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Country Paper

of

The Syrian Arab Republic

(Final Version)

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The recency of Syria's venture in this sophisticated and complex field prompts her to request further assistance from United Nations organizations specialized in the field of science and technology and we are confident that our sincere request will meet with a full response which will ultimately prove beneficial to the international community as a whole.

Finally we would like to confirm that Syria will do its utmost, both within and outside the United Nations system, to ensure the success of this Conference and, consequently, to anchor one of the fundamental bastions for the establishment of a new international economic order on a firm foundation based on justice and equality, respect for the rights of all countries, non-interference in their internal affairs, curbing aggression and refraining from occupying the territories of others by force in order that our world may become one in which technology is transferred for the sake of development and international brotherliness rather than for purposes of destruction.

INTRODUCTION

The Syrian Arab Republic is greatly interested in the United Nations Conference on Science and Technology for Development because of its profound belief in the significant role played by science and technology in the furtherance of economic and social progress and in the consolidation of international relations in the interest of the world community.

The Syrian Arab Republic, which obtained its political independence around 30 years ago, has had painful experience of the importance of technology. This is because, although the initial most striking impression of the importance of technology is its positive aspect of effective contribution to the development of national economies and living standards, our country has experienced the other aspect of this technology manifested in various types of sophisticated and deadly weapons used for purposes of aggression against the Palestinian people which fell victim to Zionist ambitions. The level of this technological progress can be seen in the aggressiveness of Israel and its attempts to perpetuate its occupation of the territories of a number of neighbouring Arab countries by the force of its sophisticated weaponry.

This state of affairs has forced the Syrian people to reluctantly dedicate the major part of its human and material resources to bolstering its defense capacity to face Israeli expansionist designs manifested in the instigation of military and political pressures and successive wars aimed at weakening the national economy of the Arab States. In effect, the Arab States have become a vast testing ground for the latest advanced technological inventions of the armaments' industry as recently happened in the case of the peaceful inhabitants of South Lebanon on whom cluster bombs were tested as a reflection of the level of refinement attained in the demolition industry. Hundreds of innocent civilians were killed and many more suffered serious injury and were reduced to a position of dependency on the national economy. This human tragedy shows Zionism in its true light as the enemy of all the humanitarian and civilized values on which the principles of the United Nations and its institutions are based.

In these distressing circumstances Syria takes this opportunity to draw the attention of the international organization to the importance of basing international relations on the humanitarian principles and ethical values recognized by the world community.

Syria is convinced that the transfer of technology cannot be successfully achieved under the shadow of aggression and occupation. The reason for this is that the transfer of technology takes place through the construction of factories and workshpos and the training of young national cadres, which require persistent efforts and a great deal of time, while the destruction of the fruits of such initiatives only requires a few air raids on industrial locations such as those which occured during the 1967 and 1973 wars when Israeli planes devastated many of our installations such as schools and electricity generating plants whose output was in no way related to the armaments' industry.

In bearing arms to defend the security of the country and its people our younger educated generation perceives the obverse side of man's technological achievements intended to promote economic development and raise the living standards of our people so greatly attached to the concepts of freedom, progress and independence.

Under these distressing circumstances Syria has realized the importance of the purposeful planning of all its activities and planning instruments have gradually been introduced into the various sectors at all levels. The science and technology sector has not been overlooked in this development and the importance of planning can be seen in the many study projects undertaken in connexion with institutional arrangements which the country hopes will play an outstanding role in the formulation of scientific and technological policy in conjunction with development plans with a view to avoiding the many difficulties which we will attempt to highlight in this report through a survey of the present technological situation in Syria and the proposal of certain solutions which might help to overcome them. These proposals, by their very nature, reflect Syria's conviction that the greater responsibility lies primarily on our own shoulders to rectify the scientific and technological situation from which we are suffering. Only then can regional and international co-operation prove fruitful and beneficial to all parties concerned.

Preface:

The scientific and technological situation in the country with regard to the transfer of technology for development has been assessed through an objective study of a series of prominent projects which have been completed or are being carried out in accordance with economic and social plans in the following fields:

- food and agriculture;
- natural resources including energy;
- health, housing and the environment;
- transport and communications;
- industrialization including the manufacture of the machinery for production.

I. Science and Technology for Development

A. The choice of technology and its transfer for purposes of development

B. The removal of obstacles impeding the improved utilization of know-how and available potential in the field of science and technology for development purposes in all countries and especially for their utilization in the developing countries

1. The position of technological dependence, an analysis of the difficulties impeding the transfer of technology and an assessment of the decisive factors governing policies and priorities for the transfer and adaptation of technological capabilities

The State of technological dependence from which Syria is currently suffering is a relatively recent phenomenon the origins of which only date back to the last century. For thousands of years our country was a principal centre of creativity in the world from which the Greeks and Romans in ancient times and also the Italian cities and the West European countries in the Middle Ages and even in the seventeenth century borrowed a considerable amount of know-how and basic techniques which were prime factors in the growth of modern western civilization.

