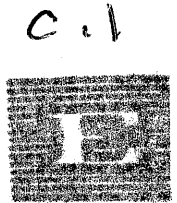
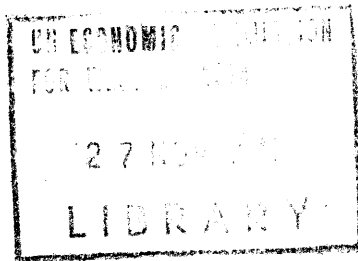




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TECHNOLOGY POLICIES
AND SOCIO-ECONOMIC DEVELOPMENT
IN IRAQ

by

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* The opinions expressed in this document are those of the author and do not necessarily reflect the views of the United Nations Economic Commission for Western Asia.

TECHNOLOGY POLICIES AND SOCIO-ECONOMIC

DEVELOPMENT IN IRAQ

Technological development is a macro condition. It is the resultant of all micro inputs and actions in the different sectors of society related to scientific and technical activities, accumulated over a period of time. Technology is the main propellant for growth, production, modernization, progress and prosperity. Technology is the end-product of research and development. R & D leads to new know-how on materials, processes and products, which takes the form of technology when it can be used for commercial purposes. Science, research, know-how, technology enhanced socio-economic development, therefore, go in sequence. For this reason, technology and know-how are not an end by themselves, but only means for attaining higher production and more efficient performance; and thus leading to higher GNP and higher per capita income. Technology should also serve the social needs and objectives of society and not the other way around.

What does this mean in terms of technology policies ?

It means that in order to achieve real progress in technological development, policies pertaining to development technologies should be designed in such a way that they are comprehensive, coordinated and balanced.

They should be comprehensive in a sense that they must cover all aspects of socio-economic development , in various forms of modern technology, without omission or exception, but with well calculated priorities. They should also be coordinated, externally and internally with other policies in all sectors of the development plan, taking into consideration the technological competence of each sector, and their technological components and level of progress. Last but not least, they should be balanced in the socio-economic sense, creating the correct and compatible condition between manpower competence and hardware competence. This, perhaps, is the most important factor in creating the proper human base harmonious with the achievements of science and technology.

These three conditions have been the basis on which technology. development policies embodied in the National Development Plans in Iraq have been based on during the last decade.

TECHNOLOGY POLICIES AND NATIONAL DEVELOPMENT PLANNING

Science and technology policies in Iraq are based on the present requirements of the country and future perspective of development. Fundamentally, science and technology policies cannot be formulated independently, aside from social and economic development objectives. Accordingly, national development planning since 1970 has included, explicitly or implicitly, policies pertaining to science and technology development. Studies for the long-term development plan up to the year 2000 included a long-term perspective of scientific and technological development.

1. Policy Objectives:

The previous National Development Plan for the period 1976 - 1980, which has just been completed, as well as the new National Development Plan for the period 1981 - 1985 adopted a set of policies, inter-related and complementary with each other, pertaining to science and technology development. The objectives of these policies are :

- (a). Building-up indigenous capabilities for carrying out development programmes

utilizing modern and up-to-date technological achievements.

- (b). Raising the technological level of the manpower base of the country in order to operate and maintain technologically advanced development projects efficiently and successfully.
- (c). Creating dynamic conditions for continuous flow and accumulation of modern technology through absorption and adaptation of imported foreign technology as well as creation of new appropriate indigenous technology through local R & D.
- (d). Acting as a catalyst for accelerating socio-economic development.
- (e). To increasing productivity in all economic sectors by using modern techniques in operating and managing of production and service facilities.

2. Technological Targets:

The five-year National Development Plan 1976-1980 had set ambitious targets for scientific research

and technological development. Among them, it planned to increase government expenditures on scientific and technological research from 0.4% of the National Income at the beginning of the plan period in 1976 to 0.9% at the end of the plan period in 1980. It is now planned that this ratio should reach 1.2% of the National Income in 1985. It also planned to raise the number of scientists working in R & D from 2 persons per ten thousand of population in 1976 to 9 persons in 1985. This is an increase of more than four-fold increase. The present plan also aims at raising the number of technicians working in R & D from 0,4 persons per ten thousand of population to 9 persons during the same period. This will constitute more than 22-fold increase. (1)

Science and technology policies in Iraqi Development Plans have been designed along three pronged axes, namely :

- a- Manpower development.
- b- Flow of technology.
- c- Institutional framework.

