

ROLE OF ENGINEERS IN ECONOMIC DEVELOPMENT AND POLICY MAKING OF A COUNTRY

By

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Abstract

The growing steps of the economy of any country are; primary production, low technological, high technological and services based economy. So the economic development of any country depends on resource utilization, government policies, Environmental Sustainability, Science and technology and awareness of the latest tools for the economic development. Hence, science and technology plays an important role in the development sector. Engineers belong to the 'services sector' of the society. Engineers make up the core of innovative development and play an increasingly crucial role in the adoption of science and technology. Although the role of engineers is considered to be confined only to the designing of infrastructure, yet they also have an important role to play in the management. Some engineers end up as leaders of technology-based companies or in other parts of the manufacturing, construction or service based industries or government that requires a different set of skills. Engineers have a diversified role in the society for the development of the economy of a country. Engineers can have significant influence on the infrastructure development, government, policies, agricultural productivity, environmental sustainability, disaster management, ethical and social responsibilities and many other fields for the progress of any country. One of the major challenges for the engineers is the utilization of indigenous resources for high-tech. innovations so that a society can have a balanced economy. Engineers should also be trained to take up the management part of the projects.

1- Introduction

Economic development is the development of economic wealth of countries or regions for the well-being of their people³. The economic development is a continuous process which results in an increase in per capita income provide basic necessities and benefits to the public.

1.1- Indicators of the progress of a country

The progress and prosperity of any country can be estimated by the Gross Domestic Product (GDP / capita) of that country⁴. GDP/capita is equal to the product of labour productivity (GDP / hour worked) and labour utilization (hours worked/person). So if the labour utilization is increased, the GDP will also increases and vice versa.

2- Economic Development Steps

The Figure-1 shows the developmental steps in the economy of countries. The first step of the economical development is the primary production or domestic level manufacturing that is followed by the poorest nations of the world. The next development section is the industrialized economy in which there are low-quality, less-skilled and low-paid jobs which often involves the use of outdated equipments that are not only economically inefficient to run but also hazardous for the environment. This step involves lowest standards of occupational health and safety. Many developing countries fall in this range. The third step of the development includes advanced industrialization with better awareness of the environment, resource efficiency and management. The fourth stage involves transition to a knowledge-based service economy. The incomes are higher, the technology is advanced and there is an increased awareness of the environment and social impacts. Many European countries fall in this range.

1. Senior Project Officer, WWF – Pakistan

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3. The Role of engineers in Economic Development, Nigeria 2010.