The origins of scientific and technological dependence are to be sought in the industrial revolution which constituted a fundamental historical turning point and gave increasing and definitive predominance to the Western countries over the other countries of the world. Since then European industrial techniques have been invading Syria:

> Primarily in the form of consumer goods which began to take place of locally manufactured articles, thus destroying the ancient traditional crafts. These goods entered the country under cover of the imperialist agreement imposed on the Ottoman Empire and which prevented the protection of the national economy against the western economic invasion.
>
> In the form of production tools or small scale installations which came into fairly wide use among the inhabitants of the country, such as spinning looms, sewing machines, mills and presses etc. which sowed the first seeds of economic and social change.
>
> Finally, in the form of large installations, mostly of an infrastructural nature, established by western companies under the capitulationary system and in accordance with conditions and technical specifications which were frequently inappropriate. These installations - railroads, electricity generating plants, banks, commercial agencies, insurance companies etc.- remained in the hands of the foreign companies which, as alien bodies, had little influence on the social environment. On the other hand, they were also major instruments for economic exploitation, intervention and the exercise of colonial domination.

During and after the nineteenth century the country witnessed several attempts at reform, the building of a modern state and liberation from foreign domination, all of which were thwarted by the intervention of the Great Powers at that time. The last such attempt was led by the National Movement shortly before and during the First World War and led to the military occupation of the country by the colonialist armies. After the country attained its independence in 1945 the Government rapidly took steps to protect and develop the economy . Foreign machinery was purchased, scientific missions were brought into the country, funds were allocated for infrastructural expansion and considerable efforts were made for the extension of education and the training of specialists. The Central Bank of

Syria was established to control the monetary system. This Bank formulated development programmes and concluded a co-operation agreement with the Soviet Union and was thus able to break the strangle hold of western technological monopoly, especially in the field of petroleum and sophisticated weaponry for the preservation of national independence.

As a result, there was a wider and more rapid spread of science and technology than had ever taken place in the previous colonial period and this included the manufacture of technological consumer goods. The consumption of electricity, for example, increased from 16 kwh in 1940 to 62 kwh in 1955 and 111 kwh in 1965. There were similar increases in the number of motor vehicles, radio sets and chemical products and also in production machinery and the training of scientists: in agriculture there was a steep increase in the use of tractors, fertilizers and pesticides etc. Factories were established in various branches of industry. In the transport, services and construction sectors the spread of modern technology was no less significant.

The Government realized at an early stage that rapid development made it necessary for the State to assume direct responsibility and it thus took upon itself to provide an ever increasing proportion of the requisite investments and adopted the technology of comprehensive planning. It was thus obliged to carry out more and more studies, establish technical bodies and institutions and pay more attention to education and the training of specialists. It was able to implement large scale development projects based on advanced science and technology such as the major hydro-electric dam on the Euphrates, oil production, the processing of phosphates, the construction of railroads, the establishment of modern metallurgical, engineering and chemical plants and the generation and distribution of electrical power.

Does this mean, then, that scientific and technological dependence has ceased or become less acute? By no means. It has persisted for three main reasons:

(1) The accelerating pace of development in the developed countries by virtue of the escalation of the scientific and technological revolution.

(2) The continuation of imperialist exploitation in various forms, military pressures and wars.

(3) The failure to organize an independent national technological capability. In most cases, therefore, it remains very difficult, when implementing our development projects, not to have recourse to the developed countries and to choose the most appropriate technology. At the present time do we have any option but to choose the most modern weapons needed for our national defence and the most modern installations, aircraft, communications and mensuration equipment, computers etc.?

Scientific and technological progress imposes itself upon us and, consequently, the degree of dependence also remains very high. However, this does not mean to say that technological dependence cannot be reduced to a certain extent in some incidental or supplementary project works.

In general the study, design and execution stages are undertaken by Syrian technicians whenever the projects are limited in extent as in the case of the construction of small and medium-sized dams, irrigation networks, water purification plants and water, drainage and electricity distribution networks and also in the majority of development projects where the study, design and execution stages are undertaken by Syrian technicians using traditional technology due to the low cost of manpower. In most major projects participation by foreign firms is almost complete (the Euphrates dam, certain major water supply projects, railway construction, petroleum refineries, oil exploration, the Damascus sewage project, the treatment plants at Homs and Hamah and pollution control in the Barada and Orontes basins) although continuous efforts are being made to associate local personnel with the study and design of part of these works with a view to the training of local experts.

Endeavours are also being made to utilize national personnel in the supervisory stage of project implementation in such a way as to ensure contact with foreign experts and to utilize the experience thus gained in the transfer and absorption of the technology used.

The analysis of the difficulties impeding the transfer and selection of technology is a complicated operation since these difficulties are not the product of contingent circumstances but are the results of a complex cultural and social structure of long standing. Inspite of this, however, it can definitely be said that the basic problem resides in the inadequate experience and organization

of the technical and administrative managerial class capable of undertaking the task of formulating integrated policies designed to :

1. Identify technological requirements for the successful implementation of our development plans;
2. Select the fields in which technology should be transferred;
3. Meet the conditions for the successful transfer of selected technology and make the necessary preparations for its absorption through the provision of technically and scientifically qualified managerial staff and the establishment of the necessary installations, laboratories, research centres and other infrastructural requirements as a base to ensure the successful adaptation of imported and absorbed technology.

