

## **Engineering Profession in Bangladesh in the 21<sup>st</sup> Century**

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### **INTRODUCTION**

The world civilisation has transformed from primitive to a complex living society through various stages of technological revolutions. These technological revolutions have created a breed of people called engineers who have shaped the destiny of today's civilisation. The recognition of engineers as a separate academic discipline probably took place about 200 years ago with the dawn of industrial revolution. The application of scientific knowledge for the production of commodities to meet the need of the society created the engineering profession. Engineering has been defined as an art and science of utilising scarce resource of nature to the benefit of mankind. The first technological revolution saw the running of locomotives, steamships; mining to exploit the resources of nature, and machines to produce commodities in factories. The second revolution which took place about 100 years back saw the generation and transmission of electricity, development of electrical devices such as coded signals through wire, telegraph and telephone, lights, power for turning devices. For the first time at this stage, through development of chemistry, technology was available to produce artificial products from nature such as synthetics, plastics, petrochemicals, etc. Thus a new world was created gradually filling the natural world with man-made products. Towns and cities were created, skyscrapers shaped the sky line, elevators, cars, underground rails continued circling the busy urban habitats dressed in synthetic apparels. At the end of this century we are now on the threshold of another technological revolution. A revolution spearheaded by computers, space technology

giving rise to satellite communication, information technology, robotics, new materials, genetic engineering and biotechnology.

The world in the meantime has witnessed a gradual societal transformation: from a feudal society to an industrial society, a colonial society, a society under controlled economy, and finally to a society which advocated free market economy. The growth of technology has thus changed the fabric of the society. New and emerging technologies have already started affecting changes in range of economic activities, environmental scenarios and control over financial supremacy. The profession of engineering has to deal with a whole range of techniques and products which demands new skills and modes of work and a revolution in management methods.

As a developing country, Bangladesh has to go through many of the above transformations to come to a stage to face the challenge of this third revolution. A stock taking is therefore necessary to mark the present status and direction that is needed to meet the next millennium.

### **BACKGROUND**

The 1991 Census reports that Bangladesh has a population of 108 million with an annual growth rate of about 2.17 percent. With such growth rate, the estimated present population of Bangladesh should be about 123 million. According to 1991 Census, the country has a population density of 750 people per square kilometre. The population densities of some of

the major cities of Bangladesh are 11700 for Dhaka, 2200 for Chittagong, 3700 for Khulna, and 1370 for Rajshahi.

The principal industries of the country are jute and cotton textiles, tea, paper and pulp, cement, leather tanning, chemical fertilisers, sugar, and light engineering products. The main exports are jute, jute products, ready made garments, tea, hides and skins, fish and newsprint. The industrial production contributes only about 8.4% of the GDP. Natural resources of Bangladesh include natural gas, a coal reserve and underground hard rock. Some petroleum reserves are expected to be present within the Bangladesh territories.

Bangladesh is primarily an agricultural country. This is reflected by the fact that about 66 percent of employed persons work in agriculture, forestry and fisheries. Only 3.4 percent of labour force are employed in professional and technical works and 13.6 percent are employed in production and transport. Bangladesh presently produces about 1200 graduate engineers annually. There is a lack of information on number of technically skilled labour force and technicians in this country.

## CURRENT STATUS AND FUTURE SCENARIO

### Engineering Education

The role of engineering profession in Bangladesh in the coming century will depend to a large extent on the quality of engineering education. At present there is only one Engineering University and four Institute of Technologies (BITs) producing about 120 graduate engineers annually. In addition, a few private universities have recently started offering engineering degrees in a limited number of disciplines. Bangladesh Agricultural University produces agricultural engineering graduates. There are 18 Polytechnic Institutes and a Islamic Institute of Technology within the country that offer courses in various engineering technologies leading to Diploma certificates.

Most of the undergraduate degrees are offered in traditional engineering disciplines such as Civil, Mechanical, Electrical and Electronics, Chemical, Metallurgical (Material Science) and Agricultural Engineering. The only engineering university of the country also offers degrees in Water Resources Engineering, Computer Science and Engineering, and Petroleum and Mineral Resources Engineering. The total number of engineers produced in Bangladesh represents a poor "engineer to population" ratio. In recent years, due to limited scope of engineering education in the country, many students are going abroad particularly in the neighbouring countries to get engineering education. The opportunity for post-graduate engineering education is even more restricted. Whereas Bangladesh University of Engineering and Technology offers Master's and PhD degrees in major engineering disciplines on a regular basis, the BITs have only started administering Master's level courses recently. Consequently, there is a continuous flow of good graduate engineers to foreign countries for higher education, very few of whom return to Bangladesh. It should be noted that although the current supply of about 1200 graduate engineers per year represents a poor number, the capacity of private and public sectors to absorb engineers is far less than the present output. Thus, increasing the number of engineering educational institutions alone would not solve the problems of engineering education.

