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on

Science and Technology for Development

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Part One

SCIENCE AND TECHNOLOGY FOR DEVELOPMENT

Item I: Selection and transfer of technology for development.

Item II: Removal of the obstacles impeding the optimum application of techno-scientific knowledge and skills to development in all countries and in the developing countries in particular.

The origin of progress and the origin of underdevelopment: the generation and transfer of techno-scientific knowledge.

It must be recognized that modern science and modern technology originated and flourished in the course of the past two centuries in those countries that are now "advanced", and that these countries owed their "progress" to their possession of the fruits of science and technology. It must also be recognized that all these countries would never have arrived at their achievements had the variety of knowledge, information and skills not been available in integrated form within the boundaries of each country and had the possibility of the interchange and transfer of this knowledge, information and skills among the countries in question not been facilitated. In that same period of time, the other countries of the world lived in a state of isolation imposed upon them by conquest and imperial domination in most instances. Only those aspects of techno-scientific knowledge sanctioned by the dominating (advanced) nations were allowed to be transferred to their territory - and only in the quantity, manner and type willed by the imperial power in question.

Even today the basic problem remains in the enormous difficulties that obstruct the attempt to transfer techno-scientific knowledge from the countries that possess it to the countries that do not. Furthermore, many developing countries lack the skilled nationals who are capable of even assimilating advanced techno-scientific knowledge, much less generating new knowledge.

Technological Dependency:

The question of science and technology and their role in socio-economic development, especially in the developing countries, has become the subject of numerous studies which have analyzed the known processes with which techno-scientific knowledge is transferred and applied and the known obstacles confronting these processes. Among these obstacles some are internal(defects in the internal organizations and policies of the developing countries)and others external(negative conduct and transactions of the advanced countries). Together these obstacles constitute the immediate cause of the different aspects of technological dependency evident in the developing countries. This dependency affects the weight they can exert in general international affairs and it creates disturbing imbalances in the distribution of techno-scientific, human and natural resources among the inhabitants of the globe.

Some Internal Causes of Technological Dependency:

There is a general consensus that the conduct of the production establishments of the advanced countries and the conduct of the giant multi-national corporations account to a large measure for the causes of technological dependency. This is evident in the exploitative positions taken by the monopolistic owners of technology during negotiations for the transfer of technology, when they take advantage of technological weakness in some developing countries and the great material wealth of other developing countries. This situation has aroused the world's conscience and it has brought agreement on the urgent need for establishing a New International Economic Order, for applying the convention on the economic rights and obligations of states as defined by the General Assembly of the United Nations, and for the implementation of the Code of Conduct regarding negotiations for the transfer of technology (such that it promotes more equitable economic relations between the developing and the developed countries and between the recipient of technology and its exporter).

Some External Causes of Technological Dependency:

There is also an international consensus that the conduct of the production establishments of the developed countries and the giant multi-national corporations plays a significant role in creating technological dependency. This is evidenced in the unfair positions adopted by technological monopolies at technology transfer negotiations, when they take advantage of the technical weakness of the developing countries, which is coupled, in some instances, by their great financial wealth. This has aroused the conscience of the world and has led to agreement on the necessity of building the New International Economic Order and the Covenant on the

Economic Rights and Obligations of States as adopted by the United Nations General Assembly and the need for adopting a Code of Conduct for technology transfer transactions that will promote more equitable economic relations between the developed and the developing nations and between the exporters and the recipient of technology.

Some Symptoms of Technological Dependency in the Egyptian Experience:

The Egyptian experience with foreign technology transfer has been accompanied by a number of unfavourable influences that can be traced to the inequality of the negotiating positions of the Egyptian side and the side represented by the technology exporter, which is usually a monopoly with world-wide power and influence. In this situation of inequality, the bargaining position of the Egyptian party is bound to reflect a number of weaknesses, among which are:

1. Difficulties in making sound estimations of the price paid for a given technological purchase.

2. Uncertainties regarding the question whether the technology purchased is the best available, as a result of the paucity of information on the technological alternatives available on the world market, their ownership and their true market value.

3. The high royalties exacted by technology exporters in return for the use of their patents, licenses, technical know-how, trademarks and technical services.

4. The unfair terms of technology transfer contracts, which have a harmful effect on the recipient party, such, for example, as the following:

   (a) The imposition of restrictions on the exports of goods (produced with imported technology) to given markets, requiring the sanction of the technology exporter with repect to the scope and size of exportation.

   (b) The requirement that the technology exporter may benefit from the technical improvements that the recipient introduces into the technology imported into Egypt, with no provision for reciprocity.

   (c) The employment of the right of supervision over production and standard specifications as an excuse for imposing unfair terms on the technology recipient.

   (d) The imposition of restrictions on the freedom of the recipient to contact third parties in order to obtain complementary technologies on the free market.

(e) Imposition of restrictions on the quantity and type of production activity permitted the recipient.

(f) The provision of the payment of royalties (usually exorbitant) during the period of licensed production.

5. Entrapment in contracts resulting in the transfer of obsolete or inappropriate technologies.

6. Exaggeration by technology exporters of the need to employ the personnel they propose.

7. Inflation of the cost of technological elements (such as equipment, accessories, expertise, services, materials, etc...).

8. The imposition of monopolistic conditions for dealing with technology exporters, prohibiting the recipient from freely conducting transactions with other parties.

Accordingly, the Egyptian Government, aware of the realities of the international situation in this regard, has conceived a well-studied in-depth framework for directing its national efforts. This framework involves the following objectives:

1. Promoting the political will for change:

This is done by convincing the policy-makers of the country that science and technology and their applications constitute the sound - may, the only - approach available in today's world for accomplishing socio-economic development, and that the ever-increasing participation of local techno-scientific expertise in this area is the country's only assurance that development will be sustained and energized, eventually freeing the country from technological dependency. This conviction must be grounded in the political realities of our contemporary world, in terms of the factors that account for the power, influence, luxury and technological superiority enjoyed by the developed countries, the expectations of the extent to which these advantages will continue into the future and the effect that these realities will have on the relations between the developed and the developing countries.

2. Determining the parameters of the techno-scientific policy of the nation:

The ultimate objective of such a policy is to approach self-reliance in question of science and technology related to the achievement of the socio-economic development of the country. Accordingly, this policy should be closely related to all middle and long term national development planning efforts. If this is to take place the first requirement is for a central organization for national techno-scientific planning (represented in the Academy of Scientific Research and Technology which should work in close co-operation with the organizations responsible for the development planning of the society as a whole. This body should be nurtured so that it grows in competence through the experience of its executive techno-scientific extensions. It should be able to provide technical advice to the Government in all that is related to the technologies it applies in the execution of its major projects. It should also be able to conduct the necessary preparatory studies for these projects and to participate in their implementation, when it has established their soundness and value for the country.

3. Improving Egypt's bargaining posture in technology transfer transactions and in their implementation:

This eventuality depends upon the availability of local expertise with the skill to assure the State success in vertical and horizontal technology transfer transactions.

Practically speaking, technology transfer agreements must be shaped so as to lead to a genuine development and evolution of local capabilities; it must not be limited to the mere purchase of technical know-how and capital goods. This can be done by stipulating that local institutions must participate in providing a part of the requirements of production - by preparing some of the raw materials, exploiting some of the by-products of production or by contributing to the production process itself (e.g., employing as much local labour as their skills permit). The technology exporting companies should be required to set up training centres for the formation of local technical cadres that can in a reasonable period of time replace the foreign experts managing their projects.

The developing countries have an excellent opportunity for mutual aid by exchanging expertise and experience, especially as regards technologies which have proven to be inappropriate or whose terms of transfer proved to be inequitible. Accordingly, there is a special need for the establishment of regional centres for the transfer of technology, where data concerning the experience and the expertise of member states, and technical data on the quality of available technologies and their appropriateness to the needs of development in member countries is compiled. Among the variety of technologies there are bound to be some alternatives that are open and available to all, unprotected by patents in force and, consequently, not liable to exorbitant fees on the part of the companies exporting them.

Egypt's experience suggests a number of practical measures that may lessen the negative consequences of technological dependency and enhance the opportunity for moving towards self-reliance in the field of technology transfer. These measures can be summarized as follows:

(a) The country should foster a realistic conception of the foreign technology needs it considers indispensable, by exploring carefully the areas of deficiency and obsolescence in the different industries and services and determining which cannot absolutely be resolved without recourse to foreign technologies.