If such a managerial framework, capable of undertaking the task of formulating integrated policy and preparing the implementation of its above-mentioned stages in a sequential, coherent and logical manner can be provided it would facilitate the process of technological development at subsequent stages in a manner consistent with the evolution of our long-term development plans after making the necessary modifications wherever necessary.

Tasks of this nature, however, cannot be carried out without a clear awareness of all the dimensions of this complicated problem since the inadequacy of this managerial framework is aggravated by the absence of the professional personnel capable of assembling and examining data on technological developments taking place in all fields and particularly in those which we must select. Furthermore, the exporters of technology in the developed countries never bother to select the appropriate technology for the importing country but frequently supply the most modern technology in certain fields while only allowing the export of first generation technology in other fields.

From the above it is clear that the lack of consistency and integration in the achievement of our target in the selection, transfer and adaptation of technology through the projects currently being carried out in the country is due to the weakness of the above-mentioned managerial framework.

In conclusion we must not overlook the fact that the accomplishment of these momentous tasks required the introduction and adoption of modern administrative techniques and the abandonment of traditional administrative methods inherited from

past ages and which, in fact, constitute another major obstacle to the achievement of any tangible process, especially in the field of the transfer and utilization of technology for development.

As a result of the failure of the managerial framework to formulate scientific, integrated long-term policy other obstacles arise such as:

- Delay in the formation of intermediate technical cadres. This was due to the mistake of planning the development of technical manpower without basing this planning on a scientific survey of available potential;
- the failure of education and the information media to promote scientific ways of thinking and, consequently, to convince the public of the usefulness of science for development;
- the inadequate integration between socio-economic planning and scientific and technological planning;
- the failure to provide enough scientific and technological managers;
- the absence of limited subsidiary projects connected with major projects, the study and execution of which should have been assigned to national experts possessing experience gained through working with foreign experts;
- the absence of national standards for the testing, transfer and adaptation of technology in a manner consistent with national priorities in development projects and with the potential for developing local technology;
- the significant illiteracy rate despite the efforts made to eradicate it. the repercussions of this illiteracy can be seen in the following three areas :
- Inability to read and write ;
- lack of manual skill and experience in the use of simple technological processes ;
- unfamiliarity with scientifc thinking for purposes of discussion and problem solving.

- the failure to carry out an adequate study of the issue of rural revival with a view to the formulation of a plan for the achievement of this aim and the consequent selection of the technology most suited to this aim which could alleviate socio-economic disparities and thus curb rural-urban migration.
- reliance on an erroneous development strategy in the execution of turn-key projects, without the stipulation of appropriate technical and legal provisions which has led to greater technological dependence since the contracts concluded with foreign companies often lack clauses designed to provide real opportunities in such projects for the acquisition of the necessary experience for the study, execution and operation of similar projects which might be carried out in the future. Provisions should be made for participation by national technicians in the study and design stage and also for their prior training to enable them to participate effectively and usefully in the execution, commissioning and operational stages and to carry out maintenance and repairs.

2. Evaluation of measures taken at national level:

Syria has recently been preparing to take serious measures to promote the transfer and adaptation of technology for development:

(i) Numerous study and research centres have been established in the country including autonomous institutions linked to the highest authority in the State such as:
- The Scientific Study and Research Centre;
- The Atomic Energy Commission;

and others directly attached to the relevant ministries such as:
- The Industrial Experimental and Research Centre;
- The Centre for the Development of Management and Productivity;
- The Agricultural Research Centre;
- The Public Study and Design Institute;
- research and technical departments in certain ministries, etc.;

(ii) Syria is greatly interested in the project for the establishment of a Regional Arab Centre for the Transfer and Development of Technology

which it hopes will play a co-ordinating role among the Arab countries with a view to avoiding duplication, wastage and inconsistency;

(iii) serious thought is being given to the establishment of a national centre for scientific and technological documentation and information that would be able to remedy the considerable deficiencies affecting national scientific and technological libraries while, at the same time, providing information about their holdings and co-ordinating their activities. In this connexion the Scientific Study and Research Centre has begun a study on the use of electronic systems and sophisticated informational methods for classification and coding and the Ministry of Higher Education has completed the necessary studies for a scientific and industrial documentation centre which it is hoped to establish;

(iv) projects undertaken by specialized research organizations such as the Environmental Research Institute and the Institute for the Study and Application of Remote Sensing Techniques.

However, the activities of these centres, institutions, departments and projects were not subjected to the control of a superior scientific authority designed to ensure co-ordination, avoid duplication and make maximum use of the available potential in each of them.

The absence of managerial cadres for the formulation of scientific and technological policy has made it impossible for Syria to adopt integrated national policies for the transfer and development of technology. Syria still lacks the managerial framework for the formulation of scientific and technological policy, one of the tasks of which would be the establishment and adoption of an integrated national policy for the transfer and development of appropriate technology.

