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THE PROBLEMATIQUE OF THE ARAB BRAIN DRAIN

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

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Introduction

The brain, drain, technology and information transfer, and socio-economic development, all revolve around learning. These processes are indicative of certain aspects of change in the total body of knowledge possessed by a society. In this seminar we are interested in the Arab brain drain not only as so many academically certified individuals moving across international borders; we are also concerned with its causes as well as its effects.

According to rough calculations that I recently made, the percentage of the outflow of Arab medical doctors, engineers and scientists to Western Europe and the US up to 1976 was 50, 23 and 15 per cent respectively of the total Arab pool; the numbers were 24,000 doctors, 17,000 engineers and 7,500 natural scientists[1]. The flows within the Arab world are also considerable. Here one finds large numbers of school teachers and administrative personnel in addition to engineers and doctors. It might be useful to view these flows in the perspective of the prevailing systems of Arab higher education.

The number and size of Arab universities have been growing at an exponential rate since the end of World War II. There are around 50 universities in the Arab world today. Because of this high rate of growth, the doubling time in the accumulated number of university graduates is 5.3 years, and the total number

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1. A.B. Zahlan, "The Arab brain drain", Population Bulletin of UNECWA, June 1979. In this paper, available information on the flows and their destination was presented. A number of explicit assumptions were made to obtain the numbers cited here. The limitations and shortcomings of available data were also emphasised. The outflows were compared with the outputs of Arab universities.

of university students is roughly equal to the total number of university graduates. This situation cannot continue for ever and will begin to change once the fraction of Arab youth entering university in the 17-22 age group goes beyond the 30 per cent point. This will occur towards the end of the century. One can estimate that if the present trends continue there will be roughly 12 million Arab university graduates by the year 2000, and there will be an equal number of university students. The significance of these numbers can be readily appreciated if one were to compare the percentages of university graduates among the adult population in 1975 (0.8%) with the forecasted figure of 8 per cent.

The bulk of education at Arab universities is on the bachelor (BA or BSc) level with the exception of medical education (MD level). A common feature of higher education is the distinction between education in the sciences and in the humanities. In 1975, 42 per cent of all university graduates in the Arab world had received their education in the physical, medical, agricultural and engineering sciences. There is a general trend towards more, rather than less, education in the applied sciences. A growing number of Arab universities are being established as purely engineering institutions.

Egyptian universities offer doctoral level instruction on a modest scale. The majority of Arab doctoral education has been taking place in Europe, the USSR and the US. Here the statistics are poor. I estimate that there are roughly 27,000 Arabs today (1980) who have acquired a PhD level education and that this number is probably increasing at an annual rate of more than 10 per cent. At least 50 per cent of the degrees acquired are in the sciences and engineering. Some 50 per cent of all Arab PhD-level scientists and engineers have emigrated. Again here statistics are fairly poor, and the subject has not received adequate attention.

The record of Arab educational institutions in supplying the majority of the technical manpower in the civil services is impressive. These graduates have sustained the expansion of both the educational system and the health services. Infrastructures, agriculture and industry have also been staffed by these graduates.

But such a promising statistical picture is marred in view of the resources, facilities and funding available to Arab universities. In general, they suffer from: a paucity of instructional and research facilities, a high student teacher ratio (sometimes approaching 400:1), poor quality text textbooks, virtually no funds for scientific research, and low salary scales that severely limit the number of professors who can afford to devote time to research. A few of the institutions that have been established in the oil-producing countries appear to possess large budgets, but it is still too early to predict whether they will be able to develop high quality universities. The absence of research activity in Arab universities is of course related to the universally low esteem in which research and development are regarded by Arab governments[1]. The level of expenditure on R&D in the Arab world is roughly US $2 per year and per capita. But it is doubtful whether - apart from a few of the oil-producing countries - the expenditure on R&D in 1979 was equal to what it had been in 1965 in terms of the constant value of money. It is no wonder, then, that the Arab scientific output on a per capita basis is roughly 0.5 per cent of that of advanced countries and 1 per cent that of Israel. I estimate that conditions are so poor that the average productivity of an Arab scientist measured in scientific publications is less than 10 per cent of his counterparts elsewhere. These considerations have serious implications to the developmental policies of the Arab states and to any policy that seeks self-reliance or serious technological objectives.