(b) Fresh information should be collected concerning innovations and inventions that improve the methods of production the world over. This store of information can provide the government with crucial data on the technologies available in all areas of production and services and the different alternatives available and their sources of supply, thus strengthening the government's negotiating position.

(c) Egypt has the necessary resources for benefiting from the current trend towards the transfer of manufacturing centres from the industrialized countries to selected developing countries where natural resources and inexpensive labour are available.

(d) Agreement should be reached on an optimum formula for technology transfer agreements. This formula should be used during all such transactions. While leaving the Egyptian negotiator a reasonable measure of freedom of action, it can prewarn him of pitfalls and inequitible terms that he can avoid.

(e) Economic integration (or even movement in that direction) among the Arab states may encourage technology exporters to invest in the region (by installing their industries in the different states thereof) on the basis of improved terms, given the possibility of region-wide marketing of their products.

(f) A comprehensive cost/benefit analysis should be made of every technology transfer, wherein the real costs (latent as well as manifest) to the recipient are made evident and the direct and indirect benefits to the country are spelled out.

(g) An effective method should be devised for monitoring technology transfer operations so that the problems that crop up during this application can be analyzed and their consequences evaluated, so as to assure that the contractual obligations of the technology exporter are scrupulously carried out. This monitoring procedure should prove helpful in orienting future technology transfer transactions.

(h) There is, in Egypt's opinion, an urgent international need for the revision of industrial property and patent licensing laws so as to render them more favourable to the objectives of technology transfer operations to the developing countries.

4. Obstacles that impede the optimal application of science and technology:

These obstacles differ in kind and in size from one developing country to the other. The following factors tend to be representative of the situation in Egypt, though their effect is diminishing with time:

(a) Shortcomings in the executive organizations of science and technology.

These are observable in the size and type of the organizations in actual operation, in their objectives and programmes and in the Government policies that established them; in the lack of optimum co-ordination and integration among them and in the absence of the continuity necessary for their effectiveness (cf. item two of the agenda).

(b) Shortcomings in the organizations that provide techno-scientific information.

The inefficiency of these organizations goes back to the lack of expertise and the absence of the modern storage and retrieval equipment that give scientists and researchers immediate access to the latest in scientific and technical knowledge. In addition, the regulations governing the protection of technological innovations brought about by R & D organizations and by international corporations sanction the monopolization of technological knowledge. Accordingly, it is important that these regulations be amended so as to make technological knowledge more freely available to the developing countries.

(c) The weakness of the links between scientific research organizations and the parties that benefit from the application of their research - which does not help the scientist and the producer to understand each other's problems and objectives. Thus it is that many scientists in the country are engaged in research and issues that are not directly related to current problems of production and to the country's development plans.

(d) The brain-drain. This takes different forms: migration to the developed countries or to other developing countries in search of material gain, moral and social satisfaction or both; migration within the country from R & D sectors to sectors that do not involve the challenge of scientific effort or ones that offer more substantial personal rewards.

(e) Lack of a national consensus on the importance of R & D activities: This is perhaps the major practical factor that accounts for the hiatus between developing countries like Egypt and the more advanced countries. Egypt and the other developing countries have to increase their expenditures on experimental R & D efforts so as to bring them closer to the expenditures allocated by the developed countries (around 3% of GNP).

(f) Shortcomings in techno-scientific manpower: This shortcoming is evident in Egypt despite the fact that Egypt contains the largest techno-scientific manpower resource in the Arab World. One aspect of this shortage is the disproportion between the number of research scientists and the number of research assistants in the R & D community. Accordingly, the number of R & D personnel has to be augmented beyond the present ratio of 500 per 1,000,000 inhabitants to 1,000 per million by the year 2000. This can be achieved by resolving the brain-drain problem, by encouraging university graduates to work in the R & D field and by augmenting the pool of research auxiliaries (technicians and semi-technologists).

(g) General lack of appreciation for science and technology and its poor application to every-day life.

There is an absence in Egypt of instrumentalities for popularizing the application of scientific and technological knowledge among the general population and even among school children. The result is reflected in the negative attitude of the population towards its scientists, in the lack of enthusiasm for R & D related careers and in the inability of the society to apply modern science and technology to every-day affairs, even when the actual knowledge is available. Among the remedies to this situation are the promotion of science museums, science programmes on the mass media, and manual crafts, modeling and other "scientific" hobbies among the youth (the materials for which should be made available at prices within the reach of most citizens).

Proposed remedies for these shortcomings:

The following measures are proposed for remedying these shortcomings within the Egyptian context:

1. Identifying long-term indicators of the crucial areas in socio-economic development in which science and technology can play an effective role.

2. Identifying the aspects of technological advancement and techno-scientific planning relevant to the requirements of building and sustaining socio-economic capabilities and assuring their development.

3. Designing specific R & D programmes that contribute to the achievement of technological advancement and the implementation of technological planning.

4. Utilizing scientific methods for forecasting and planning techno-scientific research activities, for assuring that all available resources are mobilized effectively and that favourable conditions are created for drawing the scientific community into development activities and involving them in major national issues.

5. Promoting the integration of development planning and techno-scientific planning and securing co-operation and co-ordination among the different sectors.

6. Promotion of the construction of the techno-scientific infrastructure (giving equal attention to the vertical and the horizontal dimensions) without which the effectiveness and capability of R & D activities cannot be assured.

7. Bolstering the national organization responsible for techno-scientific policy-making by passing the required legislation and by shielding it from sudden and frequent changes and by providing it with stability for reasonable periods of time; organizing research activities in the country on a centralized but functional national basis, so as to avoid dispersing the scarce resources available; promoting research on a contractual basis and emphasizing directed research and research that involves the participation of its beneficiaries.

8. Co-ordinating and assimilating foreign technology transfer and adaptation operations through the consultation of the central science and technology organization and in accordance with specific laws to be adopted by the country's legislature.

9. Self-reliance in technological development must become a national objective, especially in technologies related to rural development and handicrafts and in the priority areas designated by the Government in the different sectors of the economy - such as the production of cotton,

foodstuffs and medicines, the generation of energy, the mineral industries, machinery and construction, and transport in its different modes.

10. Utilization of modern methods in the financing of R & D programmes, allocating thereto a specific and growing percentage of the national income, clearly itemized in development budgets or in the annual budget.

11. Speed and quality is required in the training of scientific personnel, their auxiliaries and other employees in techno-scientific research; emphasis should be placed on the provision of cadres in the applied and the semi-industrial fields and in the areas of production and services.

12. Greater encouragement of women's education and the provision of technical education for women.

13. Young researchers, engineers and technologists need to be involved in the national effort.

14. Need for finding realistic solutions to the brain-drain problem, such as through the establishment of a new system of appointments, promotions and salaries based on the concept of incentives and rewards and containing social benefits and health care. The centrifugal forces in the society which drive scientists and technicians to emigrate and the centripetal forces which are located in the neighbouring Arab countries and in the developed industrial countries need to be balanced.

15. Attention should be paid educational services such as the documentation and information sector, educational equipment and its maintenance, patent offices, technological data banks, standards and measures, and production quality control services.

16. Scientific and technological abstracts should be made available and translated into Arabic so as to facilitate their utilization by all levels of society.

17. Deeper awareness should be cultivated of the crucial role that science and technology play in determining man's future and in energizing the resources of nations and peoples.

18. The internal political front should set clear and specific programmes for the application of science and technology for development. Groups and

individuals should be permitted to participate in all sectors so as to generalize scientific and technical training. The dissemination of information should be increased annually so as to promote purposeful development in the technological structure.

19. In the area of bilateral co-operation more effort should be made to take full advantages of the opportunities presented, and even to create such opportunities, for foreign investment through the open door policy. Full and effective advantage should also be taken of the technical assistance offerred by international and regional groupings and organizations.

20. At the Arab and the regional levels there are also plenty of opportunities in the sectors of science and technology for co-operation, co-ordination and integration wherein all parties involved benefit equally.

21. Encouragement of all the developing countries to work together in areas of technical co-operation, to concentrate all their techno-scientific energies in combined enterprises and to exchange expertise.

22. Egypt should act jointly with the developing countries to concentrate on a number of R & D projects on the international level, in whose implementation the developed countries and their research centres are invited to participate - such as in the exploitation of sea and ocean resources, the production of energy from non-traditional sources, the horizontal expansion of agriculture and the reclamation of arid and semi-arid regions.

23. The international development organizations created by some of the developed countries should be encouraged to offer their technical and financial services and their loans on favourable terms, without specific political conditions, and without exploiting the resources of the developing countries.

24. Regional and sub-regional organizations, whether private or governmental, should keep up with advances in science and technology the world over, and should be fully cognizant of their role in the present for the future.