3. Analysis of obstacles hindering the country's determination to apply science and technology to development

The principal obstacles impeding scientific and technological progress can be summarized as follows:

(a) The failure to fully appreciate the role of science and technology in development: since the attainment of its independence in recent times Syria has been preoccupied with repelling Zionist and imperialist ambitions and mobilizing all its resources for the defense of its territory and its people and successive governments have thus had little opportunity to gain an understanding of the role of science and technology in development since a true awareness of this role can only be gained through conviction acquired through the execution of numerous large projects using advanced technology and through the participation of national cadres therein. Participation of this type has been insufficient to motivate and draw the attention of many managers to the important role of science and technology in the execution of such projects. Consequently, there has as yet been no opportunity to highlight the role of science and technology in the socio-economic development process and to build up an appreciable conviction of the importance of research and modern techniques in the development process being pursued by the Government and the people of Syria.

(b) This situation reflects the weakness of the scientific and technological infrastructure since it is hardly possible to discuss numerous projects related to scientific and technological institutional arrangements without becoming aware of the extent of the country's need for further experience and expertise.

(c) Since institutions concerned with the collection and analysis of information are closely linked to a series of scientific and technological infrastructural factors, the weakness of these infrastructural factors has had a direct effect in weakening these ancillary institutions.

(d) The failure to fully appreciate the role of science and technology has, in general , weakened the role played by preliminary studies and research and has also weakened communication among researchers and beneficiaries from research and development. This explains, for example, the small number of research engineers in relation to engineers engaged in project execution. However, the experience gained in numerous past projects are bringing into ever greater prominence the significance of the study and design stage on the one hand and the importance of carrying out studies and research based on the actual situation in the country on the other.

(e) One of the principal factors hampering the rational execution and operation of planned projects is the relative incompatibility of education and training with the actual requirements of these projects.

(f) The phenomenon of the brain-drain and the migration of technical manpower is one of the main problems facing Syria. Its causes are fairly obvious and attempts have been made to deal with certain of its aspects although the magnitude and ramifications of the problem need to be thoroughly studied from the standpoint not only of the external brain-drain but also of the internal migration of technical manpower from rural to urban areas and from one sector to another. Assistance from the developed countries is a prerequisite for a comprehensive and lasting solution to this problem since the dimensions of this serious phenomenon transcend national boundaries.

(g) The inability of planning to play its required role due to the weakness of its managerial and subsidiary structures and the fact that development plans are still economically oriented and have not yet had time to show adequate concern for their social implications and, in particular, for the type of life which this development would offer the citizen.

(h) Development plans are still emphasizing the economic aspect without paying due regard to the social aspect of development although it is this aspect which supplies the personnel capable of participating in, operating and benefiting from industrial, agricultural and other economic development projects.

(i) The quantitative and qualitative inadequacy of contractors, the migration of several of them and the lack of administrative expertise, especially in the management of large, complex projects involving modern administrative methods.

(j) The lack of modern national mechanisms to control production, link remuneration to type of work and production, provide individual incentives for increased productivity, encourage initiative and creativity and specify contractual relationships in such a way as to ensure an effective contribution to technological planning and implementation.

(k) Neglect of the role played by research - in particular economic feasibility studies and financing policy - and by auto-financing in many investment projects and the search for external markets for their output with a view to alleviating the foreign exchange crisis from which we, as well as other technology importing countries, are suffering are still threatening many projects with failure.

4. Formulation of appropriate recommendations for the solution of the above problems through the adoption of measures at national level:

(i) The creation of a body for the formulation of scientific and technological policy, planning, budgeting, co-ordination, monitoring and evaluation;

(ii) The development of a body concerned with the formulation of educational and training policy and co-ordination among all the ministries and institutions concerned;

(iii) The creation, within the scientific and technological policy-making body, of a department to examine ways and means of transferring science and technology, including the transfer of information and documents and the registration of patents and concessionary agreements;

(iv) The creation of a specialized scientific secretariat and councils in each ministry or national technical economic sector (industry - agriculture - public works...) to co-ordinate and discuss the activities of the research centres;

(v) Dealing with the problem of the brain drain and the migration of technical manpower through the adoption of appropriate measures and the provision of a suitable climate for the utilization of their expertise;

(vi) Attention to administrative development and the introduction of modern administrative methods in all sectors, particularly in complex projects involving the use of various sophisticated technologies;

(vii) Reinforcing the specialized bodies in all sectors by a study of projects and a strengthening of bodies concerned with execution, control and operation;

(viii) Linking wage structures to productive output and establishing a system of incentives to ensure the motivation of the most capable workers, technicians and managers;

(ix) Making further efforts to eradicate illiteracy, particularly among workers in the public sector;

(x) The promotion of local, Arab and regional scientific and industrial conferences, enabling those concerned to attend them and also to attend specialized international conferences, and co-ordination among all the relevant bodies in order to make use of the scientific and technical expertise gained through these conferences;

(xi) The continuous development of university and intermediate technical training and vocational training curricula, the despatch of students and training missions abroad in order to meet the actual needs of projects included in the development plans and co-ordination in this respect between the ministries of planning and higher education and other relevant bodies;