(1) Report of the Republic of Iraq to the United Nations Conference on Technology and Development, held in Vienna, 20-31 August 1979, (in Arabic), pp.27.

MANPOWER DEVELOPMENT

1. Policies and programmes :

Manpower is the base for absorption, adaptation and development of all technological innovations. No country can have a progressive science and technology policy or organize its indigenous R & D efforts unless it has the manpower capabilities of proper standards, qualifications and experience to undertake and accomplish the required jobs efficiently and successfully. Accordingly, Iraqi planners believe that first and foremost emphasis should be directed towards building-up the technological base of manpower through integrated educational and scientific policies. Such policies should provide comprehensive educational facilities and should formulate and adapt the educational programmes on all levels, to satisfy the requirements of the National Development Plan. In Iraq programmes implementing such policies include :

- (a). Compulsary education for all elementary-school-age children.

- (b). Compulsory eradication of illiteracy programmes for all persons, male and female, between the ages of 15 - 45 years.
- (c). Expanded and dispersed programmes for all educational levels , starting from kindergarten upto and including higher university studies.
- (d). Establishing a large number of technical schools and vocational training centers to provide and train the lower and middle level cadres in agricultural, industrial and commercial activities.
- (e). Higher scientific and technological colleges and institutes to provide technological skills suited to development programmes.
- (f). Scholarships abroad for a large number of qualified college graduates to attain higher education and specialized training.
- (g). All these programmes are free of charge and the government bears all expenses. In many programmes, some insentives are provided to attract and encourage participation and enrolement.

These programmes are accompanied by such additional measures which can establish, over a period of time, an equilibrium between supply and demand for skilled trained manpower to ensure successful implementation and operation of development projects without excessive reliance on foreign personnel and skills.

2. Training of Skilled Manpower:

One of the biggest constraints in the development of Iraq is the shortage of properly trained and experienced manpower to look after the construction and operation of big projects. With the establishment of sophisticated industries, modern agricultural farms and other development projects, this problem has been further magnified. Consequently, Iraq puts its greatest emphasis on training its manpower and building up indigenous capabilities which can take charge of and successfully run these big projects. All major suppliers and contractors of machinery, capital equipment and its erection must undertake to train Iraqi nationals in the operation, maintenance and repairs of these machines. Training of skilled manpower in Iraq takes various forms.

It can be training of nationals in workshops and operating projects abroad, similar to those being built in Iraq. It can also take the form of on the job training in the projects set up in Iraq under the guidance of foreign experts and technicians. It may also be training in technical schools and research institutions all over the world. There are many branches of activities in which such training is taking place. To mention but few, such as, industrial, agricultural, irrigation, telecommunications, oil, power, and many others including atomic energy for peaceful development purposes. The in-plant training programmes have been very useful and successful in satisfying immediate and urgent needs of the country. Efforts are also being concentrated on management training programmes in order to provide local cadres capable of managing modern and complicated economic ventures on efficient basis.

3. Accomplishments and Results:

It would be reasonable to ask now, have these manpower development programmes been successful ? The following few indicators will reflect some of the accomplishments in

this sphere.

The number of students in all levels of education in Iraq has increased from 1.32 million in 1968 to 3.75 million in 1980, an increase of 184%. Investments in educational facilities have increased many folds during the last ten years. Investments in the 1976-1980 Plan for educational facilities reached more than ID. 726 million (\$2.4 billion) compared to only ID.(78) million (\$260 million) in the 1970-1975 Plan. This means that the average annual investments in educational facilities, buildings and hardware, have increased by more than eleven times in the last decade.

