In The Name Of God

The Role of the Science & Technology collaboration in Iran's Industrial Development

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Abstract

Science-technology collaboration has become increasingly important for the countries' development due to various factors. First, given the increasing complexity of technology, it is difficult to develop a new technology at a single institution. Second, there is intensifying economic competition on a global scale which is largely driven by technology. Third, there is an all – encompassing influence of technology on the environment, social welfare, and national security. This article focuses on countries typologies concerning the science & technology status and suggests strategies for improvement in the related fields. Finally Iran's status is studied and the corporate university of Iran's Water & Power Industry and its activities for the above mentioned collaboration is reviewed.

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1 – Introduction

New era of development has been emerged in todays' world: production is rigorously based on knowledge and rely on technologic innovations. In this period, welfare and poverty come into existence simultaneously: welfare for progressive countries in science & technology collaboration ; and poverty for those countries unable to establish efficient science & technology base. Furthermore, the changing market needs and priorities in todays' world, has made science & technology collaboration an important neccesity. Nowadays while industry is motivated to take advantage of R & D seeds and other resources possessed by universities for the development of new products and processes, the latter is expected to vitalize their education and R & D activities closer to the needs of industry and society. Understanding the countries typology concerning science & technology status, can be helpful for designing national strategies for development.

2 - Countries typology concerning science & technology status

The most important differentiating indicators in this classification are: the portion of scientists & engineers to the total population, percapital income rate, quality of human resource, higher education system and its collaboration with industry and , R& D activities. The quality of higher education system is critical as the roots of future scientists and scholars resides in them.

2-1 – Countries with no science & technology Base

These countries are in primary stages of development: low degree of GNP, limited capable human resources in science & technology, lack of science & technology fundamentals, limited natural resources or weak exploitation, unefficient training system, low percapital income, allocating less than ./3 percent of GNP to R&D.

2-2 – Countries with Fundamentals of science & technology Base

These countries are yet in industrialization process and have established industrial base middlingly. They are raw material importers, and their basic challenge is domestic industrial development. Regional cooperation is one of the most effective ways for rapid formation of science & technology base, and this can be done through the improvement of higher education system, and investing on R & D. This group allocate more than ./4 percent of GNP to R&D.

2-3 – Countries with not efficient science & technology Base

These countries have the potential of absorbing modern technology, but they are mostly imported. Scientific society in this group is developing but absence of mutual relationship between industry and university prevents shared projects. The scientists of this group occupy several jobs, therefore they do not have researchers to its real meaning. Under this conditions, they can not have mutual relationship with the researchers inside and abroad. Investment in education should be taken into consideration broadly.

Traditional current regulations at the other hand, disappoints interested researchers. Such regulations should be set so that motivate and mobilize creative activities. **Institutes which undertake research projects have strategic role in leading international activities to national issues. Such centers should be supported and upgraded to their best possible quality.**

2-4 – Countries with efficient science & technology Base

During 19th to 20th centuries, science was established as a philosophy. At that time science & technology were treated as separated entities. It was only in the 1950s that the U.S.A established hegemony in science and technology, although Japan joined the economic superpowers during the 1980s. The rapid development of US science & technology was due largely to huge government support programs. In Japan, under the slogan of developing a science & technology - based nation, educational systems have been strengthened to produce sufficient qualified manpower in science & technology who could contribute to industrial promotion. The aggressive introduction of imported technologies and implementation of highly efficient mass production and rigorous quality control systems played a leading role in expandind markets. It is important to mention that science & technology policies have led to Japan's industrial development.

3-The importance of Science-Technology Collaboration

University-industry cooperation has several advantages. First, industry provides a new source of funds for universities and such funds normally involve less red tape than funds provided by government. Second, university professors and researchers are exposed to real industrial problems and needs which they could not otherwise confront in their ivory towers. Many universities have now

entered both short-and long –term research partnerships with industry.

One interesting but effective approach to the collaboration is the establishment of an independents organization, be it private or public, which deals with the commercialization of R&D outputs. In the present world, it is recognized that high-tech venture businesses are the engine of economic growth. The university lab-venture program can be used for this purpose. Under this program, professors and researchers can set up venture businesses on businesses on the campus. In the light of its considerable success, member countries should relax the rules and regulations relevant to the use of university facilities for venture promotion.

A promoting university-industry technology transfer can be used which intends to establish an intellectual creation cycle. This cycle is rotated based upon the concept that industry obtains patent for R&D outputs from universities. These outputs are utilized for the commercialization of new products by private firms. The licensing income thus derived is fed back to universities and researchers for new R&D activities.