25. There is a need for forming outstanding leaders in science and technology capable of mobilizing the scientific community for the assimilation of changes and advances in science and technology and for the maximum application of their fruits to the resolution of the country's problems and the elevation of its standards.

Item III: The means for promoting the integration of science and technology with socio-economic development.

Item IV: Modern science and modern technology as means for overcoming obstacles to development.

Introduction:

The Arab Republic of Egypt has passed through discouraging social and economic circumstances. This situation has persisted to this day, and is expected to continue for a number of years until its causes have been removed and it has become possible to control it. The causes of this crisis are directly related to numerous internal and external factors; in the main, however, they can be identified as follows:

(a) The conditions in the country created by the succession of wars over the past thirty years.

(b) The explosive growth of the population.

(c) The measures that emanated from the governments' policies over the past twenty years in their effort to reform social and economic life.

General strategy for socio-economic development:

In the past few years in Egypt a new conception has evolved of the outlines of a general strategy for socio-economic development needed for the speedy and decisive rectification of the present situation and for the preparation of the country for meeting the challenges of the year 2000. This conception is founded on the basic targets defined in the "October Paper" and involves the following:

1. Reform of the course of the economy and treatment of the economic and social aberrations that have threatened the progress of the system.

2. Acceleration of socio-economic development beyond the rates so far achieved.

3. Preparation for Egypt of the year 2000, so as to secure the infrastructure for progress in the coming generations.

4. Internal and external liberalization of the economy so as to provide all the needed security for private and public capital.

5. Strengthening, orienting and stimulating the public sector so as to enable it to lead the development process.

6. Building the Egyptian individual and providing him with the necessary elements of social, scientific, cultural, sanitary and economic development.

7. Acceleration of the pace of progress towards a culture based on science and faith.

8. Securing the open society with the enjoyment of freedom, in which each citizen feels assured of his present and future well-being.

The Government has prepared a comprehensive socio-economic development programme embodying for the present a Five-Year Development Plan (1978-1982) which is now being implemented in every service of the State. The purpose of this programme is to implement the following objectives in a manner that takes current conditions into account:

1. To accelerate the rate of development (to an average of not under 9-10% per annum), as rapid development has become a matter of life or death for Egypt and as victory in the battle for development will determine all the prospects of the Government in the forseeable future.

2. Correction of the course of the economy which has undergone numerous deviations to the detriment of the recent past. This can be done through the speedy treatment of the problems of replacement, renewal and sound administration in the basic services, in production units and in the service sector.

3. Reinforcing the capabilities of the Egyptian economy so as to give the Government the flexibility permitted by food security.

4. Achieving optimal exploitation of the nation's three economic sectors (public, private and co-operative), while opening the way for Arab and foreign investments in the light of the Government's open door economic policy.

5. Provision of the political and social stability needed for rapid economic development. This will encourage foreign and governmental investment and will help diversify the range of economic co-operation with the Arab countries, thus bolstering the strength of the Arab community which is dependent upon the firmness and the soundness of its economy.

6. Welcoming, encouraging and guaranteeing foreign capital and at the same time, orienting it so that it supplements local technological capabilities with the advanced technologies required by the country's projected take-off.

7. Bolstering Egypt's open door policy as a means for the country to obtain the most modern technologies and to acquire new capabilities for production, thus meeting its domestic needs and generating a competitive export economy.

General Strategy for Scientific and Technological Research:

The National Five-Year Plan (as with all the plans projected for implementation up to the year 2000) includes projects that in their essence require the application of technology for achieving the development desired. The Plan was designed by the Government to keep step with techno-scientific efforts, taking into account the manpower elements that need to be trained, the techno-scientific institutions that need to be created and the work programmes and methods that need to be followed during the coming stage in which the Five-Year Plan is to be implemented and during the period of later longer-term plans. The Government has begun preparing the intellectual background against which the techno-scientific plan is to be based, situating it in the conceptualization of the strategy for scientific research in the coming stage prepared by the Academy for Scientific Research and Technology. This strategy includes the following measures for achieving the integration of science and technology with techno-scientific research efforts:

A. Respect for reality in techno-scientific research efforts:

The purpose of this guideline of the new strategy is that the country's techno-scientific research organizations should revise their calculations, and reassess their priorities and their activities, selecting those research methods and those areas that seem to be the most appropriate:

(a) Where the practical benefits seem to be optimal for the country in its present conditions and readily achievable, the matter should be given top priority.

(b) Where the practical benefits are uncertain, but the need justifies the attempt and no alternative is in view, the matter should be given relatively high priority.

(c) Where the benefits appear to be uncertain and call for preliminary research, the matter can be put aside for the time being or it can be dealt with in the category of pilot and exploratory research.

This is a frank invitation to the specialized, full-time scientific research institutions (as opposed to the universities and other educational institutions) to direct their research to problems which have a concrete effect on society and that benefit directly the party in whose interest the research is conducted, i.e., the Egyptian individual. It also invites the pursuit of research methods aimed at the imitation of ideas and products where imitation is a plausible alternative to the importation of goods or the importation of the technology needed for producing them.

B. Cultivation of a sense of commitment within the local scientific research community:

The Egyptian experience in the field of science and technology indicates that the size and quality of the contributions made by members of the techno-scientific community proved to a large extent to be a function of the specific relationship between the individual scientist and the scientific institution to which he was attached. This was observable in all institutions, both those that combine higher education and research (such as the universities) and those that specialize in scientific research and experimental development only (such as the National Research Centre and the numerous research centres attached to the different ministries). It has become clear to the Egyptian institutions responsible for specialized, full-time research and experimental development that the scientific publication approach is not the best approach to the production of the kind of research that is directly related to the development process and that it is not the best standard for evaluating the achievements of scientists and technologists responsible for this kind of research. The alternative is revealed in two approaches pursued by the Egyptian scientific community in its contemporary experience:

(a) The contractual system linking the researcher with the institution where he works is being consolidated. The contract defines the responsibility which the researcher (or research team) is willing to undertake and bring to fruition in return for the provision by the institution of all the material requirements of implementation and in return for the application of a system of varied incentives and rewards to motivate researchers to greater effort.

(b) Wages and compensations laws are being enacted to provide scientists and researchers and their assistants working in R & D establishments all over the country (other than universities) with material compensations for their efforts that are not related solely to their publication record and formal academic degrees.

C. Consolidation of the bonds between R & D organizations and production establishments:

Everyone involved in the area of governmental science policy and organizational management are agreed that one of the serious obstacles to socio-economic development in the area of the application of science and technology in the country is the serious weakness of the links connecting R & D organizations with production and service enterprises in the country, as represented in the tenuous transactions that characterize this relationship today. There is some disagreement as to the causes of this weakness (historical, organizational, psychological, etc.). Responsible parties on both sides, however, hardly disagree on the fact that the basic remedies for correcting the situation are available as regards the methodology required and its instruments.

Numerous attempts have been made and much effort has been expended in the different sectors of the country to confront this problem (which is common to many developing countries). The following two examples illustrate an aspect of these efforts.

(a) Centre for the Development of Engineering and Industrial Designs:

This institution, which is attached to the Ministry of Industry, was established as the fruit of co-operation between the Egyptian Government and the United Nations to supply the missing link between

scientific activity and industrial production. By the nature of its activities, the Centre is closer to the latter, as its primary concern is with studies that are directly linked to production. Its activities include the preparation of engineering production designs, the preparation of prototypes for various products, the establishment of specifications and the planning of the industrial units that perform the actual production. Because of its special purpose, most of the tasks assigned to this Centre have their origin in the production sector itself.

(b) Organization for the Promotion of Inventions and Innovations:

This organization, which is attached to the Academy of Scientific Research and Technology, is still in the process of formation. Its purpose is to provide a direct link (missing at this point) between the laboratory and the application of its findings to industry.

D. Reinforcing the field services provided by the R & D community:

The strategy whose outlines have been drawn up by the Academy of Scientific Research and Technology puts the emphasis on deriving the maximum benefit from the scientific and technological knowledge that is publicly accessible in the developed countries. It also encourages imitation as the shorter and the quicker path to results whose workability has been demonstrated.

In order to make basic principle workable the scientific research community must assume responsibility for providing industrial workers with the last and the latest technological knowledge of scientific value to production.

To do this, of course, it is necessary to have access to the sources of existing technological knowledge and the different alternatives available for the performance of the same task, and it must be possible to test the technology, evaluate its performance with local raw materials and local implements, and adapt it if necessary, without neutralizing any special qualities it may possess, so as to make it compatible with local conditions.