The number of students at university level education (colleges and institutes) has increased from about 63,000 in 1978 to over 100,000 now. The number of engineers graduating from engineering colleges has increased by 416%, and those of doctors graduating from medical colleges increased by 120%. Students graduating from technical schools and institutes jumped by a big leap of more than 15 folds. (2)

(2) See, Revolution and Development in Iraq, Ministry of Culture and Information, 1980 (in Arabic).

Building manpower is a time consuming process, but once the manpower of the required standard and calibre became available, Iraq will definitely be able to make rapid progress in its R & D programmes and to develop its own technology in different fields most suited to its local conditions and development objectives.

FLOW OF TECHNOLOGY

1. Expanded and Comprehensive Development:

Iraq is presently undergoing an intensive economic and social development. It possesses the resources which can be most profitably invested in large development projects, in industry, agriculture, transport and communication, infrastructure and essential services. The Government is endeavouring to have a well conceived and balanced development plans so as to build-up economic projects and provide social services which can subscribe to the country's progress and prosperity of its people. One of the typical difficulties of most developing countries is generally the absence of adequate resources for their speedy development. This is none of the handicaps in the case of Iraq. On the contrary the main problem before the planners in Iraq is how to attain the most economic and social benefits from the utilization of readily available resources for speedy development by using modern technology and most up-to-date techniques.

(1981 - 1985) plan, in billions of dollars: (3)

Sectors	1970-1975 Plan	1976-1980 Plan	1981 Annual Plan
Agriculture & Irrigation	1.9	7.2	2.3
Industry & Power	2.8	15.0	4.2
Transport & Comm.	1.3	7.7	4.3
Services	(1.6	8.0	6.3
Education		2.4	0.9
Others	2.5	10.3	4.5
Total	10.1	50.6	22.5

2. Importing Technology:

It is a well known fact that Iraq has not developed its own capital goods industry to satisfy its development needs. Consequently, almost all machinery, equipment and capital goods, whether for industry, agriculture or infrastructural facilities have to be imported from the developed countries. For this reason Iraq has always been dependent on foreign technology and know-how for most of its development projects. The government explores possibilities of obtaining technology and know-how

(3) National Development Plans - Ministry of Planning

Iraq has set before it an ambitious development programme with which it can achieve a swift transformation in its pattern of production and foreign trade of the country, namely, from the production and export of crude oil to that of intermediates and manufactured product, on one hand, and to meet the consumer and developmental needs of the country, on the other. Iraq must, therefore, expand and modernize its agriculture, establish consumer and capital goods industries, provide infrastructure and services necessary in order to continue and expand its dynamic development efforts.

Enormous amounts of capital is being invested in Iraq in new and modern technology. Let us look at some investment figures in the last ten years. The last two development plans had invested over \$60 billion in development programmes covering all sectors of the economy and social services. The following is the break-down of investment allocations in the major sectors of the last two plans, (1970 - 1975) and (1976 - 1980), as well as the first year investments of the new

- (b). By consulting engineers in designing and preparation of technical specifications and tender documents of development projects.
- (c). Through the import of machinery, equipment and other capital goods in general, as well as supply and erection contracts for development projects.
- (d). By supervision of construction of large and sophisticated development projects by specialized consulting engineers.
- (e). In the form of management contracts with specialized and experienced firms for the construction of projects and assisting in their operation for a certain period of time.
- (f). Through turn-key contracts for specialized and urgent projects. This form had been used extensively in Iraq during the mid-seventies due to the desire of the Government to speed-up development programmes.
- (g). Through supply and erection contracts by foreign firms, and with the Iraqi cadre

from various sources in different countries. Finally, after considering all aspects, such as level of technology, training of Iraqi personnel, costs, limitations on use of technology, and other conditions, it selects the most favourable offers from reliable and reputed organizations in the world. As a result of the expanded development programmes taking place in Iraq, numerous and diversified forms of technology exists side by side, sophisticated, modern and traditional technologies. Government policies encourage the use of most up-to-date technologies in agriculture, industry, services, and management.