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1. A detailed description and analysis of scientific research and science policies in the Arab world are presented in A.B. Zahlan, Science and Science Policy in the Arab World, published in Arabic by the Centre for Arab Unity Studies (Beirut, 1979) and in English by Croom Helm (London, 1980).

The activities dependent on high level manpower (HLM) are on a large scale and the number of projects in mining, defense, communications, industry and civil works have been steadily increasing. The estimated cost of engineering projects currently underway, for example, is of the order of $400 billion[1]. I have shown elsewhere, however, that the majority (90 to 100 per cent) of these projects are conceived, planned, designed, constructed and equipped by foreign consulting, contracting and engineering firms[2]. The entire process is undertaken with the minimal participation of local institutions and manpower.

The general mode is one of technology-free transactions that result in the installation of turn-key and product-in-hand projects. Since the prime contractors are generally foreign, and since the Arab states pursue no technology policies, little employment is generated for engineers and scientists. Thus current activity involves the utilization of extensive numbers of professional manpower, yet it is undertaken in such a fashion that local opportunities for developing indigenous institutions are minimized; and dependence of foreign R&D, foreign engineering and consulting firms is overwhelming.

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1. The figure of $400 billion is a crude estimate of the volume of major engineering, equipment and construction contracts between Arab countries and foreign sources. The execution of these contracts is normally spread over four or five years. The concentration of these contracts is in: hydrocarbon and petrochemicals ($160 billion); civil works: roads, irrigation and drainage, harbours, dams, silos, race tracks, universities ($100 billion); transport systems, equipment and machinery: railways, ships, aeroplanes, trucking fleets, military equipment, farm machinery ($80 billion); industrial plants (other than hydrocarbon and petrochemicals): iron and steel, pharmaceuticals, phosphate fertilizers, potash, ($40 billion); communication systems ($10 billion); and others. In the case of civil engineering contracts a substantial fraction of the cost is spent in local currency for the purchase of materials and labour services. The figure of $400 billion is presented merely to indicate the size of the Arab market for technology services and products.

2. A.B. Zahlan, "Established patterns of technology acquisition in the Arab world", in A.B. Zahlan (ed.) Technology Transfer and Change in the Arab World, Pergamon, (Oxford, 1978), pp. 1-27.

In other words, the system of higher education and developmental practices are not mutually inter-dependent. We have already observed that both national support to R&D activity and the per capita output of researchers in Arab institutions are extremely low despite the demand for technical knowledge and skills as amply demonstrated by their purchases from foreign suppliers. Furthermore, a brain drain is taking place in precisely those fields in which the Arab states are vigorously importing foreign expertise.

The dependence and brain drain situations may be highlighted further by making some international comparisons. The numbers of Arab technical manpower on all levels (technician to PhD) are already considerable. The total Arab PhD population today is comparable in number to that of either the USA, Germany or the UK during the period from 1939 to 1945. Similarly, the Arab world boasts 30,000 to 40,000 research workers, a number that is equivalent to a third of the world population of R&D workers in 1940. Yet the current level of scientific and technological discovery, innovation and invention, as well as the application of science and technology do not compare with the dramatic accomplishments of the 1940's. The many factors that constrain creativity cause the internal Arab brain drain which in turn is reflected in the external brain drain.

Comparative Experiences

The historical experiences of many nations exhibit major cultural discontinuities that were induced by an unusually high level of interaction with foreign sources of knowledge. The type and extent of these cultural exchanges vary greatly. The discontinuity is terminated when the receiving nation attains a parity with the leading centres in that particular field of knowledge. Generally, the state and order of learning are altered during a relatively short period of time[1]. The agencies for effecting these transformations are combinations of foreign study, the establishment of new institutions, and

1. The experience of the United States during the period 1870-1900 is a case in point. An intensive interaction with Europe took place, as a consequence of which both the level and quality of research activity increased rapidly and the order of learning, until then dependent on amateur scholars and scientists, underwent a major transformation. See Edward Shils, "The order of learning in the United States from 1865 to 1920: The ascendancy of the universities", Minerva, XVI, (1978), pp. 159-195.

the importation of expatriate scholars and scientists. The relative importance of these different means changes from country to country; although the phenomenon is common, its dynamic features can be different. The duration of the processes, their relative intensities, the numbers of individuals involved, the velocity of change in the state of learning, the nature of the transformations in the order of learning, the role of central power, the receptivity and capacity for transplanting the acquired knowledge all vary considerably[1].