The major factors that would govern development of engineering education in Bangladesh are national demand which is tied to the economic and industrial state of affairs of the country, and, of course, technological innovations. Currently the world is witnessing an unprecedented growth in science and technology where the engineering profession will have to deal with a whole new range of techniques and products which demand new skills and a management methods. There has been phenomenal advancement in information technology, robotics and artificial intelligence, space technology, biotechnology and biomedicine, genetic engineering, and material science. The traditional engineering profession which is based on a much smaller body of knowledge will have to be transformed. Many

new specialised engineering disciplines are emerging and will continue to emerge in the next century. With rapidly changing developments in science and technology, continuing education is likely to become an integral part of engineering education in the twenty first century. In the changing scenario, management and communication skills are going to be emphasised in engineering education (Seraj et al., 1996).

### **Emerging Technology and National Needs**

With the current trend in globalization, Bangladesh cannot remain isolated from the technological advancements that are taking place around the globe. As stated earlier, continual new developments in information technology, robotics and artificial intelligence, space technology, biotechnology and biomedicine, and genetic engineering will play a major role in shaping the 21<sup>st</sup> Century. It has been argued that contrary to the popular belief, scarcity of natural resources may not be a constraint for development, provided engineers are able to use the emerging new technologies to the best advantage of mankind (Mahmud, 1996).

Like the rest of the world, emerging new technologies will have a major influence on engineering profession in Bangladesh. However, the development of new technologies in the country will depend to a large extent on national need and demands in the coming century. A few areas deserving immediate attention in Bangladesh include physical infrastructure, global information infrastructure, mitigation of natural disasters, energy sector, agricultural production, health care, environmental protection and preservation. The emerging technologies will have to cater for developments in these areas. In Bangladesh, the present condition of physical infrastructure including transport network, power supply, water supply, sanitation and telecommunication is extremely poor. Development of these physical infrastructure and their efficient operation and maintenance is going to be a major challenge for the engineering profession in the coming century.

During the last two decades, the world has witnessed a phenomenal growth in computer and telecommunication technology which is often referred to as Information Revolution. This information revolution has brought in new opportunities for Bangladesh. Among many areas, software development and export appears to be the most promising for Bangladesh (Choudhury, 1995). A small share of the US \$ 250 billion per year software market can have a significant impact on the economy of Bangladesh. In Bangladesh, which is prone to natural disasters such as cyclone and floods, engineers can play the most important role in risk assessment, mitigation plans, and dissemination of warnings with ready access to global, regional, national and local warning systems. Increase in agricultural production, improvements in the storage facilities of agricultural produce and agro-based industries can play very important roles in our economy. The major challenges for agricultural engineering professionals in the next century would be to increase as well as to diversify food production, develop a link between agricultural products and agro industry, and environmental preservation (Farouk, 1996). The economic development of a country is closely linked to the availability of energy. In fact, per capita consumption of energy is often used as an indicator of development. However, increasing concerns about depletion of fossil fuels and their adverse environmental impacts are forcing planners to think about low-energy development alternatives and to depend more on renewable sources of energy (Choudhury, 1995). With increasing prospects of exploration of natural gas and oil in the coming years in Bangladesh, the engineering profession has to formulate a national strategy for the energy sector.

### **Sustainable Development and Environmental Protection**

The best known definition of sustainable development is "*meeting the needs of the present without compromising the ability of the future generations to meet their own needs*". In Bangladesh large and growing population are exerting an ever increasing pressure on a dwindling natural resource base. Urbanisation

and growth of industries are reducing agricultural and forest lands. According to a 1990 estimate, Bangladesh had a forest reserve of 8000 sq. km, which is about 5.6% of the total land area, whereas a 25% forest cover is usually considered necessary for maintaining a healthy environment. In addition, about 5% of the country's forest reserve is reduced each year by deforestation to meet the need of the growing population. Often human development interventions are held responsible for environmental degradation. Many engineering projects are criticised for degradation of environment and for not yielding the benefits predicted by engineers and designers, making the people *victim* rather than beneficiary of development. In Bangladesh, as in the rest of the world, environmental awareness and knowledge are increasing and the engineering profession will have to be more careful about the impact of any development project. In the coming days all projects are expected to be designed with due consideration to environment in order to ensure that the overall impact of the project is positive.