(xii) The promotion of scientific research at universities, especially in connexion with development projects, and the promotion of co-operation between universities and centres for applied research;

(xiii) The development of educational methods and information programmes and the dissemination of scientific and technological know-how among the population which should be encouraged to take an interest in and to utilize such knowledge;

(xiv) The introduction of science and technology as an integral part of the development plan by:

- Formulating a development programme for science and technology;
- using science and technology for the formulation and execution of sectoral projects;
- using scientific and technological methods in the preparation of plans;

(xv) Planning the development of the local capability in scientific and technological research in order to ensure the development of existing and potential industries;

(xvi) Taking advantage of projects involving the contractual participation of foreign firms and companies in order to acquire the experience needed for the study and execution of similar projects and to utilize local potential wherever possible in the execution of these projects;

(xvii) The undertaking of studies to determine the necessary scientific and technological priorities for the development of the economic sectors, and paying special attention to advanced technologies of wide benefit to scientific and productive activities;

(xviii) The establishment of centres specialized in the application of science and technology in:

- The various sectors of the national economy linked to ministries;
- the various scientific sectors linked to universities;

(xix) The establishment of a scientific information and documentation centre, the principal functions of which would include acquainting scientific bodies with the latest scientific developments throughout the world in both Arabic and other languages, acquainting universities, research centres and economic institutions with national scientific potential and achievements and the recording of current research and imported technology;

(xx) The allocation of a minimum amount of funds to be spent on scientific and applied research and associated scientific services, for the purpose of which a fixed percentage of the gross national product would be assigned and a national fund established;

(xxi) The formulation of a plan designed to increase the number of scientific personnel engaged in scientific and applied research to a minimum of 500 persons per million of the population, efforts to ensure the proper distribution of these personnel and endeavours to achieve a quantitative and qualitative increase in the number of intermediate technicians in the scientifically active labour force until the ratio of this category of researchers becomes at least 3 to 1;

(xxii) The adoption of all the measures needed to ensure co-ordination between national scientific policies within the context of an Arab scientific policy aimed at the achievement of the higher objectives of the Arab World.

6. Methods for the integration of science and technology in socio-economic development, scientific and technological developments and their use for the removal of obstacles impeding the development process

An analysis of Syria's present technological situation indicates that the transfer of technology in general will not result in the desired development unless it is accompanied by a corresponding modernization in the administrative field. In fact, it must be preceded by the transfer of modern administrative technology.

Syria is aware that the fundamental problems posed by the transfer of technology are basically of a social, political and economic nature and that their transfer requires an appropriate and sophisticated environment. These factors necessitate a particular type of general infrastructure within which various approaches to the transfer of technology can co-exist. Syria is also aware that a rise in the level of economic development can only take place through the formulation and application of an appropriate scientific and technological policy suited to the needs and potential of the country.

In accordance with this principle Syria has prepared long-term plans aimed at the establishment and development of relatively sophisticated scientific infrastructures to ensure constant scientific contacts with the outside world through the development of teaching programs and curricula at all levels and also through sending delegations to participate in scientific seminars and conferences. In the field of primary education the Ministry is continuing its efforts to achieve universal, compulsory education through the provision of all the educational facilities needed to raise the proportion of admissions in the primary stage as a whole and in the first grade in particular. As a result of these efforts the compulsory education of all males in the first primary grade has almost been achieved. In the case of females the proportion of admissions has increased considerably in recent years, although still lower than that among males, and apportunities are provided for successful condidates to enter the various faculties of the universities and institutes in the country. As an expression of this feeling of high responsibility a number of decrees have been promulgated with a view to rectifying the existing imbalance especially with regard to intermediate cadres, by raising the salaries of these categories and providing other incentives. In this connexion the Government is endeavouring to halt the brain-drain and migration of technical manpower, encourage their return and retain their services

since, in effect, they represent the fundamental component for the success of any worthwhile scientific or technological activity.

In the field of higher education and scientific and technological research numerous projects have been prepared with a view to the establishment of managerial bodies for the formation of scientific and technological policy at the highest levels based on the conviction of the political leadership that this is indeed one of the basic infrastuctural factors.

It should be noted that most operations involving the transfer of technology take place horizontally in Syria. The same technology is used in various fields (for example, the use of lathes for the production of various commodities such as carpenters' planes and implements for the woodworking and textile trades etc. and the use of drilling and levelling equipment for road construction and the excavation of dams etc.) and there is only rarely a vertical transfer of technology whereby science is converted into technology and technology, in turn, into a tool for the production of new or improved commodities.

Moreover, the horizontal transfer of technology often takes place from the industrially developed countries in the form of a "phased transfer" (for example, the use of electronic equipment, especially advanced computers). Technology is only rarely transferred from the developing countries which can be considered as being at the same technological level as Syria, i.e. in the form of a "linear transfer" (for example, the importation of passenger buses for the Karnak Company from Turkey which manufactures the bus chassis and imports the basic components from West Germany.