In fact, interactions between university and industry will lead to vitalization of education and the deployment of creative academic research. Flexibility in mobilizing researchers from one university to another and from one project to another , facilitates university and industry linkages which leads to develoment. For promoting theses linkages, technology licensing organization can be established, under which research results or patents generated by universities are transferred to industry , particularly to venture businesses. Such a system functions as a technology transfer agent**. Iran** can learn from the developed countries' experiences in technology marketing and the development of professional staff. **Traditionally, Iranian university professors have mainly been concerned with the writing of academic papers and paid little attention to commercial activities through the acquisition of patents. It is absolutely vital to change their mindset toward the promotion of industry – university linkages. It is recognizes that this will not be easy , however.**

4- Obstacles against Science-Technology Collaboration

The basic problem that hampers the collaboration lies in different values and perceptions in industry and university. **The value of industry is the extension of knowledge for commercial purposes**, while **university traditionally condemns profit – making motives**. Researchers should pay more attention to applied research leading to

patents rather than to the writing of academic theses. For example, the **yardstick for** the promotion of associate to full professors **should not** be based upon **the number of papers** they write **but** on the number of **patents they acquire**. More basically, it is important to change the mindset of young researchers from basic to mission – oriented research through the provision of financial and other incentives.

5 - Collaboration : An international perspective

Industry has traditionally interacted with universities by supporting general research activities in the form of endowments or gifts. There has always been informal collaboration between industry and university researchers accompanied by various advisory exchange programs and student training schemes. Those interactions have now intensified. From the enterprise's point of view, technological progress is an unavoidable route for competitive survival. Firms must take a proactive approach to R & D investment to enhance the level of technological sophistication and ensure long – term profitability. **Collaboration with universities** enables enterprises to have **access to well- trained manpower, research facilities**, and, most importantly, **basic and applied research results** from which new products and processes will evolve. This partnership can help enterprises to obtain professional expertise or solutions to specific problems and assist in continuing education and training.

More universities are urged to make their research results and skills available to the general economy. They are now incorporating economic and social development as part of their mission (Etzkowitz, 1988) and acting as a source of technical expertise and knowledge for enterprises (Westhead and storey, 1995).

Different types of links between universities and business enterprises range from highly diversifield relations in countries such as the USA to growing yet unevenly developed systems in some european countries such as the UK. Today , most policy makers subscribe to the view that such collaboration increases the distributive power of innovation systems by allowing the smoother and faster flow of knowledge from universities to the final private- sector users. Consequently, university industry collaboration has become an attractive tool for policy makers and one of main themes on the innovation policy agenda in many countries. Governments have directed their R & D support to facilitate mutually beneficial and productive partnerships between universities and industries. They have used a variety of mechanisms to facilitate university – industry research interactions, such as development of public infrastructure,

training of graduates, removal of legal obstacles and constraints on personnel mobility.

6-Knowledge Transfer and Training Schemes

Obviously , the level of science & technology is determined by the quality of staff and researchers. Policy measures should be devised to provide a good education in science & technology that will motivate students to take jobs in the field. The social status of scientists and engineers should be improved. Science & technology should contribute to symbiotic relationship between the limited resources of the earth and mankind as a common target for all countries. Science & technology collaboration at the global level should advance through the quality elaboration of training schemes.

7-Iran status

Science & technology resources in Iran are in accordance with its needs but there exists a huge gap between research findings and its application in industry. Iran needs to nurture an environment favorable for the promotion of industry and university linkages, that have well been established in the developed countries.

Universities can play a leading role in generating a number of venture businesses which can become a main engine to boost the economy. In spite of the increasing momentum of collaboration, problems and constraints that make the actual implementation of collaboration less effective are many. They include, different mindsets of academics and industrialists toward R & D activities, weak institutional mechanism to promote collaboration, information gaps between universities and industries, and high risk involved in commercialization. If the main mission of universities and R & D institutes is not only to educate and create new knowledge but also to transfer it successfully to industry for the greater benefit of society, it is necessary to develop and nurture closer linkages among industry, and science. Developed countries lead their science & technology plans and projects to the countries with effective science & technology base, So countries without this capabilities are potentially ignored.

Additional industrial support to universities is also provided through contracts for special projects. Contractual agreements with individual investigators generate strong person-to,-person relations that favor technical cooperation. Generally, contract research is managed by industry-sponsored centers or nonprofit or organiztions. The main tasks are to help find suitable partners, commissioning, projects,

managing the legalities, etc. They are meant to achieve three objectives: stimulate and direct the transfer of scientific and technological knowledge between the public and private sectors; coordinate and concentrate collaborative R&D efforts to share strategic competencies among firms; and conduct R&D geared toward demonstration projects and industrial innovation.

For Iran the ability to acquire , integrate , store,share, and apply it is the most important capability for gaining and sustaining competitive advantage.

