

## **Engineering education for economic development**

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WEEKEND MAGAZINE (February 09 2008): Among the three components of growth, namely, human, natural and physical capitals, the greater contribution is by human capital, to the level of 64 percent. In comparison, to quote the World Bank, natural and physical capitals contribute 20 percent and 16 percent, respectively.

Indeed, the development of human capital is the primary factor for setting up direction and pace of national progress and prosperity. Though rich in human resources, Pakistan remained under-developed to a great extent. Efforts made in this direction in the early seventies were significant, but these could not be sustained.

It is only recently that efforts have been stepped up afresh in exploiting this most valuable resource. Still the government expenditure on education currently remains in the range of 1.7%-2.5% of the GNP. The hard reality is that we still need to strive to generate a vision for developing human resources.

A case in point is the low base of engineers available compared to demand at national and international level, in quantitative as well as in qualitative terms, particularly in the perspective of promoting higher education.

Obviously, there is lack of political will and commitment, which has resulted in declining interest in engineering studies, as reflected in the fact that during the last four decades or so, only four engineering universities were added to the existing number of the universities. Of the total 53 degree-granting institutions that have been set up in the private sector, only five offer engineering courses.

It is shocking to learn that, according to a report on the subject, less than eight percent of the total enrolled graduate engineering candidates were registered for post-graduate studies during 1982-86 period. And most shameful is the fact that none of our engineering universities could produce even a single PhD. engineer, during this five-year period. The situation has not improved much today either, unfortunately, due to a number of factors - from employment to environment to financial constraints.

Defined as a person professionally engaged in a discipline of engineering, an engineer applies the principles of science and mathematics to develop efficient and economical solutions to technological problems of varied nature and diversified spectrum. In the words of Albert Einstein: "Scientists investigate that which already is; Engineers create that which has never been".

In modern times of changing trends, an engineer's role is not confined anymore to that of an inventor or creator but has been extended to that of a contractor, consultant, teacher, manager and other technical professionals.

Similarly, the erstwhile traditional branches of civil engineering, electrical and electronics engineering, mechanical engineering, mining and geological engineering, metallurgical engineering, industrial and manufacturing engineering or agricultural engineering have diversified further.

In fact, the quality of our engineers directly affects the quality of our daily lives - from defence to infrastructure telecommunications to consumer goods. The recent advancements have thus re-defined the branches of engineering, which now cover all spheres of life and every aspect of society - you name it.

Consequently, the wide range of specialised sub-branches includes aerospace engineering, biomedical and biological engineering, computer software and hardware engineering, nuclear engineering, environmental engineering, systems engineering, chemical engineering, pharmaceutical engineering, textile engineering, automotive engineering, telecommunications engineering, materials engineering, methods engineering, petroleum engineering, polymer and petrochemical engineering, reservoir engineering, tunnelling engineering, marine engineering, mechatronic engineering, urban engineering, social engineering, and even, financial engineering.

In short, an engineer skilfully and optimally manages the resources of human, finance, materials, machines and energy into completed processes and is also responsible for management planning and business development. Likewise, professional work is no more limited to its design, analysis and/or construction or development of a product. The engineer employs knowledge, expertise and experience to evaluating and solving problems of national economic planning, given the opportunity and resources.

Engineers have contributed immensely in all sectors since the creation of Pakistan - raising practically from zero level, be it railways or road works, waterways or power generation, agriculture or construction, mining or industry, employment or environment, transport or telecommunications, population or healthcare, defence or other strategic areas. Indeed, the economic growth, industrialisation and infrastructure development witnessed during the last sixty years would not have been possible without the effective involvement of the engineers.

Today, Pakistan has an irrigated land covering 182,300 square kilometers, highways spanning 254,410 km and an 8,163-km long railway track. The country annually produces 1,300 billion cubic feet natural gas and about 24 million barrels petroleum crude oil. The country yearly generates electricity to the level of 7.7 billion kWh.

Major industries include steel, heavy engineering, shipbuilding, textile, cement, sugar, fertiliser and electrical goods. The many engineering feats accomplished in recent times include Tarbela multi-purpose project, the world's largest earth - and rock - filled dam, and the Karakoram Highway, the highest paved international road globally.

Whatever the constraints, political or non-political, Pakistan's major economic sectors have continued to maintain a solid pace of expansion to date, resulting in sustainable

development, for which significant credit goes rightly to the engineers.

Be it the times of war or of peace, or dealing with a catastrophe of flooding or earthquake, imprints of the engineers have always been predominantly strong, along with other professionals. Internationally too, the Pakistani engineers have achieved recognition and admiration for services in various fields in different countries.

Like the past and the present, the future too belongs to the engineers. The country is faced with new and serious challenges of excessive globalisation and competition, water and power deficiencies, fostering industrialisation and rapid infrastructure development, thus creating a demand for more highly qualified engineers on par with the newly industrialised and developed countries.

There is a need, therefore, to address the issues of quality engineering education seriously, ideally through joint efforts of the government policymakers, educational institutions and employers, primarily from industry. To cope with the challenges of the new century, rather millennium, with a view to taking the nation higher on the path of progress and prosperity, it is imperative to strengthen and supervise the present system of engineering education.

For the purpose of enhancing human, institutional and infrastructure capacity and capability in the field of higher education in engineering it will be desirable for the government to take bold initiatives on priority. It is suggested that the Ministry of Science and Technology may be mandated with the promotion and regularisation of higher education in engineering, on the pattern of Australia, Poland, Bangladesh and other countries in the region.

Or, the government may consider establishing a full-fledged Ministry of Higher Education, like in Malaysia, Sri Lanka, Saudi Arabia, Egypt, Jordan and Syria.

At the same time it is proposed the government establish another organisation, exclusively for extending support to the engineers for continuing their engineering education and creating an effective industry-university linkage.

This will provide a forum to the engineers for expanding knowledge and skills in respective disciplines, assimilation of new technologies and advancement of careers, through exchange of ideas and viewpoints with the government, educational institutions, industry and media. The proposed organisation will also encourage the promotion and dissemination of scholarly research work and keep abreast with the global advancements in engineering practices, technology and engineering education.