E. Maintaining balance and integration between the basic and the applied sciences and the human and the social sciences:

It should be mentioned here that this strategy does not call for concentration on applied research (and the resort to imitation, whenever circumstances permit) to the detriment of basic research. What is encouraged is the maintenance of a balance between the proportion of effort and expenditure allocated to basic research and that allocated to applied research. It also assigns an essential role to the humanities and the social sciences in the socio-economic development process in Egypt. The application of technology has an immeasurable effect on social behaviour as also on the possibility of polluting the environment.

The role of the basic sciences:

Until recently research in the basic sciences has had the lion's share of research efforts at Egyptian universities and at the research centres attached to the ministries. Even at the National Research Centre, which specializes in, and devotes itself entirely to, research, most of the research actually conducted was in the basic sciences. This situation is normal for the universities (where academic freedom is exercised and where upper echelon cadres and experts are educated); it is tolerable at science and technology centres (where cadres are educated in self-development); but it is neither normal nor tolerable for basic research to occupy the greater portion of the research efforts of the R & D institutions of the country (including the institutes of higher education), especially in the present crisis situation. The transformation has already begun with seriousness and rapidity at the research centres attached to the ministries. For example, at the National Research Centre it is expected that by 1980 the distribution between basic and applied research will be 20 : 80.

The role of the humanities and the social sciences:

All human societies with a long history of civilization, such as Egypt, have been influenced to varying degrees by modern technology, and in most instances the degree of influence was substantial. Everything now indicates that as a result of the introduction of new technology new kinds of social change shall take place in Egypt in the coming years.

Many social thinkers in Egypt do not hesitate to express their wariness of the consequences of such changes on the behaviour of the population, on social customs, religious values and other aspects of the psychological and moral composition of the people. Accordingly, humanists and physical and social scientists are all agreed on the need for exhaustive research into the problems and the conditions that are likely to accompany the application of modern technology among the different categories and classes of Egyptian society. This research should be conducted not only for the academic objective of identifying the variables involved, but also for the practical objective of recommending the preventive and remedial measures that need to be taken at the different stages of development that are accompanied by the introduction of modern science and technology.

For example, one of the problems currently occupying the Government (on whose behalf the Academy of Scientific Research and Technology is conducting a number of special projects) is that of rural development. Rural development threatens to transform the entire life-style of rural communities whose pattern had not changed measurably in thousands of years. These changes will be brought about when technologies are introduced that depend upon the wide use for the first time of electric power thus increasing the physical energy available to the farmer, the members of his household and even his livestock. Drastic social and behavioural changes in the life of the individual, the family and the community of rural Egypt can only be expected when rapid changes are introduced into a social pattern linked to agriculture that has witnessed little transformation in thousands of years.

F. Increased dependence upon modern science and technology:

Those responsible for socio-economic development in the country are agreed that the major present and prospective problems facing Egypt can be reduced to the four below:

(a) Shortage of food.
(b) Shortage of construction materials for expansion.
(c) Shortage of the requirements for raising the standard of living above subsistence level.
(d) Explosive increase of the population (which is a factor that exacerbates the other three problems).

These experts also agree with their counterparts in science and technology that all the material problems of humanity (or most of them) can be controlled through the solutions offered by the known achievements of science and technology and by the tremendous inventions anticipated by the basic sciences and from their technological applications. In fact, efforts are currently under way in this regard in Egypt, such as in the application of remote sensing devices and in the study of non-traditional sources of energy, particularly solar energy. There are also several projects for the application of advanced technology to the control of water resources and to their protection from pollution.

There are ample opportunities for the application of modern science and technology to the resolution of the crucial problems facing Egypt. These opportunities call for the introduction of improvements in many of the R & D and production organizations of the country. They also call for the full utilization of the services of experts from the developed countries and from international organizations.

The following by way of example only are a number of areas in which modern science and technology can serve effectively the development of Egypt:

(a) Introduction and breading of improved strains of flora and fauna.
(b) Technologies that help economize on irrigation water and facilitate counselling on its optimal utilization.
(c) Technologies that help decrease agricultural crop losses at the pre - and post - harvest stages.
(d) The use of non-traditional sources for providing food for both humans and animals.
(e) The optimal use of electrical energy for improving the standard of living and productivity in rural communities.
(f) The use of organic wastes of all kinds.
(g) Exploitation of solar and wind energy and alternate sources in the development of outlying regions.
(h) Application of the most advanced technologies to waste treatment (including recycling).

(i) Application of the most sophisticated knowledge available to the utilization of the unlimited resources of desert sands in the construction industry. Developing the technology of construction so as to speed up the constructing of buildings.

(j) Development of modern methods for forecasting future needs, for comparing alternatives and for encouraging participation in decision-making.

(k) Development of modern methods for storing and utilizing data.

Part Two

INSTITUTIONAL FRAMEWORK AND NEW FORMS OF INTERNATIONAL CO-OPERATION FOR THE APPLICATION OF SCIENCE AND TECHNOLOGY

Item I: The construction and development of an institutional framework for science and technology in the developing countries.

The importance of the role played by formal organizations devoted to science and technology in the socio-economic development of the country is well understood in Egypt. This awareness has developed through several stages, as follows:

1. Science and technology, despite the variety of origins and objectives, are no more than the products of human effort and any human society can contribute to their development.

Accordingly the popular conception that these activities are the exclusive property of the peoples of the developed countries, and that our role is limited to that of importing them into our countries whenever we need them for implementing the construction and production projects of development programmes must be changed.

2. Any decision that the Government makes should be a response to the awareness of the unfavourable consequences of isolating of the country's science and technology organizations and its production and service organizations from each other. Upon generating the political will to effect the changes desired, the Government should set about transforming

the local conception concerning the role of science and technology in the life of the nation so that it is realized that this role includes a place in the everyday life of individuals and families as well as in the behaviour of the national institutions that have the responsibility for selecting productive technologies and establishing them in the country.

3. What is required is not a mere bureaucratic gesture but a serious policy decision that is far-reaching in its objectives, and complex in its substance. It should lead to the transformation of the organizations active in the country, the modification of the Government's spending policy vis-à-vis these organizations, the determination of their responsibilities, and the creation of strong links among them, commensurate with the size of the transformations envisaged and the importance of the consequences accompanying them.

4. The transformation envisaged, in brief, requires the establishment of national organizations that are devoted to science and technology and to progress and development therein, and that are capable of acquiring an ever increasing capacity to contribute effectively to the socio-economic development of the country.

While the assistance that can be acquired from international organizations in this field is substantial, it should be emphasized at the same time that the crux of the matter is in the willingness of the country to rely on its own efforts.

5. The construction of national organizations for science and technology whose aim is to support socio-economic development requires the establishment of organizations specialized exclusively in this field. These organizations are of two kinds:

(a) A central organization for techno-scientific planning connected to or emanating from the Government's socio-economic planning mechanisms, and especially its middle-term and long-term programmes. Its activities should be oriented by a national techno-scientific policy, designed especially to meet local needs. It can be expected to consult and co-operate closely with the development planning organizations of the country.

(b) A network of scientific and technological operations organizations is needed, comprising higher education institutes and organizations for the training of researchers and technicians to different levels of competence for the purpose of staffing a corresponding number of research centres devoted to R & D operations closely linked to national development efforts.

6. Institutions responsible for scientific and technological operations are like living entities in that they are created, they mature and they develop and their education can be sound or faulty. Accordingly they must be nurtured and assisted in their first steps; later, their performance must be evaluated. It might be wise for these institutions to begin with research activity similar to that conducted at universities so as to develop their scientific groundwork and so as to permit the training of the needed research and specialist personnel. At the second stage, they can move on to their major national task of applying science and technology to the liberation of their country from technological dependency.

7. Because of the nature of the function assigned techno-scientific planning and performance organizations and the importance of their mission, upon which the future of the whole society depends, the decision-makers of the Government should give these institutions the security that guarantees their growth and development by providing them with continuing support and the prospects of long term stability. Repeated administrative changes, the play of administrative arbitrariness, the dictation of unsound decisions by the authorities - these practices which are observed in some of the developing countries are among the major factors that sabotage if not kill the development and advancement of techno-scientific institutions. They cause them to lose faith in their mission and in the ability of the authorities in the country to make sound judgments.