The extensive pursuit by American students of a European advanced education between 1870 and 1900 led to a major transformation of the state and order of learning in the United States. During this period, around 1,000 Americans[2] obtained their doctoral education abroad (mostly in Germany); owing to the receptivity of their society, the necessary institutions to sustain and develop the new learning were established almost simultaneously.

The high rate at which this transition occurred can be seen from the considerable growth in the number of graduate schools (from none in 1870 to

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1. There is a great deal of information on facets of these cultural changes. But there is little comparative analysis. The purposes of this paper are adequately served by order of magnitude comparisons.

2. This number (1,000) is based on a compilation I have undertaken of American students studying in European universities during this period. This number does not include either non-doctorate students or the large numbers of American physicians who went to Europe for residency training. One of the greatest US scientists of this period, Willard Gibbs, earned his doctorate at Yale University and spent three years in Europe as a "post-doctoral" fellow.

   The transformations under discussion were also promoted by substantial numbers of European scientists and scholars who emigrated to the US at this time. To include some, or even all, of these categories would not, however, alter the structure of the analysis much.

50 by 1900), the rapid increase in the number of legitimately earned doctorates (125 in 1890, 250 in 1900) and most especially from the emphasis on the dual objectives of quality and relevance.

The experience of Japan was even more spectacular. Here a non-European culture successfully interacted with that of the West. Between 1872 and 1898, Japan "consumed" some 19,000 man-years of foreign teachers, engineers, clerks, artisans and others to effect a major transformation in its own educational, governmental and private institutions[1].

In both the US and Japan the small number of foreign HLM and foreign educated nationals directly contributed to the enormous internal changes that resulted. The relatively small-scale involvement of national and foreign HLM during a limited period of national development was amplified by the transformation in the state and order of learning. The intellectual quality of the induced response and the creative energies released were paralleled by the establishment of new types of institutions that became the basis for a new national enterprise. The transformations involved the means and modes of production and public policies related to the application of technology, since most events during the past two centuries have been heavily dominated by science and technology.

National and foreign manpower were elements in a major transformation; they were not isolated individuals lost between two cultures[2]. The American and Japanese transitions were dominated by the national dimension and, only to a

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1. Japan, despite its strict isolationist policies, had maintained a strong Dutch connexion since 1640. Dutch learning was taught extensively. Grant Kohn Goodman, The Dutch Impact on Japan (1640-1853), E.J. Brill, (Leiden, 1967). However the advent of Admiral Perry in 1853 caused a decisive change in Japanese policies. During the two decades that followed, the Shogunate Government dispatched five missions to the West: 90 persons to Europe and America (1861), 36 persons to Europe (1862), 34 persons to France (1863), a similar group to Russia (1865), 21 persons to France (1867). In 1862 the first students were sent to Holland. The Meiji Government assumed power in 1868 and undertook vigorous measures to accelerate the process of transformation. Umetani Noboru, The Role of Foreign Employees in the Meiji Era in Japan, Institute of Developing Economies (Tokyo, 1971).

2. These transformations are always associated with personal difficulties and obstacles. Despite the apparent speed and ease with which these events have occurred in some countries some participants had problems in adjusting and in securing employment.

secondary extent, by the individuals who participated in the process. These are nation-centred events. The associated brain drain has not attracted attention[1].