4. The Role of Engineering in Sustainable Economic Development in "The South Pacific", 2010.

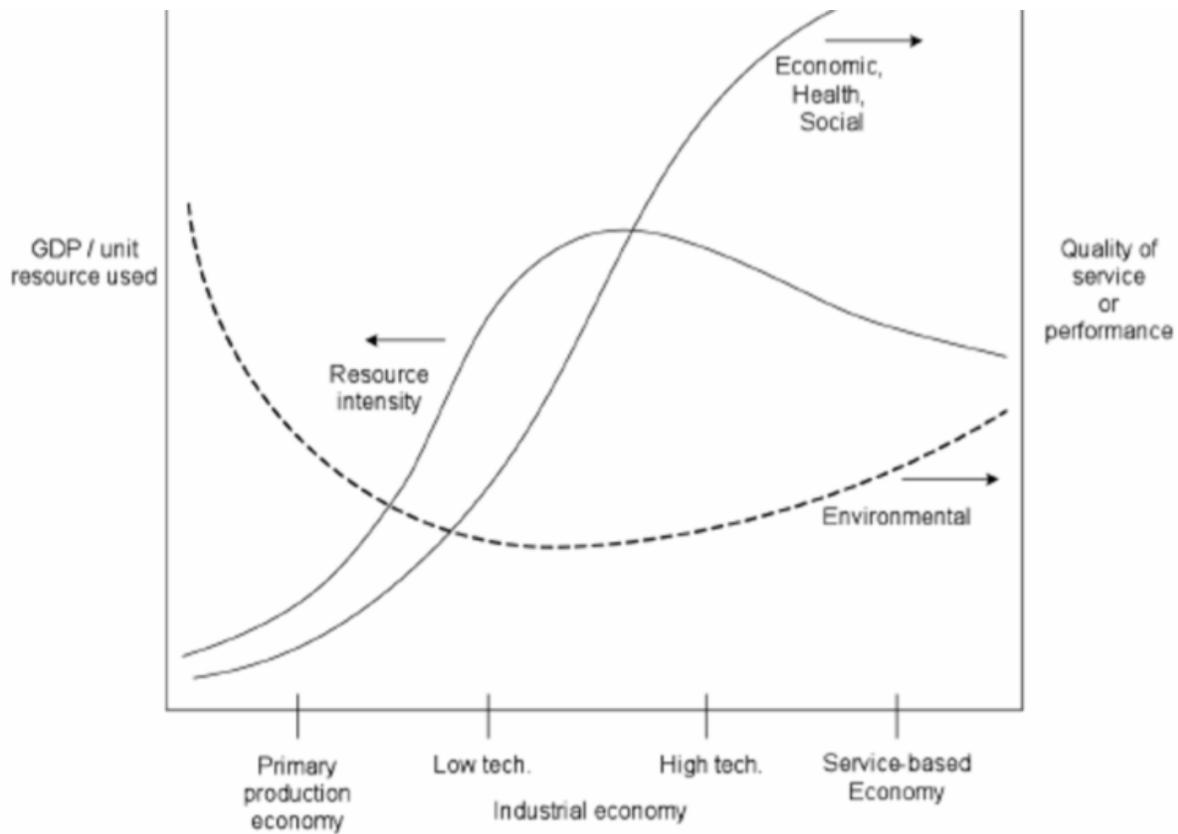


Figure 1. Changes in economic development, social, health, environmental and resource intensity performance of economies⁵

So an important part of the economical development is the adoption of high technologies, knowledge based services and reducing environmental impacts by precaution measures.

3- Factors affecting the economic development

Factors impacting at the economic development are as follows:

- i. Resource utilization
- ii. Government policy
- iii. Environmental sustainability
- iv. Adoption of Science and technology
- v. Awareness
- vi. Negotiations

i. Resource Utilization⁶

The natural resources are an important aspect on which the economical development depends. The resources can be sub-divided into the categories of exhaustible (minerals, salts, metals etc.) and

5. The figure taken from a paper, 'The Role of Engineering in Sustainable Economic Development in The South Pacific, 2010'.

6. A white paper on China's population and development.. (<http://www.acca21.org.cn/chnwp14a.html>)

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inexhaustible (forests and grasslands). The primary problems with respect to the utilization and protection of resources include lack of policy / mechanism which results in extravagant use of resources and the outflow of pollutants can cause a collapse of economy in the long run. So the distribution of the resources by means of administrative intervention helps to support the economy.

ii. Government Policies⁷:

Governmental policies positively affect economic development by providing a friendly environment for businesses to move into and operate within a community. According to the U.S. Department of Agriculture, policies key to this philosophy are sufficient funding for community infrastructure, such as public works projects, favorable business taxation laws and the availability of financing through bond initiatives. The social and cultural values also affect the economical development by people's attitude. The government policies should also consider the behavior of the people for the betterment of the economy.

iii. Environmental Sustainability

As the world's population is growing day by day, the resources are becoming increasingly scarce. It has been reported that about 1.2 billion people reside in regions where water is physically scarce. The figure will rise upto two-thirds of the world's population by 2025.⁸ To mitigate such disasters, there is a dire need of sustainable use of the resources. A number of different technologies is already being adopted and considered in the developed nations in order to ensure the sustainable use of resources. To this end, the developed as well as certain developing nations are trying to adopt international standards for emission control and reduction measures like carbon footprint reduction, water footprints measurement, 3 R's (Reduce, Recycle and Reuse) policy and ISO standards. Engineers can play an important role in improving the environmental conditions of the country through adoption of waste treatment technologies. In the case of Pakistan, which has already started adopting certain environmental standards, engineers can provide cost effective solutions for solid waste management like landfill site construction, waste water treatment systems using indigenous technologies.