8. The Egyptian experience in this area deserves to be described. There are in Egypt twelve techno-scientific institutions at the university level, which vary in size, the type of specialization offerred and maturity. Then the Egyptian experience moved on to include specialized R & D institutions - with the National Research Centre and the numerous other institutes and specialized centres that were established. In addition, there are the institutions for techno-scientific planning that operate at the central level in the country, culminating in the Academy for Scientific Research and Technology.

9. Based on the Egyptian experience, it is possible to draw a picture of the functional objectives expected of science & technology institutions, depicting the increasing levels of sophistication expected them with the passage of time and with the benefit of their own growing experience:

(a) These institutions should embody the sentiments of the nation which needs their help in obtaining modern techno-scientific accomplishments, in the generalization of these accomplishments, in their evaluation, and in the assessment of the national need for them. This is at first a negative position for all it requires is observation and follow-up activities.

(b) Foreign and local companies undertaking investment projects involving the transfer of advanced technologies should be able to resort ever more frequently to these institutions as a source of recruitment of technical administrators instead of importing all their expertise from abroad alongside all their production materials and equipment.

(c) These institutions should play a consultative role to the officials and the decision-makers responsible for technical and technological decisions regarding the transfer of technology.

(d) They should participate in the formulation of the country's socio-economic development plans providing the scientific tools for comparing the different alternatives available for selection.

(e) They should conduct experimental research supporting investment projects in the country that require the import of technology under contract with foreign companies so as to make sure that the imported technology is appropriate and its technical properties are sound before the contract is signed. They should research any reasonable possibilities of the utilization of local raw materials and intermediate products in projects in the place of imports, the best possible use for by-products and residues left over from main-line production and the compatibility of each project with the local environment (so as to avoid pollution). They should estimate the economic compatibility of each project with local conditions (labour: capital density) and with other projects on the national scene.

(f) These institutions should be able to make progress in the direction of self-reliance and liberation from technological dependency by inventing technologies for the production of goods and services (which would have to be imported) through local efforts, beginning with the simple and the basic, and with technologies whose ownership does not pose legal problems and progressing to more complex inventions; beginning with imitations of foreign products, they should pass on to the stage of additions and improvements, and finally to that of original invention.

(g) The practices of these institutions should progressively link the efforts of their scientists with the results they produce through the increased application of the contractual system.

(h) The executives of these institutions and their personnel must realize that the evolution of the responsibilities of these institutions must be achieved in determined periods of time, so as to enable the scientific community to cath up as speedily as possible with their colleagues in the developed countries.

Item II: Research and development in the developed countries concerning the major problems of the developing countries.

The Egyptian Government would like to express its viewpoint - based on its own experiences past and present and its assessment of the results of these experiences - concerning the new format it wishes to apply to its relationships with the industrially developed countries and to the variety of techno-scientific activities that call for co-operation - including activities that are implemented bilaterally as well as special and concerted activities that take place in the developed countries for the purpose of promoting socio-economic development in Egypt.

A. Assistance to techno-scientific research conducted in Egypt:

The comparative evaluation of the research conducted under the aegis of specialized research teams in many Egyptian institutions which are financed in whole or in part by scientific research institutions of the developed countries and to whose implementation the latter contribute reveals that some research has no connexion with the crucial problems

connected with the essentials of life in this society (in brief: the problems of food, housing, public health and population growth), but represents a scientific luxury that is not in keeping with the urgent needs and national priorities of the country. Such research projects are selected because research institutions in the developing countries choose them and give them priority for financing, selecting them for their compatibility with and complementarily to their own research priorities. The Egyptian side agrees to undertake such research because it fails to see alternatives in more pertinent, more functional, and more beneficial projects in terms of Egyptian realities; because some of these projects are accompanied by material benefits to Egyptian industry (modern equipment and machinery) or to the Egyptian researcher (incentives and compensations); and because the Egyptian researcher lacks confidence in the power of national research projects that concern the Government to attract the interest of his research counterparts in the developed countries and convince them to participate in them and to recommend them for financing.

A practical solution to this problem has developed over the past few years: One of the great powers (with which Egypt co-operates has made its support conditional upon its thorough conviction (based on prior investigation) that the project is beneficial and is related to the essential needs of Egypt's development and that its investment embodies the best chance and guarantee of serving the interests of the Egyptian individual. Egypt considers this a sound approach and recommends that it be followed in all techno-scientific research projects which are jointly conducted by Egyptian institutions and their counterparts in the industrially developed countries.

B. The education and training of Egyptians in the developed countries:

In recent years, the number of universities and institutions of higher learning in Egypt has increased. Many of those universities have developed the capability for conducting scientific research to the point where they can qualify their students for master's and doctor's degrees in most disciplines, thus filling their own faculty staffing needs. Some of them have even become capable of helping newer and smaller universities

by training their teaching staff for them. The Government, accordingly, is beginning to restrict sending students abroad to the new disciplines that are not represented sufficiently in the departments of Egyptian universities. The Government is also encouraging the sending abroad of individuals who are not employed in university teaching or scientific research, such as the cadres of specialists and experts, technicians and various research auxiliaries, for the purpose of acquainting them with the latest of technological accomplishments and applications and giving them the opportunity to pick up new expertise.

The assessment of these training missions indicates that their efficacy can be improved if the Government takes the following into consideration in the future:

(a) The participation of Egyptian scientists in the R & D research projects that are conducted in the developed countries, should be promoted even when these projects are linked to the applied industrial and agricultural enterprises of the host country, whether their objective is the treatment of problems general to the developing countries or only those aspects that are specific to Egypt, including intermediate technology projects appropriate to the environment and the conditions of the developing countries.

(b) The opportunity should be given to those who are sent on training missions to work directly in the fields of industrial and agricultural application and production. They should be given access to the details of the new methods used in the management of production enterprises and in the production process itself.

C. Modern methods of organizing and managing national R & D institutions:

Undoubtedly one of the most important factors that accounted for the success with which the advanced industrial countries developed their societies was their ability to organize effectively their R & D efforts and to mobilize them into an effective instrument of national policy. This effectiveness is most evident in governmental establishments and in the corporations that have bureaux which measure their effectiveness in terms of the value of the

returns derived from the accomplishments of science and technology. It is precisely in this area that the developing countries have experienced their greatest shortcomings, and Egypt was no exception. Thus the kind of assistance that would profit Egypt directly and specifically would be to energize its national R & D institutions with projects for developing the performance capabilities of the country's central research organization.

D. R & D activities in the advanced industrial countries:

In Egypt many obstacles stand in the way of socio-economic development, some of which deserve radical treatment in terms of basic scientific research and experimental development . Some of these problems are extremely crucial, extensive and fraught with consequences for the present and for the future. Upon their resolution depends the question whether the country is to move forward or slide further backwards, in fact, the life or death of our society. These problems can be outlined as follows:

(a) Shortage of food.
(b) Shortage of the elements for expansion of construction.
(c) Shortage of the requirements for raising the standard of living above subsistence level.
(d) The explosive increase of the population (which exacerbates the other three problems).

Accordingly, the kinds of R & D activities that take place in the advanced industrial countries and that can benefit the developing countries in general and Egypt in particular are precisely those that deal with the issues outlined above. The following are some instances of what is required of research in this regard:

(a) Food shortages:

This problem is common to all the developing countries. What is required of research in the developed countries in this regard is a more concentrated effort of the basic and the technological sciences to develop agricultural and animal resources and to improve the quality of rural life. This should include thorough research in the the following areas:

(i) Research on the problems of desertification.

(ii) Treatment of the problem of the salinification of agricultural soil.

(iii) Modern methods for economizing water and optimizing its use.

(iv) Optimizing fertilizer use (traditional fertilizer plus the development of new types of fertilizer).

(v) Development of improved strains of agricultural crop (in terms of productivity and resistance to deseases and insects).

(vi) Introduction and cultivation of non-traditional plants (from among what we currently considered wild plants), for use as food or for industrial uses, and especially for planting in arid and semi-arid soil.

(vii) Research for the discovery of new and more effective means for combatting plant deseases and harmful parasites, especially those that attack essential food crops.

(viii) Research and development of new and more effective methods for combatting the major cotton deseases.

(ix) Research on desalination and use of brackish water for irrigation.

(x) Development of tools and equipment for farming and for implementing pre - and post - harvest operations. These tools should be simple in design, efficient in performance and low in cost.

(xi) Development of the technology of transport and storage so as to reduce pre - and post - harvest losses; development of more effective means of combatting the deseases that cause these losses.

(xii) Development of means for the optimum and maximum utilization of agricultural refuse and animal manure.

(xiii) Development of new and improved breeds of animal for better meat, milk and poultry products.