In order to strengthen linkages between R&D institutions and industry, government policies should, for example, the use of locally available resources by focusing on the areas of excellence, reliance on the spillover efforts of military R&D on industry, and leverage in government procurement systems.

8 - Activities and Programs suggested to promote R&D - technology collaboration in Iran

8-1- Government – University – Industry - Research Roundtable

The Government – University – Industry Research Roundtable is suggested to provide a platform for dialogue among leaders of government, universities, and industry in national science and technology. It facilitates personal working relationships and the exchange of ideas on issues, problems, and promising opportunities among those responsible for developing and deploying science and technology resources. The rountable can be sponsored by some important academies of science, technology, engineering, universities as well.It is guided by a council that sets agenda , addresses some topics, oversees the plans and activities of working groups that address additional topics.

The sponsorship of Government – university- Industry Roundtable, provides a neutral setting with credibility among all elements of the research community in the three sectors. This allows diverse points of view to be presented in roundtable deliberations. In these meetings all participants can play an active role. The combination of study and analysis by operational-level representatives in the council generates an environment leading to new ideas and procedures in research

8-2- Small Business Technology Transfer program

This program done through a uniform process and three phases, can provide a strong incentive for small companies and researchers at

nonprofit research institutions ,e.g., universities, to work together to move ideas from the research institutions to the marketplace and to foster high –tech economic development.

In phase 1, scientific and technical feasibility ,commercial potenial , and the capability of the small business involved are determined. This phase represents the preliminary step to future agency support in phase 2 and involves a relatively small investment. Several different proposed solutions to a given topic may be funded. Proposals are evaluated on a competitive basis by giving primary consideration to their scientific and technical merit.

phase 2 awards are made based on the results of phase 1 efforts and the merit and potential of phase 2 proposals.

During phase 3, engineering research centers which can be established at universities, make use of the above mentioned proposals . They provide an integrated environment for university and industry to focus on next generation advances in complex engineered systems. Such centers are expected to establish an intellectual foundation for industry to collaborate with the academic community. These centers form long term partnerships between university and industry and develop a culture where graduate and undergraduate students work in multidisciplinary teams in collaboration with their industrial partners.

8-3- Industry/ University Cooperative Research centers

The Industry/ University Cooperative Research centers expect to

- develop long term partnership among industry , university
- consult with center members to set a research agenda focused on shared research interests and opportunities.
- share equally among center members the intellectual property developed.
- monitor the progress of research and offer advice , thereby facilitating two-way transfer of knowledge between universities and industry.
- involve industrial and other partners who will be the primary financial resourese for it;
- establish a formal structure and policies for members
- rely primarily on the involvement of graduate students in research , thus increasing their knowledge of industrially relevant research; and
- submit the partnerships formed to review by an independent evaluator.

8 - 4 - Research Consortia

A research consortia is a group of private companies and governmental and /or academic institutions organized to achieve a common goal of transferring a major technology from basic research to commercialization. The consortium is thus a mechanism that can steer basic ideas toward practical application.

8-5- Effective Knowledge Flow

Such a network can transfer and disseminate new knowledge as rapidly as possible for the economic actors and to influence the quality and direction of research to the user needs both in the shorter and longer term. These multiple loops of knowledge circulation among various actors and activities involved in the innovation process are often referred to as knowledge flows. There are many channels through which knowledge can flow between these institutions and a variety of approaches to measure the flows.

9 - Iran's Water & power Idustry corporate University

One of Iran's strategies for Industry & university collaboration is the establishment of a corporate university called the Institue of Mangement Research and Education. In order words, complexity, extent and character of the Water and Power industry, and its critical role that plays in the development of the national economic and industrial infrastructure and awareness of the vital function of managers in the performance of that role, has made establishment of such an Institute inevitable. By establishing this Institute the Ministry of Energy has made scientific and continuous study of management issues in its subsidiary and affiliated companies of Water, Power & Public Service Industry possible.

Moreover, by channeling the results of these studies to management seminars and training courses and by putting them to scientific use in the framework of management plans, it has prepared the ground for necessary and fundamental transformation of these companies. The development of the managerial education and research regarding public service Industry has been taken under the attention of this Institute's planners.

The institue of Mangement Research and Education, through applying science and nationalizing technology, learning through action, brings science & technology collaboration into action. Thus the environment of work changes to the center of action & training that are the prerequsite of radical change. Training qualified human resource management who can understand todays' transformations,

know the other countries strategies, and feel great social responsibilities is the major role of the institute in the industry. Encouraging the people with industrial experience to transfer them to universities is another main activity of the Institue.

In general, the basic aim of the Institute is to train and flourish executives who possess the managerial knowledge and capability to shoulder great, sensitive and key responsibilities so that they may be able to effectively and efficiently manage their organizations. The Institute intends to realize this central aim in the following manner.