iv. Science and Technology

Science and Technology play a core part in the development of any country's economy. These techniques are adopted and implemented by scientists and engineers. The adoption of Science and Technology is the main aspect of industrial economic and social development. The promotion of co-operation between Science and Technology knowledge producers in the universities, Research and Development (R&D) Institutions and Science and Technology (S&T) knowledge users in the industry and the private sector is essential for the innovation and commercialization of research. This is extremely important for a developing country like Pakistan, where the economy is in transition against changing economic development trends in the world.

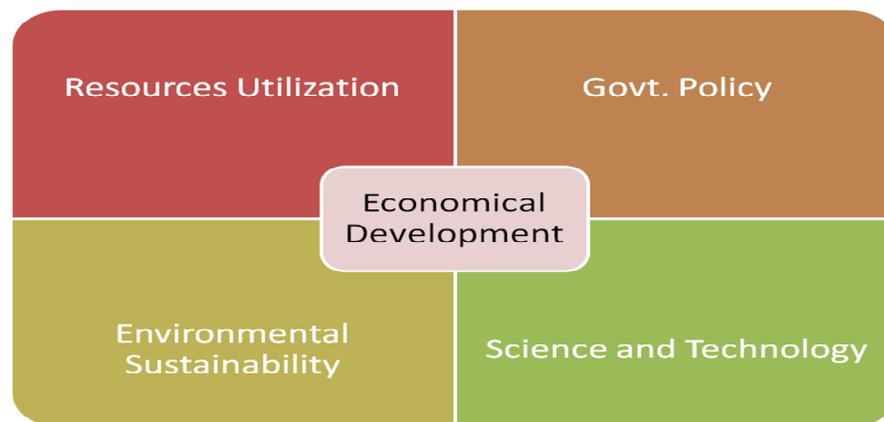


Figure-2: The factors affecting the Economical Development of any country

7. <http://smallbusiness.chron.com/factors-affect-economic-development-3940.html>

8. FAO, 2007.

v. **Awareness of the economical development tools**

It has been observed that with the passage of time the economical development tools have been changed. The tools or actions involve multiple areas including development of human capital, critical infrastructure, regional competitiveness, health, safety, literacy, and other initiatives. So awareness and priorities to these areas reflects the country's priority in the field of economic development.

4- **Who are Engineers?**

Engineers are technical persons of the community who utilize resources of the country and introduce innovations in the infrastructure and provide solutions to complex national problems. Engineers also move the country towards developmental race with techniques and innovations.

Engineering economy is a major part of the total economy of the country with application of engineering projects. It involves the cost benefit analysis of the proposed projects.

4.1- **Role of the engineers in Economic Development and Policy Making**

Engineers are the core part of the society and they can take part in the development and progress of any country. In the century ahead, engineers will continue partnership with scientists in the great mission of acquiring new knowledge of the physical and biological worlds. Engineers can play an important role in the following sectors for making the economy strong and sustainable.

a. **Infrastructure development:**

The economy of any country depends on the infrastructure development. In Pakistan, hydrological engineers can play an important role in the dams' design and construction etc. Also the energy crisis could be tackled by the alternative energy resources. Although the role of engineers is usually defined in the context of infrastructure designing, yet they can also play an important role in the management. Some engineers end up as leaders of technology-based companies or in other parts of the manufacturing, construction or service based industries or government that requires a different set of skills. Some engineers prove themselves to be excellent managers and never want to be leaders. Some have a desire to be a leader early in their career. So roles of the engineers are important which cannot be ignored.

b. **Engineers role in Policy Making:**

Engineers have practical field experience regarding different fields including management, so they should be made a part of the public policy making as they know better the facts and figures of the fields. Engineers should also be involved in the higher management or in the bureaucracy. As technocrats they can use their power of authority for taking decisions based on ground realities.

