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# **INTERACTION BETWEEN INDUSTRY AND HIGHER EDUCATION INSTITUTIONS, ENGINEERING UNIVERSITIES IN PARTICULAR**

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**ABSTRACT:** Interaction between industry / professional sectors and higher education institutions, engineering education in particular is vital for development and prosperity. For a sustained development of economy, a close collaboration between engineering universities / technical institutions and industry is very essential. The stronger interaction between providers of higher education, engineering / technical education and industry be utilized for relevancy of curriculum, research and transfer of research results to industry. Such linkages and partnership will provide a curriculum relevant to national development and needed research activity. The advancements in majority of engineering fields are quite rapid. Therefore, the rapid developments / advancements both in sciences and market require relevant higher education and engineering education programs. The higher education system needs to be responsive to the new innovations in technologies. The expertise must be exchanged between the engineering industry and higher education. The paper deliberates on strengthening the interaction between higher education / engineering education and industry / professional sector.

## **1. INTRODUCTION**

The higher education institutions and engineering universities produce a good number of graduates every year where as the industry / professional sector considers that majority of the graduates lack the necessary job-site skills required by the industry. In most of the cases the engineering universities / institutions follow a supply driven system rather than a demand driven market oriented system. The graduates of engineering universities and others qualifying from higher education institutions should be aware of the current trends and practices being followed in industry. They must have the knowledge and skills required by the industry. An engineering / higher education system be developed which is responsive to the new innovations in technologies and which can take care of competitive market. Thus, creating and establishing channels of linkages between higher education / engineering education and industry is the need of the hour in order to meet the future challenges.

## **2. KNOWLEDGE GROWTH**

The exponential growth of knowledge and the rapid change of science and technology is another global trend. Knowledge is doubling every 7-10 years and in some cases every 3-5 years. The resultant relatively rapid obsolescence of knowledge and skill has implications for Human Resource Development. The Week-End Australian newspaper [1] contacted education experts in a range of fields to estimate the shelf-life of Australian undergraduate degrees. The shelf-life of the degrees estimated as follows:

1 year	for computer science
2 years	for electrical engineering
3 years	for accounting and general medical practice
4 years	for business
5 years	for civil engineering
10 years	for dentistry and surgery
15 years	for architecture.

All the education experts contacted agreed that the undergraduate degree provided the essential "intellectual capital" on which to build future learning. The rapid rate of accumulation of new knowledge and the fast pace of technological change will mean a need for regular knowledge updating and skills upgrading, Peng Boo Tan [2]. To overcome this, we need to work for and improve interaction between engineering / higher education and industry.

### 3. KEY PLAYERS

The key players in strengthening interaction between engineering institutions, universities and industry are universities / engineering institutions, industry and government. Universities / Engineering Institutions major responsibility is to provide qualified manpower according to the requirements and needs of industry. Industry on the other hand needs to provide input about their needs and requirements. Industry should also be involved in curriculum development and policy making for higher education, engineering education and training. The government has the role of a facilitator in building and improving interaction between engineering / higher education and industry as shown in Fig.1.

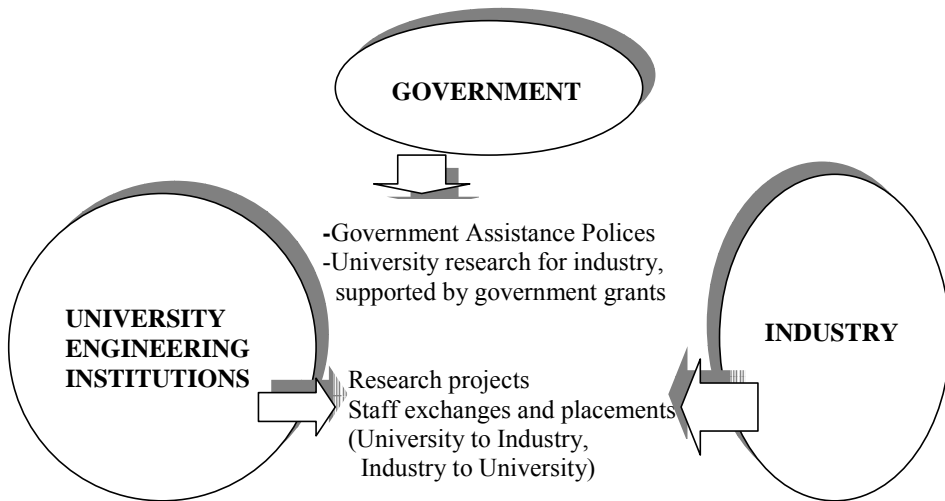


Figure 1: Key Players

#### 3.1 Universities / Engineering Institutions

A major responsibility of universities / engineering institutions is to produce trained manpower to meet the needs of industry / professional sector. Their out put must cater to the actual need, requirement and expectations of the local industry / professional sector. The