Person-centred versus Nation-centred Models of the Brain Drain

The literature on the brain drain reflects a variety of attitudes and concerns. By and large, the individual is at the centre of analysis. I shall refer to this approach as the **person-centred model.** In it, one counts the number that migrate, classifies their professional qualifications, and determines the push and pull forces that induced their movement. Glaser, in his UNITAR study The Brain Drain[2], reports on: the motivations of foreign students; the variations by speciality; their ties with home; the decision to study abroad; and their flows. Even the study of the variations among developing countries is viewed predominantly from the perspective of the student, the emphasis being on the migrant and the host country. The country of origin plays a peculiarly passive role. In the Glaser model, the push factors are seen to have occurred because the developing country did not undertake certain reforms. This point of view is taken one step further by Bhagwati who links the push forces to the brain drain opportunity:

> In short, the external migration possibility, the brain drain opportunity, actually inhibits the 'internal diffusion' process which carries, however slowly, these professional skills to where they will create greater social impact[3]

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1. On the basis of the available information on the careers of Americans who studied in Europe, I estimate that their brain drain was in the vicinity of five to six per cent.
2. William Glaser, The Brain Drain: Emigration and Return, Perganon, (Oxford, 1978).
3. Jagdish N. Bhagwati, "International migration of the highly skilled: Economics, ethics, and taxes", Third World Quarterly, I, 1979, p. 20.

Within the person-centred school there is agreement about the overall structure of the problem and disagreement about various linear perturbations that could be applied to bring the flows under some form of control. Third World countries appear unable to shield themselves from the competition imposed by advanced countries for the services of their own nationals. Economists argue, usually on the basis of general principles, about whether the country of origin has lost or gained in this transaction. A divergence of views prevail on: the benefit or loss to Third World countries; the measures called for to arrest or reverse the process; and possible compensations to the countries of origin. The fundamental assumptions of the researchers in this model are the same, although interpretations and suggested solutions vary widely. We shall illustrate this point with two examples. The "Western" component of this school emphasises the push factors, and suggests two main solutions: that the educational programmes of developing countries should meet local demand more closely; and the type of "applications of science and technology" suggested recently in UNCSTD (Vienna, 1979). The "Third World" branch espouses the "UNCTAD reverse technology transfer taxation scheme" whereby the immigrants and, possibly their host countries, should be taxed to compensate the developing countries for their losses.

The person-centred approaches have inspired a large variety of actions and policies. For example, some countries have established universities and institutions where students and faculties enjoy special privileges[1]. Others have promulgated special repatriation laws whereby returnees are granted certain financial and employment advantages. But there are little indications that these measures have had any significant impact on the brain drain. Thus by reducing the brain drain problem to such economic and personal terms, one loses sight of the social and national dimensions.

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1. Gerald Moore, "Le role des universités dans le tiers-monde: Former des elités ou servir la societé?", in Le Monde Diplomatique, September (1970), p. 10.

By contrast, a nation-centred approach would seek to understand the brain drain as a factor of cultural, scientific and developmental policies. For, after all, the latter largely motivate governments and societies to sponsor national and foreign learning. Within the context of a nation-centred approach the interest would be in the efficiency with which highly skilled manpower is employed. Whether a person emigrates or is under utilized would become a problem in human geography. The fact that an external brain drain may or may not benefit a foreign country is of trivial importance to the developing country; the issue of central importance is the degree to which these talents contribute to their society.

In the person-centred model the inappropriateness of the educational system is advanced as a push factor. An inquiry into how the educational system came about to be, by what means, and under what conditions, is all too often considered to be beyond the scope of the study of the brain drain.

Satisfactory educational programmes are the product of creative and iterative processes initiated by culturally integrated individuals. The nation-centred approach would view these processes in an historical continuum and would investigate the factors and policies that impede or favour creative and adaptive development. The educational systems initiated by, say Muhammad Ali's French advisors, the Protestant missionaires in Syria, the British in Africa, or by UNESCO consultants become merely initial points of departure, and their defects are converted into incentives that inspire thought and action: a society participating in a learning process finds challenges in rendering its institutions appropriate.

The ethics and morality of the brain drain would be superseded by an acute awareness of the requisite measures and practices for a society to emerge from under-development to self-reliance. Thus in viewing the external and internal brain drain in this context, the focus of national leadership would be diverted away from the melodramas of individuals incapable of coping with their immediate problems and towards assessing the effectiveness of national measures to complete cultural transformation.