The transfer of modern developmental technologies and know-how from developed countries take place through many channels and by numerous forms. Most important of which are listed below:

- (a). Through consultancy services given by specialized foreign consultants in preparation of economic and technical feasibility studies.

doing the supervision of construction and carrying out buildings and other civil engineering facilities by local contractors. This form has been most popular in the last few years for medium and large projects.

- (h). Through direct execution of projects by specialized Iraqi organizations whereby experienced cadre takes full responsibility for carrying out studies, preparing and designing projects as well as execution and supervision of works. In such method, the Iraqi side relies on foreign sources only for the supply of machinery, equipment, materials and other imported inputs. This form is becoming more desirable nowadays, specially in oil and industrial projects, due to its high level of building-up indigenous technological capabilities.
- (i). Through technology agreements by licencing, know-how, process design, technical collaboration and the like. In using this form equity participation, royalties on sales, participation in management

is usually avoided. Direct financial remuneration is preferred in most cases.

- (j). Last but not least, through and by training agreements with suppliers, contractors or specialized training institutions, either on-the-job or abroad in similar projects and facilities.

3. Bottlenecks and Difficulties:

Iraq has been facing many bottlenecks and difficulties in importing its technologies from abroad. Firstly, information is lacking on the best type of equipment and machinery available in different countries, and reliance has to be placed on the responses received by international tenders. Since the most important suppliers of equipment are the big corporations, it is doubtful if we get strictly competitive bids, and that the supply is not intrinsically, controlled by some sorts of mutual

understanding among them. Consequently, we are offered neither the best equipment nor the lowest price. To add to these difficulties, the delivery periods for the equipment are sometimes too long which creates deficiencies and discrepancies in our planning system. The short-falls that follow, particularly in the infrastructure and some basic industries, have a multiplier effect.

Another source of difficulty, is the unavailability of replacements. Past experience has shown that these days generally it has become a problem to find replacements after about ten years of the purchase of any machinery or equipment. Any orders placed for such replacements are executed after a long period of time and exorbitant prices are quoted for these replacements. Everyone will appreciate that the normal life of industrial machinery is at least twenty years and it should be obligatory on the suppliers of machinery and equipment to stock and manufacture replacements for the lifetime of the machinery. Also, when the equipment manufacturers propose to discontinue the manufacture of particular type of machinery

or equipment, they should furnish free of cost detailed engineering designs and drawings for these machines and their parts to the original purchasers so that they can gradually make their own arrangements for making replacements according to their needs instead of scrapping the machines and buying new ones.

4. Non Compatibility of Imported Technology:

One of the major difficulties faced in importing technology from the developed countries, is that such technology has largely been developed to suit their own economic and social requirements. This does not necessarily coincide with the needs of Iraq and the objectives of its development plans. Any adaptation or modification in imported technology requires a great deal of costly research and development efforts. This in turn will affect the allocation of resources for development. In addition the developed countries prefer to undertake to construct projects on turn-key so that they may maintain their secrets of technology and process design. They are always reluctant to pass on full technological

information and know-how to enable the recipient country to be able to develop and adapt imported technology to its requirements.

5. Technology Transfer Agreements:

Technology transfer agreements often contain restrictive and limiting clauses. Tied purchases of equipment, machinery, spare parts, intermediates and raw materials are sometimes mandatory. Insistence on employment of specified skilled personnel and excessive dependance on expatriates discourages local skills and R & D efforts. Prohibition of exports of manufactured products and restrictions on exports to specified countries, affect the economic benefits of the project as well as hinder regional economic co-operation.

Also, technology transfer agreements usually involve substantial and excessive payments by way of royalties, outright payments, dividends, salaries and allowances of foreign personnel, repatriation of profits and capital, guarantees for profits, royalties, tax and tariff concessions, currency and exchange rates, etc..

Such conditions restrict the smooth flow of developmental technologies, making it intermittent transfer rather than dynamic and continuous flow. Experience in Iraq has shown that present practices and conditions (technical, financial and legal) in technology agreements with most of the international companies have obstructed technological development.