- Emphasizing the applicability of the educational material in light of the needs of the Water, Power and Public Service industry.
- Paying particular attention to ensure that different aspects of the training programs possess a comprehensive quality.
- Developing managerial Research & Consultation
- Distribution & expansion of managerial culture
- Establishing scientific and research contacts with universities and other centers of higher education both in Iran and abroad.

The main activities of the Institute are research, offering consultation services, long-term, full-time and part-time graduate programs and medium-term and short-term courses, especially in fields related to the Water & Power industry and managerial consultation. These courses are the **operation management** courses specifically designed for the Province Water general managers, the managers of the Country's Power Distribution System, managers of the Water and Sewage Systems of Iranian cities, Operational Company C.E.O ,**project management** courses specifically designed for project managers and experts in project planning and control. These programs will take more than hundred hours and will be executed according to the students work conditions. Short-term programs include:

- **General Courses:** General management at the supervisory level, mid-level and strategic management.
- **Specialized Courses:** Domestic procurement management, domestic contract and tender management, financial applications for non-financial managers, computer and its application in management, job classification project for Electric, Water and Sewage distribution companies, foreign procurement, statistic & informatics, goods management,

principles of storage and inventory control, organization and methods management, operations management, etc.

- **Customized Courses:** ISO 9000 seminars, organizational dynamism seminars, and management assistant courses, given on the location of the company concerned.
- Continuous training during managers working years under the name of **Promotion& Flourished Program** including hundred educational courses. And it will be continued under the control of this Institute in Ministry of Energy and its subsidiaries.

Despite the fact that the research and consultation department of the Institute has been operating for only four years, it has had noticeable achievements. The department has provided various consultation services for the Ministry of Energy and its subsidiaries in the execution of various management improvement and restructuring plans. The most important projects already executed or being carried out at present are:

- Designing a comprehensive human resources management system for the Hormozgan Regional Electric Co.
- Documentation of experiences concerning the participation of Iranian experts in the construction of Power plants
- Identification and evaluation of managerial talent in the Tehran Regional Electric Co. (Shadow Managers)
- Designing training courses aimed at raising the capabilities of Water and Power Industry managers
- A study of the evolution of Dasht-e Moghan Water and sewage system
- Designing a plan aimed at improving the organizational structure and administrative methods in the Tehran Regional Electric Co.
- Designing and implementing a productivity evaluation system for the Tehran Regional Electric Co.
- Organizational Pathology Design of Gharb Regional Water
- Different designs of documentation of manager's managerial experiences
- A study to recognize managerial research priorities of Khozestan Power Maintenance Company

In order to improve the skills of its students, the Institute, in the last two years, has worked to design and draw up case studies based on actual experiences by managers. These studies are presented as

educational projects in the classrooms, to be discussed and analyzed by the students. From forty case studies twenty-two have been published. In this regard, the Institute experts in cooperation with Water & Power Industry managers, will collect will document the manager's experiences.

With years of successful experience in offering long-term (full-time and part-time), medium-term and short-term educational programs, the holding of different management seminars and dozens of general and specialized management courses, more than a million class hours in general and specialized training courses in management, implementation of research projects, collection and systematization of the valuable and useful experiences of managers and organizations, IMRE declares its readiness to cooperate in all fields of management research and education.

10 - Conclusion

There are a wide variety of programs and activities in the world for the promotion of science technology collaboration. Obviously, not every one of them can be transplanted from one country to another. Countries desiring to initiate similar programs are advised to choose one choose or more of them through appropriation adaptation by taking into account their country-specific circumstances.

It should be noted however, that countries with similar conditions and common specifications can follow the same policies. Suggesting policies for Science & Technology collaboration development are summarized as below:

- Developing countries should nationalize imported science & technology concerning the cultural facts of their countries.
- Lack of managerial thinking in science & technology application should be taken into consideration
- Establishing effective science & technology base.
- Acquiring the international support.

REFERENCES

1. Foouzat, Ebrahim. **Industrial Development & its Obstacles in Iran**, Chappakhsh pub, 1994.

2. Finkley, Suzara. **Science & Technology in Developing Countries & Suggesting Strategies**, UNESCO, 1990.

3. Tajima, Takashi. **Government Industry University Partnerships**, Asian Productivity Organization, 2001.

4. Tajima, Takashi. **Managerial & Entrepreneurship Development in Supporting Industry**. Asian Productivity organization, 2002.

5. Blind, Knut., **Standarts, Technical Change & Lessons from Industrialized Countries for Developing Countries**, **www.unido.org/doc,2005**

6. Wagner, Caroline. **Metrics for science & Technology Infrastructure. www.unido.org/doc,2005**

7. Gallagher, Kevin. **Trading Away Industrial Development**, 2005