The Arab Experience in the Nation-Centred Model

During the nineteenth century, Muhammad Ali of Egypt established educational institutions as part of his modernisation plans. But, as I have shown elsewhere, these institutions were slow in being established, and were on a small scale; they had a teaching but no learning component, and the entire exercise failed to exhibit any scientific or social imagination[1]. For example, the existence of oil in the Red Sea and Suez regions was fully known to his engineers, yet the possibility of utilizing this oil did not occur to them despite the great prevailing shortage of energy. Similarly the manpower shortage in the country did not lead to an interest in either improving nutrition and public health standards or in increasing labour productivity. Although qualified scientists existed, they did not contribute to a significant change in the state or order of learning that was commensurate with the demands of the technologies sought[2]. Yet, Egypt had consumed more man-years of foreign manpower before 1840 than Japan was to consume between 1870 and 1900.

During the 160 years since Muhammad Ali established the first "modern medical school" in the region at Abou Zabel, later the Kasr Al-Aini Hospital, there has been an enormous increase in the number of medical institutions, students and graduates. Nevertheless, the region remains dependent on knowledge generated abroad for all developments in the biological and medical sciences. Medical graduates still acquire their specialization abroad; likewise, the body of knowledge that is being imparted in medical schools is totally imported, the local contributions being on the peripheries of medical science.

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1. A.B. Zahlan, "Established patterns of technology acquisition in the Arab world", in A.B. Zahlan (ed.) Technology Transfer and Change in the Arab World, pp. 1-27, Pergamon (Oxford, 1978).
2. Ibid.

On the eve of World War II (1939) King Farouk established the Fouad I National Research Council (NRC) in Cairo. The objectives of the Council showed remarkable foresight and were in fact similar to the spirit of the UN Conference on the Application of Science and Technology to Development (1979). The war years posed great challenges that could have generated the development of new industries and agricultural techniques, for there was certainly no shrtage of degree-qualified manpower; yet the NRC was stillborn. Moreover, the local technical problems precipitated by the war were so pressing that the US and Britain finally had to establish the Middle East Supply Centre (MESC) in Cairo to cope with them. Most of the activities of MESC called for scientific imagination and skills, rather than R&D[1].

During the past three decades, most Arab states have acquired their full independence and have embarked on large scale programmes to combat underdevelopment. These efforts have in general combined the three classical approaches: foreign study; the expansion of national educational institutions;

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1. MEXC staff were involved in a large variety of activities that included: converting Arab locomotives from utilizing imported coal to Arab oil; locust control; managing food and other supplies on a regional basis; organizing the first regional conference in agriculture; as well as preparing numerous technical reports and a few books on the region.

   Stevan Dedijer in "The IQ of the undeveloped countries and the Jones Intelligence Doctrine" utilized R.V. Jones's (Most Secret War, Hamish Hamilton, London, 1978) approach to scientific intelligence during World War II to develop an intelligence doctrine relevant for the Third World. There are fundamental differences between a British Jones and a Third World Jones. R.V. Jones was an integral element (and this despite Jones' many difficulties with his colleagues) in an effective and operational system that included information gathering (Bletchley Park, photographic reconnaissance, prisoners and others), support in data analysis (British scientists and libraries) and, equally important, an organized and rational system to receive his findings. The Third World Jones has extremely imperfect instruments and support in information gathering and analysis; moreover he is poorly connected to the apparatus of decision-making. These are the factors that contribute to the internal and external brain drain. The target of policy should be primarily to remedy these institutional constraints.

and the use of foreign experts. Thus, in 1978, there were more than 25,000 Arab students in the US, and there were larger numbers in Europe and the USSR. In 1980, Arab university graduates will probably exceed 1,100,000. In Saudi Arabia alone, there are more than 100,000 Europeans and Americans, and certainly more than one million Arabs that belong to the categories of "teachers, engineers, clerks, artisans". It might be useful to note here that the number of Saudis who had obtained a PhD in the US by 1979 exceeded 1,000, i.e. more than the number of US citizens who had earned their degrees in nineteenth century Europe. A few years ago, the number of researchers in Egypt alone was 18,000.