The absorption of sophisticated technology imported from the industrially developed countries is a difficult and complex process requiring considerable efforts over a long period of time since a balance must be struck between the volume of scientific knowledge and imported technology on the one hand and the national scientific and technological infrastructure on the other. The full magnitude of this problem can be seen in the developing countries and Syria is largely facing the same difficulty, one aspect of which appears in the imbalance between the lower, intermediate and higher levels of competence and, in particular, at the intermediate levels concerned with the repair and maintenance of equipment.

One of the fundamental measures which Syria must apply in a serious and thorough manner is that of identifying the areas and the sectors that should be given priority in the transfer of technology in the light of the country's economic and social strategy,and establishing the machinery capable of adapting and modifying patents under licence so as to ensure their compatibility with the size of local production, domestic resources and existing technology, thereby guaranteeing that they represent the most favourable alternative in terms not only of the quantity but more particularly the quality of resulting production.

Although Syria is emphasizing the importance of selecting specific fields for the transfer of technology, it is, nevertheless, aware that technological progress takes place on a broad front and not by means of a bridgehead. This means that the successful transfer of technology in a narrow field requires the development of a broad front of scientifically based key industries (electro-mechanical plants and chemical industries) in addition to the use of modern managerial methods, the provision of highly specialized scientific personnel and scientific and technological research centres supplied with the most modern equipment. Therefore, Syria is convinced that the achievement of a leading position in a limited technological sphere requires the provision of a technological base as a minimum. This is because technological innovation results from the interaction of several technological capabilities pulling in the same direction. Some attempts have recently been initiated to discover the most appropriate methods of determining the optimum combinations of various fields for the horizontal, vertical, linear and phased transfer of technology so as to meet the requirements for the rapid growth of our national economy in a manner consistent with our own potential in addition to the utilization and development of local technology wherever studied and experiences substantiate its usefulness.

Syria is convinced that there are numerous technologies in neighbouring countries which it would be in Syria's interest to transfer (linear transfer) and that the requirements of the present day and age obliged Syria to transfer more sophisticated technology from the more advanced countries in certain fields (phased transfer). The Syrian officials are not unaware that, whatever the quality of the horizontally transferred technology, its results will remain limited in comparison with what could be achieved through technology which Syria could develop vertically since the experiences of various countries have proved that

its results far surpass the results obtained through horizontally transferred technology.

On the other hand, the experience of various sectors in the field of the transfer of technology has led to the realization of the importance of establishing bodies for the collection and processing of data. The zeal shown for the acquisition of electronic computers and the attendance of courses in programming and analysis is only one manifestation of the awareness of this importance inspite of the fact that the framework needed for their utilization has not yet been established, thus considerably limiting their use in a retional manner.

A review of the experience of various sectors confirms that the great majority of operations for the transfer of technology to Syria take place by means of introduction and direct use i.e., as already mentioned, through the so-called "turn key delivery" method rather than by absorption. This method requires the provision of the necessary framework and institutional foundations which Syria still lacks.

Finally, although the economic development that has taken place to-date has been a consequence of horizontal and phased technology transfer, and the efforts at introducing vertical technology transfer are still new and quite limited, the radical solution to the problem of harnessing science and technology to the service of development cannot be implemented in isolation from the purposeful and comprehensive planning of the different activities of the country, including the orientation and programming of scientific and technological research. This is the bridge which Syria has chosen for its transition from the world of underdevelopment to the world of progress.

II. Institutional Arrangements and Forms of Co-operation

A. Institutional arrangements

1. Conceptualization of national structures for science and technology

Syria is aware of the importance of adopting a long-term scientific policy strategy whose formulation ought to be entrusted to a high-level body attached to the highest political and executive authority in the Government, working in close co-operation with the topmost organs of socio-economic planning, and responsible for designing the goals and policies of the country in science and technology, including the major directions to be taken in this area, and for putting science to the service of political and executive policy-making in the Government.

2. Assessment of the current situation at the national level and evaluation of the capabilities of existing scientific and technological structures and of the measures already adopted

The Government has shown concern for institutional arrangements and has established the following structures:

(a) The Centre for Scientific Research and Study: Opened in 1971, it is modeled on the lines of other national research institutes. It is entrusted with specifically oriented research serving different facets of development. It is autonomous and most of its researchers are full-time staff; others serve on the faculties of the country's universities;

(b) The Higher Council for Science: Established in 1956, this is an advisory body composed of representatives of scientific organizations engaged in basic and applied research, and is active both in the preparation and training of scientists and in the technical supervision and actual implementation of the Government's socio-economic development projects. One of its most important responsibilities is that of promoting the study of science and encouraging scientific research so as to keep pace with international progress and to give socio-economic revival the full benefits of scientific research. The Council

has participated in the preparation of several studies and plans for the treatment of a number of scientific problems and in the science plan that accompanied the general socio-economic development plan. The Council has implemented a number of important projects:

(i) Establishment of a Public Atomic Energy Commission to promote the application of the results of nuclear research in medicine, agriculture, the exploitation of minerals and oil and the extraction of ground water;

(ii) Establishment of a Centre for Marine Studies to promote the development of local capabilities in this field and the exploitation of marine resources that can contribute to the socio-economic development of life in the coastal region;

(iii) Establishment of a Scientific Equipment Centre for the maintenance of existing equipment, the co-ordination of its use, the repair of equipment and the production of equipment that can be produced locally;

(iv) Establishment of a Scientific Periodical Library to assemble scientific reference works, journals and periodicals, and to put them at the disposal of researchers;

(v) Establishment of a Public Environmental Protection and Conservation Agency as an extension of the National Committee on Man and the Environment. Its function is to promote the conservation of natural, agricultural, mineral and acquatic resources and their rational exploitation, so as to safeguard them, to maintain a balance between their depletion and replenishment, and to prevent their deterioration and wastage.