(xiv) The investigation of "non-traditional" animals and birds for possible use as food.

(xv) Redoubling efforts for the treatment of the deseases endemic among Egyptian farm animals.

(xvi) Development of special and advanced compounds of animal and poultry fodder from local agricultural and industrial waste reinforced with chemicals for increasing meat and milk productivity.

(xvii) Exploring intermediate technologies for improving life and distributing production in rural communities, such as: rural home construction, generation of energy with small units at the level of the village or the farm, small industrial production units, units for the limited processing of field crops, utilization of the wastes of the field and of animals and humans.

(b) Shortages in construction materials:

This is another problem that Egypt shares with the rest of the developing countries; but in Egypt it assumes the proportions of a severe crisis. The role that R & D can play in this area may include the following:

(i) Development of new building materials from the cheapest materials available in the country, such as the use of desert sand lime and clay for the innovative and simplified manufacture of bricks thus dispensing, as much as possible, with centralized industrial plants and reducing costs.

(ii) Development of new designs for the construction of high production, limited cost housing units on non-agricultural land.

(iii) Development of appropriate standardized specifications for housing construction, providing the industry with standard parts and finishings to speed up construction.

(iv) Development of new binding agents and substitutes that depend on available materials.

(c) Shortcomings in the requirements for raising the standard of living above the subsistence level:

Health considerations come at the top of the requirements of Egypt for lifting the standard of living of its population above the subsistence level.

Bilharzia constitutes Egypt's most extensive health problem as it afflicts the citizen throughout his productive life and has a general effect of reducing the productivity of the whole society.

It is unfortunate that the scientific research that has been conducted in Egypt and elsewhere in the developed countries has not yet discovered the definitive solution to this problem; nor does a solution seem to be anywhere in sight. A definitive solution involves the sound and extensive application of health measures and over a wide territory, with high efficiency and reasonable guarantees against the possibility of relapses.

The general opinion is that the decisive solution of the problem of bilharzia - other than the known social treatments - using the capabilities of modern scientific research, may consist of the discovery of an agent for exterminating the snails which transmit the desease; the discovery of a medicine that cures it completely and decisively; or the discovery of an effective immunization as a preventive measure. This last is a possibility in which Egypt places much hope; but little results have so far been achieved.

(d) Explosive population increase:

There is no need for Egypt to insist on the dangers embodied in the problem of the population explosion, for this is the most serious problem facing the developing world - and perhaps the whole world - today. It is undoubtedly the problem which causes and exacerbates the food and housing problems of Egypt. In its national paper Egypt can only urge that efforts be redoubled to find moral and effective means of birth control devoid of harmful side-effects (to the health and to the psyche), that are simple to employ and low in cost. Investment in this type of research deserves encouragement and expansion so that a decisive resolution can be found to this problem - which threatens the inhabitants of this planet and their standards of life.

Item III: The means of exchanging information and expertise on science and technology for development.

Present status of scientific information in Egypt:

Scientific information activities began in Egypt as a result of the efforts of a variety of institutions and in the absence of any planning mechanism to relate and assist them at the national level. In 1954 the National Research Centre, which was still in its early days, established a techno-scientific intelligence department with the task of disseminating all kinds of information of interest to researchers and of establishing permanent contacts between this Centre and other institutions in and out of the country. This department has successfully acquitted its responsibilities within the limits of its terms of reference. Later this department evolved into a National Information and Documentation Centre whose task was to assist in spreading the scientific resurgence in Egypt and in the Arab World and to keep it in permanent close touch with the advanced countries that have enjoyed a long-term influence in the fields of science and technology, irrespective of their particular economic and social system.

The National Information and Documentation Centre does the following:

1. It seeks to compile as many scientific and technical documents as possible and to make them and their contents known to all educational and industrial institutions. To serve this purpose the Centre founded a library which has compiled about 27,000 books and 2,000 periodicals, among which numerous abstracts. The Academy is also establishing a science library to complement that of the Centre.

2. It seeks to collect the scientific production of the Arab World, to publicize it through the publication in English, French and Arabic of a biannual bulletin of Arab scientific abstracts in co-operation with the Arab League Educational Cultural and Scientific Organization, the Federation of Arab Universities and the UNESCO science bureaux in the Arab countries.

3. It prepares bibliographies and abstracts of research on all scientific and technical subjects.

4. It issues specialized technical bulletins.

5. It undertakes science photography, prepares microfilms and photocopies research works.

6. It publishes scientific periodicals of high scientific standards in all disciplines and in co-operation with organizations and centres abroad.

7. It publishes references and summary records of conferences.

8. It provides an up-to-date information service.

9. The Centre initiated this service in the discipline of pharmaceutical research in co-operation with UNESCO and of numerous researchers in Egypt, the Sudan and Saudi Arabia have been making use of it.

The Centre began to play an important regional role in the field of information and documentation when in October 1962 and in co-operation with UNESCO it sponsored a regional seminar on bibliography and documentation and the exchange of publications among Arabic-speaking countries at which the representatives of nine Arab states and observers from foreign countries and international organizations participated. Again, in April 1963 the Centre in co-operation with UNESCO organized the "Regional Training Committee for Scientific Documentation".

In December 1962 the Egyptian delegation to the Twelfth General Conference of UNESCO which took place in Paris, submitted a project for transforming the National Centre for Information and Documentation into a regional centre servicing all the Afro-Asian countries of the region. This project was adopted and the practical measures for implementing it followed the decision of the International Consultative Committee on Bibliographies, Documentation and Terminology made at its meeting in Paris in March 1963 to send an expert to study the possibilities of implementing it. The expert's report supported the Egyptian viewpoint, whereupon the Ministry of Scientific Research entered the expenses of the first stage of this project into the budget of the financial year 1963-1964... Unfortunately, the project was frozen at this point, not finding any support domestically.

In 1971 the Academy of Scientific Research and Technology was founded replacing the Ministry of Scientific Research. The Academy paid special attention to the Centre in testimony to its faith that the Centre was capable of playing a significant role in advancing the cause of scientific research in Egypt. The Academy also established the Scientific Publication and Information Committee which groups experts and individuals from all the relevant sectors of the country to plan for improving the relationships of co-operation among the different information organizations so as to create a national scientific information system. This Committee urged the need for establishing a national organization for scientific information with the National Centre for Information and Documentation as its nucleus and with the support of legislation authorizing it to supervise an integrated network of information offices and specialized libraries.

The Academy's concern for elevating the quality of work at the Centre is reflected in the provision of the necessary funds for obtaining the sources of information, in the provision of the modern equipment and implements of scientific development and printing, in the elevation of the standards of its scientists by sending them abroad for training in modern information methods. The Centre was authorized to acquire a modern printing press, which is being completed, in order to start printing science materials. This is one method of exchanging information at the international level. The road is open for initiatives and innovations in a number of areas as in the international publication of periodical abstracts such as the one on arid lands.

The Academy has recently obtained Government permission to construct a building for the Centre that is expected to be equipped wit with the most modern of implements and furnishings, including, for example, a computer and advanced communications equipment, so that the Centre can provide its R & D and its production and services scientists with speedy and accurate access to the scientific and technological data they need. The USAID is contributing to this enterprise.

Recommendations:

1. Despite the establishment of the National Centre for Information and Documentation and its existence for many years, it has not carried out its mission as well as was expected. Despite the fact that expenditures on R & D and on national investment projects were constantly increasing this increase was not matched with adequate support for the information services needed for transmitting the Centre's results to potential users. Accordingly these services must be supported if the Centre is to keep pace with international progress and if it is to achieve its objectives.

2. Accompanying the reinforcement of information services there is need for an educational programme in the use of libraries and the utilization of information. This programme should become a standard component of university education.

3. There is a need for a central organization to plan, organize and co-ordinate information activities at the national level and to remove the obstacles before the free exchange of information among the different areas that go by the name of science and technology.

4. There is a need to take full advantage of the studies and programmes in scientific information financed by international organizations, in which the efforts of many countries are involved and whose results can influence the economies of information activities and the quality of their processing and publishing.

5. The implementation of the recommendation of the scientific information committee on the establishment of a national organization for information to co-ordinate scientific information at the national level should be speeded up.

6. Computers should be used in data processing so as to benefit from the world-wide storage of information. Pending this, it should be possible to obtain access to international data banks by establishing direct communications lines to them.

7. Scientific publication should be encouraged as a component of the "information industry", especially the publication of periodical abstracts references and anthologies. This can only be accomplished by utilizing the most advanced technologies in printing, such as computer printing.

8. Current and completed research works conducted in Egypt should be compiled and processed to make them suitable for exchange.