updating of curriculum needs to be a constant feature inline with the advancements and development in that particular engineering field. The engineering education system should be demand driven market based system rather than supply driven system, Fig.2. A supply driven system (unfortunately still followed at some places) is one of the major causes of unemployment. The degrees and certification must be industry oriented and professionally recognized.

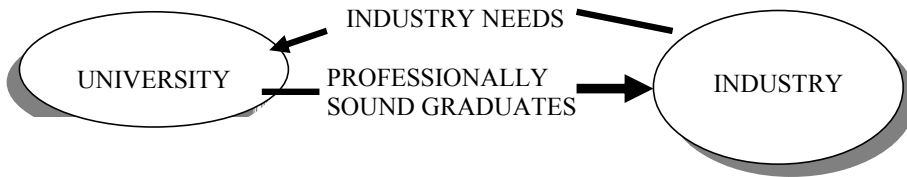


Figure 2: Demand Driven System

### 3.2 Industry

Industry need to play its effective role as they are the one to utilize the product (graduates) of universities. Furthermore, both industry and universities take advantage of joint research programs / projects. Input from the industrial sector to be ongoing process to ensure the training needs of industry be taken care off. Industry should seek greater involvement in national education and training policymaking. Industry should be provided representation on national education and training bodies, policy-making bodies of engineering institutions. Interaction between industries and engineering universities is vital for the successful and sustainable development. Representatives from the industry are encouraged to have input into curriculum development through an advisory committee.

### 3.3 Government

In most of the countries of Asia and Pacific, major national decisions on education and training are made by the Government. The policies of the government should be such which ensure that the education and training system is demand driven and fulfill the changing needs of industry. In public sector, the Government decides about the location of a technical institution and about the engineering fields / technologies going to be offered. At the time of taking such decisions the surrounding industrial setup should be the criteria. This will naturally help in establishing strong partnership with industry and will provide improved employability. According to Asian Development Bank ADB Education Policy Principles / Sub Sectors Priorities Report, sometimes government provides supply-driven technical and vocational programs at high unit cost and of such poor quality and relevance that graduates do not gain in employability or productivity. The region nevertheless contains good examples of clear and effective skill development policies. For example, South Korea, Singapore, Taipei China have ensured availability of needed skills within the framework of an effective national skills development policy, linked to an economic development strategy. Japan is another very good example (briefly given separately).

## 4. JAPAN'S FORMAT

Japan Science and Technology Basic Plan, adopted in 1996, singles out university-industry cooperation as a key strategy for enhancing the nation's R&D infrastructure. In early 1997, the Japan Government proposed an education reform. As a part of the reform, Monbusho (Ministry of Education, Science, Sports and Culture) adopted the recommendations of the Study Group on University-Industry Cooperation. The call for

change arises in response to critics who have pointed that Japan's future economic well-being will depend on the nation's ability to develop new technologies, and that universities will need to play a more active role through cooperation with industry. National universities in Japan continue to contribute to the nation's well being through basic and applied research in all fields of science and technology through producing well educated graduates. However, through meaningful cooperation with industry, it is anticipated that the universities will be able to carry out research that is more relevant to industrial R&D and will further improve the quality of education provided to students. Significantly, Monbusho (presently MEXT, Ministry of Education, Culture, Sports, Science and Technology) relaxed its restrictions in regard to eligibility of universities to apply for funding from non-Monbusho agencies such as MITI, Ministry of International Trade and Industry (presently METI, Ministry of Economy, Trade and Industry). These measures are aimed at increasing technology innovations at Japan's universities. Specific measures applicable to national universities, but needs to be followed by private universities are:

