreach programs with the community.

Undergraduate and graduate programs started from day one, two large campuses were designed, and built according to international standards. On 3000 acres (12000 Donms) out of town S & T campus was established housing engineering, medical sciences, agriculture and all applied sciences based on land-grant universities and MIT in the U.S. The university was based on quality and relevance, in teaching research and outreach program. Incubators and science parks, experimental stations and R&D facilities, in science and applied sciences were in place.

The 2nd campus was established adjacent to town, housing arts & sciences, economics, business, finance, banking,
education, humanities and social sciences, strongly linked to urbanization.

The 1st campus is now accommodating 20,000 students and 62 specializations the Jordan University for Science and Technology (JUST), with strong R&D, an Agr. Exp. Sta, and incubators and science business parks for technology transfer of R&D to commercialization, rated first in the nation and strong outreach programs in technology and health, 850 bed teaching hospital is serving the whole North. Large industrial zone for export and special high-tech zone for transfer technology, were built as public and private enterprises around the S & T campus.

The 2nd campus, Yarmouk University has now an enrollment of 30,000 students and 53 specializations. Across the street of the campus, the Guinness largest concentration of Internet café per square meter in the world, was created by the private enterprises which is a spin-off enterprises of the university, among other things.

Three factors contributed to the success of the two universities from day-one:

a. Attracting high quality faculty members for teaching and research from reputable universities without discrimination to gender, citizenship, or race, only based on merits.

b. Launching an aggressive fellowship program for Ph.D training abroad at the best schools (within 10 best worldwide rating) 700 Jordanian scholars completed their Ph.Ds and joined the staff of the two universities, within ten years.

c. Students admission policy again was based on merits according to GPA general secondary education
certificate point average, most students of 3.0 points. Those admitted below have gone a rigorous orientation program of remedial courses of one to two semesters to lift them up to university criteria requirement of admission.

**Thirdly:**

Two private universities undergone surgical and rebuilding reforms under my presidency, one is: Philadelphia University, which has grown from 3000 students to 8000 students in six years, with 29 specializations, and the other is Petra University which has grown from 3000 to 6500 students with 24 specializations both in the outskirts of Amman.

**Fourthly:**

In 1987, I was entrusted to establish a scientific entity to fund and steer scientific research at the national level, under a royal sponsorship; the higher council for science and technology (HSCT). The council was envisaged to be the umbrella of all scientific institutions in the country including the Royal Scientific Society (RSS).

**Our vision** was the achievement of internationally recognized, distinguished capabilities in frontier sciences and technologies, and maximizing the benefits of their applications for the sustainable socio-economic development of Jordan.

**Our Mission** was building national scientific and technological capacity through increasing awareness of applied scientific research, providing financial support needed for scientific and technological activities, networking
of researchers at the universities, research foundations centers, identify priority areas and pool resources to team work capabilities for creating knowledge and harness technology.

**Our Objective** was building a national science and technology base that contributes to the achievement of national developmental objectives.

HSCT was organized as small secretariat with eight main sectorial priority; water, energy, info-tech, biotech, nanotech, new materials, health and mining at the onset of HSCT, two big projects, were implemented during its first year, creating the national information network (NIC) around $8 million from JAICA (Japan) and another $16 million from CIDA (Canada) executed through McGill in S & T, infrastructure (Gene labs, biotech. etc.). Petra school of physics was created as a model to attract Noble Laureates of physics for thematic workshops to bring physics to the region.

**Fifthly:**

In an attempt to stimulate human resources and to ensure the sustainable development of the Arab society, the establishment of the Arab Academy of Sciences as a non-profit scientific non-governmental organization supported by UNESCO was created. It’s secretariats housed at the UNESCO regional office in Beirut.

The Academy published the four volumes of Arab encyclopedia on "knowledge for sustainable development", in collaboration with UNESCO and with the support of EOLSS. These volumes dealt with environmental economic and social dimensions of sustainable development. The Academy
is currently involved in the publication of the indicators of science and technology in the Arab World, in collaboration with UNESCO and ALESCO.

The Academy has organized international workshops on:

1. Bioethics: how to adapt biotechnology to culture and Values.
2. Drug biotechnology and medicinal plants.
3. Nanoscience and its impact on renewable energy and medicine.
4. Integrated water resources management in the Arab region.
5. Science parks for the developing world as engines of economics and social growth.
6. Training of science park managers
7. Bridging digital divided in developing countries.

In addition, the Academy was involved in the organization of several regional conferences and training sessions on science, technology and innovation.

Finally:

I wish to emphasize that building scientific institutions cannot be done alone. I am thankful to the good teams and co-workers, who shared and shown a lot of care.

No matter what part of the world we come from, we are all basically the same human beings. We all seek development and upgrading the standard of living of our people. We have the same basic human needs and concerns, this is a human nature. The great changes that are taking place everywhere
in the world, from Eastern Europe to Africa are clear indication of this.

This prize is not for me as a person it is for those who have shared, cared & believed in our mission. This is a good gesture by TWAS, on how the individuality is nurtured, how the hard work is rewarded and how the achievement is celebrated.