In Bangladesh, growing population coupled with rapid urbanisation and industrialisation is creating severe air pollution, water pollution and solid waste problems, especially in urban areas. For example, up to 80% of all illnesses in the country are related to water borne diseases and water related health impacts (sickness and death) are valued at 2-4% of GDP. In recent years, arsenic pollution in groundwater has become a major concern. Engineering profession can play a major role in pollution control and prevention. Engineering profession must develop new technologies and skills to combat such environmental pollution in the coming century. In addition to new technologies and skills, human resource development can have a significant influence on sustainable development. It has been argued that human resource development coupled with technical education can have a multiplier effect on all resources (Aich, 1996).

### **Constraints for Professional Development**

A few of the major constraints against the optimum development of the potential of the

engineering profession in Bangladesh are bureaucratic attitude, lack of leadership, corruption, legal protection, and dependence on foreign aid. Although engineers have to shoulder the main responsibility for executing development projects, they have very little say in formulation of national policies. Often decision makers in such projects are non-engineers and their decisions in many cases fail to materialise the desired objective. Government hardly takes up projects of national importance that is solely financed by local funding. As a result there is a lack of adequate and active participation of local engineers in projects of national importance and this is a great impediment to transfer and development of technology in Bangladesh (Sobhan et al., 1996). For example, the first *Buriganga* Bridge built by the Chinese Engineers cost about Tk. 110 crores while the new second *Buriganga* Bridge under construction by local engineers will cost about Tk. 57 crores. Even with such a big difference in cost the Government was reluctant to approve the project (Sobhan et al., 1996).

At present Bangladesh has no Chartered Engineers Act promulgated by the government. Most of the developed countries of the world have such provisions. In UK, engineers register with an Engineering Council and a sponsoring institution which allow them recognition of full professional status. By registration they are bound to abide by a definite set of professional conduct rules including ethical and moral standards. Before awarding the Chartered Engineering registration, the sponsoring institution tests his/her academic fitness, adequate width and depth of knowledge and experiences. Enactment of such a Chartered Engineering Act is needed for healthy growth of the engineering profession in Bangladesh in the twenty first century.

### **Appropriate Technology, Research and Development**

Being a developing country, Bangladesh needs low cost solutions to many of its engineering problems. Such solutions should make best use of locally available resources and must be sustainable. To adopt such an approach would require research and development as well as

innovative thinking. In the coming century universities and institutions should be encouraged to undertake strategic research work for the development and application of new techniques and technologies. Requirements for the successful application of research include the active participation of industry, the ability to transfer new discoveries and concepts from one discipline to another, and effective mechanism for dissemination (Sobhan et al., 1996). However, engineering profession should be careful about the so called intermediate technologies that are often prescribed for developing countries. In many cases, the so called intermediate technologies, offered as the appropriate ones, represent technological dead ends without any innate dynamism normally associated with technologies which help a country to go up the ladder of productivity (Mahmud, 1996).

## CONCLUSIONS

In order to face the challenges of the next century, the engineering education system has to reorient itself in order to cater for the engineers of the next century. Management and communication skills should be emphasised in engineering education. Technical education should be combined with practical experience. Information technology will play a vital role in the dissemination of knowledge and technology in the next century. With rapidly changing scenario in the field of science and technology, continuing education is likely to become an integral part of engineering profession in the twenty first century. A stronger link between industry and educational/ research institutions is essential for development of appropriate and low cost technology and their application. For smooth and healthy development of the engineering profession, the importance of professional registration and licensing should be recognised and the enactment of Chartered Engineers' Act should be expedited. At the same time a nationally accepted code of ethics for professional engineers should be developed. In the practice of professional engineering, social, economic, environmental, cultural, and political ramifications and consequences should be given due consideration keeping in mind the principle of sustainable development. In the

workplace, the leadership role of professional engineers in development projects should be asserted and the engineering profession should publicly articulate its policy position on issues where the profession has knowledge and expertise to contribute to the public decision-making process. The professional engineering bodies should monitor the state of the profession on a regular basis and provide guidelines for continual improvement of the profession.

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