- Enhancing information exchange between universities and industry
- Modifying personnel policies and intellectual property regulations to enhance exchange of personnel
- Promoting cooperation within the respective region (prefectures)
- Promoting more effective utilization of research results

The Education Reform Plan for the 21<sup>st</sup> Century also called 'The Rainbow Plan' or 'The Seven Priority Strategies' by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) states under the main points of the Science and Technology Basic Plan: Revitalize exchange among industry, academia and the government by promoting cooperative research and facilitating the authorization of business-related research activities as an important item in 'Promotion of Systemic Reforms for the construction of a New Research and Development System.' Dr. Win Aung [3]

The Japan's Format has been given not just as an example but to show the extent of importance given by the Japanese government, universities and industry to the university-industry interaction and linkage. That shows that how the three partners, key players i.e the government, higher education institutions / universities / engineering institutions and industry are cooperating, interacting with each other for the benefits for all.

## **5. KOREAN FORMAT**

Initially, Korean education system excessively oriented toward theory-led academicism. Inflexibility of the Korean Education system also proved to be a major obstacle to establishing effective links between the two sectors. Inflexible education system meant that the university curricula failed to respond to industry demands.

Efforts for Enhancing Cooperation comprised of three types of approaches.

Regional Approach: In recent years, the Korean government has introduced various policy measures in order to enhance cooperation between related parties. First one is a regional approach. The Government of Korea pursues policies aimed at fostering regional universities so they could act as the base for promoting regional innovation and growth. In collaboration with local businesses, local government, and local research institutes, the regional universities are encouraged to design and implement diverse partnership programs to lead regional development. Concurrently, the government is carrying out the 'New University for Regional Innovation (NURI)' project to cultivate specialist regional universities for each

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field of study. Similarly, GOK has placed an emphasis on RHRD (regional HRD) for RIS (regional innovation-system).

**Sectoral Approach:** In sectoral approach, the Government is supporting the creation and operation of 'Sector Councils' for each industry sector. In FY2004, Sector Councils have been established for 3 industries and this will expand to 10 by FY 2005. The Korean government reinforced participation of private sector in human resources development policy by strengthening industry academia co-operation, and through operation of Sector Councils.

**Approaches at University Level:** Many Universities in Korea are trying to introduce various new approaches to industry university cooperation and the government is encouraging university-business partnerships through formation and operation of an industry academia cooperative body and on-demand curriculums. 'Industry Academy Cooperation Agency' is an essential means of fortifying the liaison between universities and colleges. Dr. Jang-Ho Kim [4]

## **6. REGIONAL EXAMPLES, SAUDI ARABIA**

In spite of the rapid progress made over previous development plans, two key issues pointed out to be addressed in the Sixth Plan in order to improve the Kingdom's status in the field of science and technology are:

### **6.1 Technology Gap**

The most prominent science and technology issue concerns the gap between the level of technology used in the Kingdom and that which Saudi Arabia can adapt or produce itself. Many sectors of the economy have introduced and applied the most advanced technologies quite successfully. However, the capability to develop such technologies falls far behind either that of the industrial countries or the rapidly advancing countries of South East Asia. Although it will not be possible to close this gap within a short period, further efforts must be made to reduce it as much as possible. Greater emphasis must be put on science and engineering subjects in the education system, and the completion of the comprehensive national plan for the development of science and technology.

### **6.2 Manpower Shortage in Science and Technology**

Although the Kingdom has established many universities, technical colleges and technical and vocational training centers aimed at creating a sound manpower base for advancing technological development in the Kingdom, there still exists a shortage of good scientists, engineers and technicians to ensure substantial future development. (Reference, Saudi Arabia's Sixth Plan).

A Supreme Guiding Committee has been formed to prepare a National Industrial Strategy until 2020 with the challenge to diversify industrial production into non-hydrocarbon products. Only when significant increases are observed in science and engineering education, training can Saudi Arabia's industrial competitiveness grow to international levels. Further, partnerships for industrial development require greater freedom to form technical societies for engineering, IT, management, entrepreneurs, etc establishing their own quality and developmental policies, goals and objectives in order to enhance human resource contribution for innovative processes in the country. Implementing entrepreneurial development policies, including incubator projects with venture capital support, can best assist innovation growth in Saudi Arabia. Gulf Industry [5].