9. The qualifications of scientific information personnel should be raised through the organization of courses in co-operation with experts from international organizations and by sending them abroad for training in modern methods of handling information.

10. Organizations involved in the area of R & D should be urged to prepare and publish bibliographies in the subjects they handle as a basic component of their R & D programmes and not as a secondary activity dependent upon circumstances. For example, the "Sinai" and the "Nile" Encyclopaedias are two works that have bibliographies.

11. Library facilities need to be improved and the scientific and technological community needs to be informed of the services available, as the library is an essential factor in the information transfer process.

12. Patents and their publication need to be given the importance they deserve as factors in the development of industry.

Item IV: Reinforcement of International Co-operation among all Nations and Formulation of New Forms of Co-operation in the Areas of Science and Technology for Development.

Item V: Reinforcement of Co-operation among the Developing Nations and the Role Incumbant upon the Developed Nations.

Egypt's relations with groups of developing countries and with groups of developed countries:

Historically, Egypt has had a strong civilizational influence on the countries surrounding it, just as it itself has been influcenced strongly by their civilizations. In the twentieth century this reciprocal influence

has been most evident in the areas of education and general culture and most concentrated in the neighbouring Arab African and Islamic countries. This civilizational role diversified during the last fifty years so that Egypt's contributions extended to cover numerous other fields (such as public health, agriculture, construction, etc...). The past thirty years have witnessed a tremendous resurgence in our sister Arab and Islamic countries, in the wake of the independence achieved by some and the petroleum fields discovered in others.

These circumstances accounted for the sudden increase in these countries' need for the different types of assistance that Egypt was obligated to provide in practically every area of socio-economic development. This assistance naturally called for sending large numbers of professionals in different fields (more in the service than in the production fields) to work in the countries requesting them. This in some instances has had a negative effect on the internal development of Egypt.

The opening of Egypt to the countries of the advanced European world commenced with the beginning of the nineteenth century. The first manifestations accompanied the French expedition and the rule of Mohammad Ali, which saw the dispatching of Egyptian emissaries to Europe and the arrival of European savants in Egypt, the foundation of a series of economic, scientific and educational establishments, which all served as a base for a genuine resurgence in agriculture, industry, military power, and public administration in the country. These efforts, however, sufferred a series of setbacks throughout the nineteenth century and during the first half of the twentieth century (punctuated by a number of attempts at social reform). These setbacks were the consequence of the domestic administration of the country as well as the foreign interference which grew progressively to culminate in the foreign occupation of the country. These factors were operative until the middle twenties. During the Second World War, Egypt was drawn into the arrangements that resulted from the interplay of interests among the international alliances of the time. One result was that Egypt won its political independence, which opened up the possibility of new types of relationship with other countries, providing many new opportunities for the combination of interests

and the forging of bilateral and regional ties to the benefit of the socio-economic development of the country. One of the most important institutional frameworks to emerge was the founding of the United Nations and the agencies that grew out of it.

Review of Egypt's transactions in science and technology with the developing countries:

Analysis of the negative aspects of Egypt's experience of co-operation with the group of countries that belong to the Third World shows that the forms and types of co-operation have been arbitrary. The cause may very well be in the failure to define the objectives desired, the deficiencies in the executory mechanisms of individual countries, and the inadequacy of the co-ordinating effort among groups of countries.

The areas in which Egypt is in active co-operation with the countries of the Arab and the African worlds are many. Based upon the lessons learned from this experience (which includes the positive as well as the negative), it is possible to summarize as follows the areas in whose framework fruitful co-operation among the countries of a single region can take place - areas in which Egypt is interested in participating and in which it is determined to co-operate in implementing (in bilateral as well as regional contexts):

1. The education of techno-scientific personnel for work in R & D. This presupposes a comprehensive overview of the needs of the region for such expertise and an evaluation of existing educational and training institutions and their programmes. It requires the creation of centres for advanced scientific specialization (by strengthening a number of existing institutions). The countries of the region could also think of establishing one or more universities of a high calibre, with the competence to deal with the problems of the future that affect the region as a whole, much like the United Nations University in Japan. They could also establish student exchange programmes in specific discipline, whereby students pursue their studies for a time at a university other than the one where they were originally registered, or whereby they pursue specialized courses in R & D methods where these are available.

2. Scientists, university professors, experts in the application of technology and technical staff can be exchanged. This is a measure of the utmost importance and urgency and ought to be undertaken within the framework of a careful study with defined objectives replacing all the bilateral frameworks (many of which are arbitrary) in force today. These latter represent a running waste of the human resources of the countries of the region.

For example, the problem has reached such proportions that large numbers of people are choosing to leave their scientific pursuits in Egypt in order to take advantage of the higher compensations offered by friendly neighbouring states who wish to employ their services in the implementation of construction and other socio-economic development projects. Despite the fact that most of these people eventually return to their home country, Egypt, even their temporary absence results in perceptible deficiencies in some sectors or areas of the country (such as in the universities and among craftsmen). In addition, only a small portion of the income they earn abroad is brought to Egypt in the form of cash transfers or consumer goods.

The response to this problem as envisaged by the Government embodies two measures:

(a) The organization of the emigration of intellectuals and experts who wish to leave the country outside the governmental context (by limiting the numbers permitted to emigrate from each category, e.g.)

(b) Negotiating agreements with the governments of host countries wherein the latter agree to make a payment to the Egyptian Government commensurate with the earnings of all the Egyptian citizens working in their country.

3. Training technical assistants and the different kinds of middle-level technologists. The shortage of these occupations is one of the most obvious marks that distinguish the developing from the developed countries. Compared to the situation in the developed countries, the developing countries have fewer qualified assistants per scientist.

Success in this enterprise calls for the establishment of centralized programmes in the region devoted to the creation of specialized training institutions for the benefit of students from the different countries of the region, selected on the basis of geographic distribution and the degree and type of need of the different countries.

4. Strengthening the bonds among scientists and specialists at the regional level. This can be accomplished through the different federations and vocational associations and groupings wherein the objective would be to promote the practical integration of the activities of the individual scientists of all the countries of the region belonging to each federation. This can be done through the convening of scientific conferences and seminars on the development problems of the region - problems that go beyond the bounderies of the individual country and involve common aspirations and common remedies. The federations themselves can be the regional organizations that periodically convene such scientific and informational meetings.

5. The establishment of a centralized regional organization for scientific information. The Arab and the African States should readily see the need for such a centre to serve the interests of socio-economic development in each region. These centres should be linked up with the more sophisticated national and international techno-scientific information networks. This recommendation is not intended to increase the complexity of the network of organizations devoted to information, but rather to help orient them and make them into more effective instruments for the resolution of the problems of the region.

6. The effective implementation of regional development programmes through joint research projects. Naturally, such joint projects are born of the common need for their fruits, as seen by all the countries of the region or as seen by some of these countries. There are at present in both the Arab and the African regions a number of such projects most of which are being implemented through bilateral arrangements and only a few of which are being implemented through the joint efforts of all the countries involved.

The following are a number of examples of the kinds of project that deserve the joint efforts of the members of the Arab and the African regions:

- The problem of construction in desert environments.
- Desertification.
- Optimizing the use of fresh water resources.
- Combatting the pollution of the environment.
- Development of the construction industry (materials and designs).
- Conservation of natural resources.
- Development of agricultural methods.
- Development of energy resources (traditional and non-traditional).
- Optimizing the use of marine resources.
- Regional meteorology.

Many other examples can be given of projects that can be implemented through co-operation among countries of the region - projects whose objective is to transfer and adapt advanced technologies for improving national and region production, such as the technologies that rely on the natural resources of the region or of a group of countries in the region (such as forests, raw minerals, petroleum, the processing of agricultural products and fish resources, etc...).

Among the more effective means that can be employed collectively in the implementation of these projects or in the conduct of pre-implementation research is the regionalization of the specialized techno-scientific centres where the resources are available for handling these projects with effectiveness. Among the likely candidates for regionalization are, for example, the research and study centres devoted to the technology of remote sensing devices, the cultivation of new strains of plant, the husbanding of meat and milk animals, the production of electronics, and the like.

Review of the status of Egypt's techno-scientific relations with the developed nations:

The analytical survey of the types, terms and objectives of the agreements that Egypt has made with many of the developed states in the areas of techno-scientific co-operation at all levels reveals the following shortcomings:

(a) The slow implementation of projects and activities agreed upon, going back to causes for which both parties were responsible.