The objective of the Higher Council for Science is to design a plan for scientific advancement in the country that is compatible with the human and material resources presently available. Despite all its efforts, however, the Council has been unsuccessful in carrying out the responsibility for designing

the scientific and technological policy necessary to the country's development plans. Its role has diminished even at the advisory level, and its efforts have been limited to a narrow field. This suggests that the Government may need to think of creating an alternate body with greater powers and superior abilities;

(c) The Council for Higher Education: Established in 1975 together with the statute regulating the universities of Syria, it recommends general policy regarding scientific research at universities and other institutions of higher learning, so as to maintain harmony between research and the country's socio-economic policy;

(d) Centre for Nuclear Medicine: Established in 1971, it studies, diagnoses and treats tumours and promotes the training of medical specialists and graduate students of the medical colleges. Attached to it is a hospital that contains 200 beds for the pursuit of treatment and research;

(e) The Scientific Research Unit at the Medical College. It undertakes studies of chronic diseases such as cirrhosis of the liver and amoebic dysenter. It also attempts to develop the character of the medical research scientist;

(f) Departments engaged in various survey operations (topographical, geological, hydrological ...). A survey is being conducted of all the regions of Syria and the necessary maps and plans are being prepared for various purposes;

(g) Centre for Industrial Experimentation and Research. In operation since 1974, this Centre serves industry in the areas of experimentation and research related to development. In addition to its primary objectives, it undertakes other responsibilities assigned to it such as: industrial documentation and information, economic studies of industrial projects and the role of the Syrian Arab Standards and Measures Agency. The Centre's buildings were constructed by local engineers. UNESCO and UNIDO co-operated in equipping the Centre and training its staff;

(h) Centre for the Development of Administration and Productivity: Came into operation in 1967 when it organized training courses in public finance and administration, industrial engineering, job evaluation and administrative organization. The ILO is providing assistance in the form of experts and training grants;

(i) The Studies Centre attached to the Ministry of Petroleum and Mineral Resources is active in three fields: oil production, the study of underground mineral resources, and the manufacture of oil by-products;

(j) The Directorate of Agronomic Research in the Ministry of Agriculture and Agrarian Reform undertakes research aimed at the development of farming and raising agricultural production in the country.

3. In order to co-ordinate the activities of the different research centres, avoid duplication, supply the requisite human and material resources, provide uniform supervision, secure Arab and foreign aid and maintain the widest possible contact with Arab and international scientific efforts in the different fields, the Government has undertaken an organizational study resulting in the recommendation that the following councils be established:

(a) The National Science Policy Council, to define science policy, promote the use of science and technology for socio-economic development, participate in the implementation of national development plans and promote research in science and technology;

(b) The National Research Council: an administratively and financially autonomous body concerned with formulation of the scientific research and development works plan, the establishment of scientific guidelines for research and development policy for all independent and ministry-linked research centres and other tasks;

(c) The National Educational, Cultural and Scientific Council, which is a technical planning and orientation body attached to the office of the Prime Minister, with long-term objectives in the areas of education, culture and science. A special committee was formed to restructure this Council. It conducted in-depth studies on the matter and incorporated in its assessment the report of the UNESCO scientific and technological policy director. It recommended that the Council be split into two - a Superior Council for Science and Technology and a Superior Council for Education and Culture - and that they be attached to the office of the Prime Minister, either directly or indirectly through the medium of a joint council.

4. Recommendations in connexion with institutional arrangements and modes of co-operation

(a) At the national level

See the recommendations listed under (i), (ii), (iii), (iv), (xviii) and (xix) of section I.P.4.

(b) At the regional level

(i) To support the decisions of the Conference of Ministers of Arab States responsible for the application of Science and Technology to Development with a view to:

- Assisting the Arab States to develop their scientific and technological research potential, train scientists, establish an infrastructure of scientific research bodies and co-ordinate co-operation and the exchange of experts between similar Arab bodies;
- enabling the Arab States (within the context of Arab integration) to enter specialized fields of nuclear science and electronics and achieve mutual co-operation and integration in applied research geared to development;
- strengthening co-operation among the regional organizations operating in the field of science and technology in the service of joint Arab interests and advising on the best method of utilizing international co-operation;
- helping Arab member States to establish scientific and technological research centres in the following fields: energy - food - modern techniques of assessing natural resources - nuclear science - development planning - scientific documentation - electronics;
- the establishment of a special fund to finance these activities.