6. Guidelines and Principles:

To avoid the above obstructions and create a more equitable environment for flow of developmental technology, Iraq is basically guided by the following principles:

- (a). Iraq is an underpopulated country with good capital resources striving for rapid economic and social development. It is, therefore, ^{interested} in importing the latest and most modern technology for its projects. Capital intensive projects have higher priority over labor intensive ones.

- (b). Each case of import of technology is considered on its own merits, and the best technology which is most suited to local conditions is procured. No restrictions are put on the source of technology. If everything is equal, technically speaking, diversification and alternative choices are encouraged with the aim of avoiding heavy reliance on one or two sources. Strategically, this is very important on a long term basis.
- (c). For obvious and well known reasons, Iraq confines its relationship with multi-nationals to executing and performing specific jobs on contract basis and to purchase technology and know-how as necessary in each case. Iraq does not permit equity participation or substantial interest by any foreign company in its projects.
- (d). Iraq tries its best to operate, and develop the imported technology to suit its economic and social needs. Every attempt is also made to update this technology

from time to time as well as tie it up with local R & D programmes.

- (e). Gradually, a practice is being developed to refer all shortcomings and difficulties to local scientific and research institutions for investigations and remedying the defects. When the problems cannot be solved locally, foreign help is sometime sought.
- (f). In all major contracts involving the supply of equipment, machinery or capital goods, or contracts for the implementation of development projects, whether on turn-key basis or by sperate multi-contractual contracts, provisions, are provided for the training of Iraqi personnel, either on the job or in similar projects abroad.
- (g). In importing technology, all problems are reviewed from a wider perspective of the Arab region as a whole so that the arab national interests and Arab economic unity are kept in the forefront in all questions of purchase, adaptation or development of new technologies.

INSTITUTIONAL FRAMEWORK

The third axis of technological development policies in Iraq is clustered around building up institutional and infrastructural facilities. These indigenous capabilities are required to streamline socio-economic development with science, technology and R & D activities. Major emphasis in this respect is being oriented around the following capabilities:

1. Engineering and Consultancy Organizations:

This group consists of engineering and consultancy organizations which prepare economic and technical feasibility studies for development projects, architectural and engineering designs, and supervision of construction contracts. There are a number of such organizations which have been set up during the last few years, such as:

- State Organization for Industrial Design and Construction.
- State Organization for Oil Projects.
- State Organization for Agricultural Design and Construction.

- State Organization for Roads and Bridges.
- State Organization of Public Buildings.
- State Organization of Housing.
- State Organization for Irrigation Studies and Designs.
- State Organization for Transport and Communication Projects.
- State Organization for Water and Sewage Projects.
- Specialized Institute for Engineering Industries.
- National Centre for Consultancy and Management Development.
- National Centre for Engineering and Architectural Consultancy.
- A large number of directorates and establishments in different ministries and universities to carry out studies, designs and supervision of construction for development projects.

In addition, such capabilities also exist in the private sector, specially in consulting firms and engineering bureaux.

2. Construction Organizations:

This group consists of state companies, establishments and organizations, which undertake implementation or actual construction of development projects. They do the civil, mechanical, and electrical engineering works as required for the completion of projects. The long term objective of these organizations is to build up indigenous capabilities for executing and implementing development projects with minimal reliance on foreign contractors, thus paving the way for complete integration between planning, designing, execution and operation of projects.

The list of government entities in this field is a long one. Many have been established in the last few years. In addition to many of the state organizations mentioned above, which carry out construction work, the following specialized state companies could be added:

- State Company for Industrial contracts.
- State Company for Buildings contracts.
- State Company for Foundations and Piles.
- Commission for Executing Mass Transit Project.
- Commission for Executing Modern Railway Systems.

- State Establishments for Executing Dams, Irrigation and Drainage projects.
- State Establishments for Land Reclamation Contracts.
- State Company for Water and Sewage Contracts.
- State Company for School Buildings Contracts.

3. Operating Organizations (R & D units):

The government has been following a dynamic policy for establishing R & D units in most operating organizations responsible for running public sector enterprises. These R & D units have the responsibility of investigating and recognizing any technical problem which arises in the factories and plants concerned, and then appropriate remedy is taken. They also carry out some studies and research to improve or modify any operation, process or machinery in use, with the objective of increasing efficiency and productivity as well as adaption and development of local appropriate technology.