(b) Sending experts from the developed country who are of a scientific and technical level incompatible with requirements and expectations and with the size of the task assigned to them.

(c) Too generous compensation of the experts sent to Egypt, which eats up a large portion of the allocations of joint projects.

(d) The lack of sound planning and co-ordination of the relations with the developed countries which leads to the repetition and the overlapping of some co-operative projects and a lack of seriousness regarding others. This situation alone accounts for the fact that a large number of agreements have been signed with a number of developed - as well as a number of developing countries, without ever seeing the light of day and for whose implementation not a step has been taken.

(e) The multiplicity of departments within the governments that enter as parties to co-operative agreements with the developed countries (or country) which makes it difficult to co-ordinate and integrate the different aspects of the agreements.

(f) The low effectiveness of the efforts to train and educate Egyptians in the developed countries. These are often invited to participate in research and in programmes that have no connexion with the problems of development in Egypt; effectively this isolates them from local realities upon their return to Egypt.

All these negative features - and the positive features as well - that are revealed by a realistic analysis of the situation indicate the dire need for a national review of the country's present engagements so as to assess their usefulness, to compare the relative benefits derived from them, to monitor the projects that are being implemented and to assess the efforts expanded by the two sides. What follows are some guidelines for such an analysis:

1. Agreements with the developed countries should be viewed as a resource that can be used to the benefit of many activities in the country, especially the activities related to socio-economic development, which need the techno-scientific knowledge which the developed countries can provide.

2. The willingness of many developed countries to offer assistance in the different levels of training should be viewed as a series of opportunities which deserve to be taken in order to fill the gaps in the ranks of scientific and research cadres and in the ranks of the technical assistants and specialists of the different disciplines.

3. The significant fact ought to be noted that in specific areas and in specific capabilities and potentials some of the developed countries - as well as the more advanced developing countries - are relatively more advanced and sophisticated than others. Thus it is in the interest of the developing countries to develop a framework for their relationships with these countries that is well planned, well selected and well formulated so as to maximize their benefits from them and to test the good intentions of the other contracting party.

In view of all these considerations and realities, the sound fulfillment of the responsibility for selecting the types of engagement to enter into and for formulating their contents requires the following orientation:

1. Egypt's central organizations (those responsible for co-operation with foreign countries in the fields of science and technology) should have access to comprehensive factual studies of the differential capabilities of these countries and the special areas in which each one surpasses the others, such as its academic institutions, its specialized research centres, its training institutes, its R & D organizations, or its scientific field applications - in all the areas that are significant to Egypt's development projects.

2. A national formula should be devised for achieving integration and co-ordination among the real needs expressed by the different sectors (education, research, application) in Egypt. This can only be achieved if a central office compiles all the plans which the different sectors intend to implement over a certain period of time and in accordance with a schedule established from a central overview of the total development picture in the country.

3. The needs of the different sectors in Egypt should be juxtaposed against the opportunities for co-operation with the developed countries (on the basis of their capabilities). This juxtaposition should be considered in every agreement made by the Government so that these agreements will become effective, practical and purposeful. These agreements can then be oriented to fill gaps in specific areas and under specific circumstances and the arbitrariness with many of them have been characterized can be alternated.

4. This same clear vision should be applied to all areas of scientific education and training that take place abroad and to the variety of missions whose purpose is to train researchers and to give scientists specialized expertise.

5. The same applies to all R & D projects which are the subject of agreements between the Government and developed countries, so as to imbue these projects with a well-defined sense of purpose, so as to fill a gap in a specific service of the country or to meet a clear need in an on-going development project or activity. It is crucial that this sense of realism be observed in all R & D projects so that they are directed first and foremost to meeting the needs of the country - some of which are of the extremest urgency. Indeed, the trend has recently been observed for Egyptian scientific institutions and research teams to enter into projects financed by their foreign counterparts and with their participation which are not directly related to Egypt's development plans but which deal with matters of secondary importance.

6. The cultural and technical offices attached to Egyptian embassies in the developed countries should be encouraged to monitor with greater zeal techno-scientific progress and scientific development in their host country and to transmit their observations thereon to the parties concerned in Egypt.

7. The possible benefits that the country may derive from undertaking multi-focated projects ought to be examined, as also activities that require the participation of several institutions of the same developed country (or different developed countries) in order to tie together all the projects in a highly integrated manner and so guarantee the full benefits of their implementation.

Part Three

SERVICES OF THE UNITED NATIONS AND OTHER INTERNATIONAL ORGANIZATIONS

Introduction:

The United Nations has been performing its mission of servicing international affairs through organizations that have been increasing in number variety and size over the years. The motive behind this growth was the desire to put the international organization and all the possibilities at its disposal to the service of peace and the socio-economic development of all the countries of the world and especially the developing countries, thus contributing to narrowing the difference separating them from the developed nations. The experience of the past years shows that much has been achieved internationally in this regard at the hands of United Nations organizations; it also shows that much more can still be done that these organizations should be urged to undertake.

The experience of the past also reveals that the organizations of the United Nations devoted to economic and social affairs can themselves afford to review their structures, their operational procedures, the effectiveness of their performance and their relationship to each other in the interest of better arming themselves for the tasks of the coming years. Several efforts in this regard are already underway in response to resolutions of the United Nations General Assembly and the Economic and Social Council.

The Egyptian Government believes that the organizations of the United Nations and other international bodies - in their present form - have a basic role to play in the implementation of the New International Economic Order and in the implementation of the "Code of Conduct"

governing transactions involving technology transfer. The Government also believes that this role can be more effectively played after the proposed changes mentioned above have been introduced enabling these organizations the better to implement the following:

1. The provision of effective assistance to the developing countries in questions of technology transfer, through the establishment of a central international organization with data banks on international technologies that provide access to information, offer advice, participate in negotiations, monitor on-going projects and assess their performance. Such an organization would be no more than the minimum in terms of the assistance that the developing countries need of the internationally centralized organizations of the United Nations. The ideal picture would make of this organization an international fund for the transfer of technology with the authority to purchase from their producers the technologies needed by the developing countries in order to make them accessible at equitible prices and terms along with the necessary pre-application instructions and the necessary expertise for applying them.

2. The establishment of an effective international system for making technological knowledge accessable for production, especially in the developing countries, modifying current industrial ownership and licensing practices. Such a system would require legislation relating to industrial property rights and licensing practices. It would also involve the establishment of regional and country offices for the compilation, classification, storage and retrieval of the patents filed in the developed countries, in the countries of the region and locally.

3. Expending international effort towards the optimum unification of standards and measures.

4. Sponsoring integrated international programmes for dealing with the fundamental social problems of the developing countries - which consist primarily of the shortage of food (especially grains and the sources of animal protein) and construction materials and designs, public health (especially endemic deseases and those that cross national boundaries), destruction of the environment and over-population - through advanced scientific research building upon what we already know.

5. Sponsoring integrated international programmes for the development of appropriate intermediate technologies for improving living conditions in the developing countries (especially in rural environments and their productive capabilities. R & D teams in both the developing and the developed countries can be assigned the task of formulating special programmes for the achievement of these objectives.

6. Establishment of an international system for compensating and honouring the achievements of scientists who succeed in finding practical solutions to the major problems of mankind, particularly the problems outlined above.

7. Organizing a large number of training programmes and establishing training institutes in different regions distributing them according to population density. Their function would be to deal with the fundamental concerns of development, including advanced vocational and industrial training which is capable of graduating qualified trainees and students in the different disciplines. They would also support the national training institutions that share these same objectives.

8. Reviewing the procedures employed in monitoring the resolutions and recommendations of international conferences and their implementation and the assessment of the effectiveness of such conferences.

9. Conducting a comprehensive assessment of the value of the development projects executed by United Nations organizations in the developing countries, to the benefit of the new projects to come.

10. Assessing the effectiveness and the appropriateness of the standards used in selecting international experts in terms of their qualifications and compensations and their suitability to the tasks assigned them.

11. Redoubling efforts to make known to the more advanced societies the civilization and cultures of the developing countries, their contributions to human history and their potential for cultural development.

12. Reviewing the possibility of establishing an international procedure for monitoring the achievements of modern science so as to prevent them from being used for harming mankind and human civilization everywhere on this planet and for threatening world peace.

13. Developing the organizations of the United Nations and other international organizations and co-ordinating their activities so as to achieve the above objectives, rather than founding new organizations, whenever possible.

14. Establishing a system of permanent consultation between the industrialized and the developing countries on matters relating to the transfer, adaptation and application of technology in particular, and the matters outlined above in general, in application of the recommendations of the Lima Declaration.