## **7. UAE EXAMPLE**

UAE is trying to achieve the benefits of academia industry cooperation by establishing technology parks.

### **7.1 CERT Technology Parks**

CERT (Center of Excellence for Applied Research and Training) is the hub for a network of 13 Higher Colleges of Technology. It operates since 1996 two science and technology parks, one in Dubai and the other in Abu Dhabi. It is planned that the Abu Dhabi location will include a business incubator, to be operated by CERT, in cooperation with the Abu Dhabi Chamber of Commerce and Industry (ADCCI), and the United Arab Emirates Offsets Group.

### **7.2 Dubai Techno Park**

Under development by the Government of Dubai, the Park is planned to undertake research, incubation, training, technology transfer and other services in a number of industrial areas including desalination and water resources, oil and gas and petrochemicals, environment sciences, materials sciences, biotechnology and pharmaceuticals.

## **8. MODES OF INTERACTIONS**

To start with, both sides should look for creating modes of interactions. For example, a study was conducted in 1988 by the author for getting the comments of industries. The primary purpose of the study was to enlighten and make the best use of observations / comments made by various industries about the capability and competency of technical education pass-outs hired by them. The secondary purpose was to establish a “channel of interaction” between the two sectors. Seventy (70) letters with required information forms were sent and nineteen (19) replies were received which comes out to nearly 28%. Twelve (12) replies out of these nineteen (19) contained information data whereas seven (7) did not furnish any comments. Thus the twelve (12) with information data out of seventy (70), yielded an informative response of just 17%. It was not a good response but was better for establishment of a linkage. Zahid Ali [6]

### **8.1 Starting the Interaction Process**

The interaction process needs to begin by extending invitations to industry representative like Managing Directors or General Managers of large industrial units, owners of small / medium enterprises on opening and closing sessions of training programs / courses at the institution / university so as to begin the interaction process. (The author, while having the additional duties of liaison with industry used to start the process in this way). By this the industry can gather the information about the programs / research and workshop / laboratory equipment at the university / institution and the university faculty can get the information about the industry.

### **8.2 Medium Interaction**

In order to have the knowledge about what is going on in the industry, students need to be placed at the relevant industry in the surrounding area for 4 to 8 weeks duration. The industry supervisors should be requested to send a report about the fulfillment of the training

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at the various sections of their industry. It is not an easy proposition because in most of the cases the industry people do not like to see untrained extra persons at their shop floors or near manufacturing areas. (The author during negotiation meetings for placement of trainees / students at the industry came across such views but sometimes there happen to be genuine reasons behind such views)

### **8.3 Advanced Level of Interaction**

For a constant and smooth linkage industrial sectors are planned quite near or in close vicinity of engineering universities / institution. An advanced level of linkage between universities and industry is the establishment of Technology Parks for the economic growth and development. A technology park can be defined as a property-based development having a high-quality physical environment in a park like setting and located adjacent to or in a reasonable distance from a technical university or research institute. The laid down stress is on activities promoting the growth of research, technology, commercialization and knowledge-based enterprises. Regarding nomenclature, depending on affiliation and focus, it can be called a research park or research-based industrial park or technology park. It may vary in size from a few square km or large enough to become a technology city. The relationship with a university research institute is considered a key aspect of park planning and operation.

Technology parks can play an important role in capacity building in engineering and technology by brining together manufacturing, high level training facilities, research, testing facilities, business and finance in the same physical location.

## **9. CONCLUSIONS**

Higher education, engineering education in particular and industry linkages should remain alive for constant updating of courses. The rapid rate of advancements of new knowledge and the fast pace of technological change will require regular knowledge updating. Thus, industry representation for updating curriculum be made mandatory for producing graduates as per the need and requirement of industry / professional sector.

Faculty and students should have industrial visits spreading over one week in the second year, spreading over minimum of two weeks in the third year and a minimum of four to six weeks placement in the final year of a four years engineering degree program. The same can be enhanced after positive feed back and further development of linkages with industry / professional sector

Partnerships be developed so that both the partners i.e universities and industry can benefit from resources of each other and ultimately to results in benefits for all the major partners.

The circle of interaction be enhanced to regional level as well. Coordination and linkages be developed among the technology parks of the region for the benefit of each country and for avoiding duplication of efforts.

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