(ii) The establishment of a regional centre for the transfer of science and technology, the functions of which would embrace everything

related to information and documentation including patents and the registration of licences for their use;

(iii) Support for the Bureau of Co-ordination of Arabization in Rabat to increase its potential in the field of the co-ordination of terminology and support for the Moroccan Institute of Studies, Research and Arabization in its pioneering attempt at typographical reform through the introduction of the voweled Arabic script in publications and the use of standardized Arabic numerals.

B. Modes of co-operation

Recognizing the importance of co-ordination and co-operation among the Arab countries, especially in the field of science, in order to compensate for gaps and deficiencies and to raise the level of achievement; convinced that the scientific and technological challenge that confronts the developing countries and threatens their security and future makes it imperative that they derive the maximum benefit from co-operation amongst them; conscious of the importance of international co-operation in the field of science and technology for the mutual benefit of the countries of the world; convinced that scientific co-operation should lead to joint research programmes, the formation of specialized scientific centres for the provision of the basic requirements of development, and the exchange of expert knowledge among these centres and their counterparts in the world, wherefore, it is recommended:

1. That Arab scientific institutions and research centres co-operate with their counterparts in establishing research programmes of interest to Arab regional groupings; that they encourage Arab co-operation in the field of scientific and technological development and formulate plans for regional programmes that can help meet development problems on a national scale, thereby helping to compensate for local deficiencies and to reap the maximum benefits from international co-operation wherever problems are similar and solutions are appropriate.

2. That the countries of the Third World open their borders to scientific co-operation by exchanging scientific know-how, joining together in the resolution of common scientific problems, and establishing machinery for the exchange of

know-how among those engaged in scientific pursuits, the application of scientific achievements and the co-ordination of efforts aimed at developing the different sectors.

3. That Arab scientific and technological institutions co-operate and participate effectively in international scientific research, study and training programmes organized by the specialized agencies of the United Nations or by international scientific associations, participate in the various scientific conferences organized by international bodies and strive to promote the hosting of such conferences in the Arab countries in view of the advantages that could thus be gained through the increase and development of expertise.

4. That national bodies involved in science and technology co-operate with their international counterparts, with Arab League organizations and with Arab research centres, initiate an exchange of information on their respective activities, organize research on issues of common concern, establish training programmes in specialized technical fields and organize seminars and conferences on scientific and technological topics to be discussed by the above-mentioned bodies.

5. That the Conference strive to formulate a new code of conduct for the transfer of technology, including the closed transfer of know-how in the sphere of transnational corporations within the context of the New Economic Order, with the aim of securing the national interests of the developing countries and limiting interference in their affairs.

6. The creation of a system of international co-operation oriented towards the establishment of more appropriate and effective links among States with a view to the provision of technical assistance geared to the development of national potential within the context of the New International Economic Order.

7. That the objectives of the New International Economic Order be interpreted and analyzed so as to bolster that kind of co-operation that promotes the sovereign political will of each state; for this international conference represents essentially a governmental activity whose aim is to facilitate the placing of science and technology in the framework of creative international co-operation that serves the interests of all States and that places co-operation in a milieu

based on brotherhood and peaceful co-existence thus ensuring that co-operation will be more firmly grounded and more stable.

8. The possibility of regarding the role of the scientifically and technologically advanced nations in assisting the developing countries in the following manner:

(a) Direct participation in bolstering the scientific and technological capabilities of the developing countries through training and the provision of scientific know-how and equipment;

(b) Participation by experts from the developed countries, together with experts from the developing countries, in the identification of scientific and technological problems and in efforts to solve them in laboratories in both the developed and the developing countries.

9. That effective measures be taken to enforce respect on the part of all Member States for the decisions of the United Nations and its different organizations and to withhold from those States that fail to respect such decisions all assistance that permits them to benefit from the achievements of science and technology.

C. Areas of co-operation

1. In the context of neighbouring States and regional co-operation:

There should be a direct exchange of information among neighbouring States by means of correspondence or visits and further efforts must be made to promote these direct contacts. Arab organizations should play a major role in the collection, storage and dissemination of information related to development. We believe it to be essential that this role be increased and carried out in a proper and effective manner. For this reason Syria endorsed the decisions taken at the CASTARAB Conference and proposed the establishment of Arab centres for the formulation of Arab scientific policy and scientific and technological information and the establishment of the Arab Fund for Scientific and Technological Research. Syria also supports the principle of strengthening existing organizations attached to the League of Arab States and reviewing their activities and achievements with a view to ensuring that they achieve their set objectives. These Arab centres will

be liaison offices for the exchange of know-how and the formulation of programmes for co-operation not only between countries of the Arab World but also with countries of the Third World and the developed countries.

2. In the context of United Nations organizations:

In this connexion it should be recommended that more financial aid be directed towards scientific and technological projects related to development, whether general projects related to scientific and technological information, specifications and applied, agricultural and medical research or other projects more limited in scope, at both the regional and national levels. To this end the governing councils of development agencies such as the United Nations Development Programme, the World Bank and the Arab Development Fund should adopt the necessary resolutions to fund the above-mentioned projects and submit a report to the General Assembly of the United Nations in its 1981 session on the measures adopted in regard to this recommendation.