The national policy should be designed in such a way that is easy to adopt by the general public. For example in India, for the sugar cane industry the waste water discharge standards are different than other effluents' discharging standards since sugar cane waste water contains more than 4000 mg / l of BOD. But in Pakistan, same NEQS have been set for all types of the industrial effluents. So, engineers can play an effective role designing the NEQS on sector basis.

c. **Cooperation with academia**

The economy of a country becomes sustainable only with the cooperation of universities, public and private research institutes, industry and government involvement. This process should be facilitated by the promotion of University-Industry co-operation. The adaptation of universities' engineering education to address and promote industrial, economic and social needs is of paramount importance. The industry players need the promotion of partnerships between universities and industries in continuing engineering education for professional engineers.

d. **Overcoming Power crisis**

Pakistan is facing serious power crisis now-a-days. Our main electricity generation dependency is on furnace oil and hydropower. Engineers can resolve this issue by introducing alternative energy

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schemes such as solar cells, wind energy, biogas generation etc. In 1990s, Sri Lanka faced energy crisis because of the delay in the implementation of the coal power projects by successive governments that burdened domestic consumers, industry players, hoteliers and the construction industry. After a series of efforts now Sri Lankan government has approved the coal power plant to be installed in Trincomalee, which would enable commissioning by the year 2008.

e. Enhancing agricultural productivity

Pakistan is an agricultural country where more than 70% people are engaged in agriculture. Different studies have proved that more than 50% water is lost in the conveyance and irrigation losses from rivers to the farmers fields. Agricultural and Irrigation engineers can emphasis for high tech. irrigation systems to conserve that water. They can adopt techniques like high efficient irrigation system (HEIS) for the improvement of the irrigation system with saving upto 70% of the water conveyance losses in the system resulting in an increase in the agricultural productivity.

f. Social responsibility

Engineering is a multi-disciplinary profession, which has no longer remain narrowly confined to a single discipline. Therefore engineering should also consider co-values revolving around conscience in society, ethics and accountability in the work undertaken for the social, economic, cultural and political development of our country. The role of engineers can be defined by the sentence of the Hillier, 2010 that "Engineers are political actors, the political and economic pressure that engineers work under have the potential to complicate ethical choices". A professional engineer is one who performs his work by knowing the norms and ethics of the society where he is working for the ease and appreciation of the public.

g. Other roles of Engineers⁹

Engineers can help in the adoption of new techniques in the society with reference to the hot issues of the nation like water crisis, power generation. They can help the country in the development of the economy by ;

- Provide Energy From Fusion

- Develop Carbon Sequestration for global warming

- Managing the nitrogen cycle

- Provide Access to Clean Water

- Restore and Improve Urban Infrastructure

- Prevent Nuclear Terror

5- Conclusion

The economy of any country depends on a number of factors like investment, environmental sustainability, awareness tools and science and technology. Engineers are the main foundation of a society which belongs to the 'service sector'. Engineers have a diverse role in the society regarding the economical development. They can play an important role in infrastructure development, agricultural productivity, environmental sustainability, cooperation with academia, social and ethical role and to mitigate the energy crisis etc. The major challenge to the engineers is the utilization of indigenous resources to the country.

9. <http://www.ni.com/company/corporate-responsibility/empower/improve/grand-challenges.htm>

Recommendations

- a) Throughout history, the engineers have been guided or have reported to the bosses from background of Arts, philosophy and literature. So the mindset of the higher authorities is quite different to tackle the technical situation.
- b) Engineers should be given management trainings as a good manager should be good engineer. In a country like Pakistan, most of the issues are management-related than technical.. So through trainings on management, the engineers can enhance their performance and participate in the planning and management sectors.
- c) Engineers' potential should be utilized in the authority positions of institutions like WAPDA, Petroleum industry, Science and Technology etc. so that they can cater the situation in a better way on the basis of their experience.