The following are few of the government

organizations with such R & D units:

- State Organization for Chemical Industries.
- State Organization for Construction Industries.
- State Organization for Engineering Industries.,
- State Organization for Food Industries.
- State Organization for Textile Industries.
- State Organization of Minerals.
- State Organization of Oil Refining and Gas Industries.
- Iraqi National Oil Company.
- Directorate General of Pharmaceutical Industries.
- Many organizations and other entities in the agricultural sector and affiliated activities, as well as many others.

4. Scientific Research Institutions:

Iraq has been building up its professional scientific research capabilities for many years. Many research laboratories and institutions have been set up with required equipment, apparatus and qualified specialists and scientists to carry out fundamental as well as applied research

on subjects which are of interest to the present and future development of Iraq. Universities and technical colleges have well equipped research laboratories. Although these organizations undertake fundamental research they also work very often on applied research problems related to development needs.

Lately, the scientific research set in Iraq had been reviewed and reorganized. The Scientific Research Council was formed to take the responsibility of monitoring and co-ordinating all scientific research activities in the country, in addition to carrying out its own applied research programmes in specialized research centres attached to the Council itself. These centres are:

- Agricultural and Water Resources Research Centre.
- Petroleum Research Centre
- Solar Energy Research Centre.
- Building Research Centre.
- Biological Research Centre.
- Space and Astronomy Research Centre.
- Scientific Documentation Centre.

As far as technology is concerned, one of the significant changes of policy which took place in the above re-organization, was the dissolution of the Technology Transfer Centre, which was part of the defunct foundation of scientific research. The functions of the said centre has been transferred to other government departments. Those functions dealing with science and technology policy matters has been entrusted to the Science and Technology Department of the Ministry of Planning. Those connected with technology transfer has been referred to the R & D units in the different state organizations.

5. Standardization:

Standardization is an essential pre-requisite of R & D and development of technology. It is necessary at all levels of production and consumption. Standardization of equipment and production processes helps to find common answers to various production and maintenance problems. Similarly, standardization of products helps to carry on R & D for further

improvements. Iraq has been laying special emphasis on standarization and quality control activities. For this purpose, the National Organization for Standardization and Quality Control has been established. Its functions cover a wide scope of standardization and quality assurance activities in all major fields of production and principal products both in the industrial and agricultural sectors. It also cover testing of major imported commoddities and manufactured goods, specially foods and drugs. This will be a major step in import substitution and encouraging export of local manufactured and processed goods.

FINAL NOTE

As we have seen from the previous comments, various aspects of the flow and development of technology in Iraq, is being dealt with in comprehensive, coordinated and balanced set of policies. Such policies are oriented towards three major axes.

The first set of policies is towards manpower development in order to raise the scientific and technological level of local skills and technical manpower.

The second set is to create dynamic conditions in order to ensure the continuous flow of advanced technologies as well as its adaptation, modification and development through indigenous R & D efforts.

And, finally, the third set of policies is to provide the necessary institutional infrastructures required for technological development.

Iraqi planners realize that Iraq cannot do it all alone. It needs to interact with all available technologies in the world. They

also realize that Iraq needs cooperation with and assistance from all competent organizations dealing with advanced and modern technology and know-how in all its forms and levels.

Iraq believes in increasing international cooperation and multinational trade as an indispensable instrument of modernization, development and higher standard of living, as a medium for transfer of technology and as an effective means of establishing the most efficient geographical distribution of labour, when it is conducted on fair and equitable basis.

Iraq has received help from many friendly foreign countries which possess the required advanced and appropriate technology. For this purpose, Iraq has entered into various bilateral technical collaboration agreements with developed countries to provide technology and know-how. Iraq has also been receiving assistance from United Nations specialized agencies and experts in the field of transfer of technology and its adaptation to Iraqi needs and requirements. The country would continue to accept help from developed and regional organizations in this regard.