The point I am trying to establish is that the existing manpower in virtually all fields is fairly large by any standards. During World War II, the Allied and Axis Powers each had equal or even fewer technical manpower, yet they were able to make brilliant breakthroughs and expand their industries rapidly and dramatically. I cannot imagine that the conditions in any of the Arab states today are more trying than those the antagonists faced during 1939-45 or that the difficulties - whether social, economic, scientific or technical - are any greater. Thus, given the impressive Arab accomplishments in the expansion of educational facilities and the very high level of liquidity and developmental activity, why does the Arab world continue to have an internal and an external brain drain? Why is the region still educationally, scientifically and technologically dependent?[1]

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1. The crisis in learning and creativity that faces Arab societies has been the subject of numerous enquiries on the national and regional levels. The assertions made here are commonly recognized. I will mention only two expressions of this widespread concern. In 1974, the Association of University Graduates in Kuwait organized a symposium in Kuwait on the crisis in the cultural development of the Arab world. The symposium was well attended and an important variety of papers was presented. (The Crisis in the Cultural Development of the Arab World, (in Arabic), Shaker Mustapha (ed.) Kuwait University, Kuwait (1975)).

   In 1972, the Ministers of Education of the Arab States requested the Arab League Educational, Cultural and Scientific Organization (ALECSO) to prepare a strategy for the development of Arab education. The team of eminent Arab educators that ALECSO formed to undertake this work completed and published their reports in 1976 and 1977. They stress that attainments fall short of national ambitions, that transfer but no creativity occurs; and that understanding but no application results. (Strategy for the Development of Arab Education, (in Arabic, main reports published in 1976 and a summary report published in 1977; ALECSO (Cairo)).

The uniqueness of the Arab situation is in the profusion of all the factors that are usually deemed to be necessary for take-off: manpower, finance and resources. I have selected for discussion here two factors that may help to explain the present circumstances.

The first one concerns the state of learning. I have already emphasized the essentially creative aspect of cultural transformation. For a society to successfully undergo this transformation, research and scholarship must be instituted. I have already noted the number of Arab university graduates, the statistical number of researchers and PhD holders, as well as the limited financial resources allocated to research. The poor research facilities induce continued dependence on foreign institutions for post-graduate study. This dependence inevitably exposes the youth to the problems, values and patterns of thought that are primarily relevant to advanced countries. The priorities, programmes and innovations of research in advanced countries - even when concerned with the Third World - are not necessarily the appropriate ones for each and all Third World countries. Science may be universal, but the Western-type scholar or scientist is not a universal component of all societies.

Students who return from advanced study abroad also meet serious adaptation problems. The inadequacy of the facilities and resources is often the most apparent obstacle. The young scholar and scientist needs a stimulating intellectual environment within which to explore his abilities and his community in order to evolve a new course of action. Graduate study and research are the two standard mechanisms through which a society develops an understanding of its problems. Through research in a national environment, and within its own cultural milieu, a society internalises the ideas, principles and methodologies it utilises. During the past two decades, there has been some growth in the scope of research and graduate education in most Arab countries. However, the finance devoted to these purposes, the limited outputs and the continued dependence on imported R&D and literature indicate that these efforts are not commensurate with the demand. The major source of available information and analysis is still foreign.

Only when knowledge is internalized can a community hope to transform creatively its cultural heritage into modes and lifestyles unmistakably related to its past, at the same time making full use of all available knowledge. The scholar, scientist or engineer rooted in his culture and institutions is the natural and only instrument for effecting this role. A A nation that imports "modernity" pays a high price: it is cultural suicide.

The second factor concerns de facto technology policies. In any attempt to develop a nation and stimulate technical change, the decision-making apparatus and its instruments for the design and implementation of developmental policies are of crucial importance. Although Arab governments are universally dedicated to the material transformation of their societies, the decision-makers are plagued by an extremely broad range of problems which cannot be solved by utilizing national institutions in their present state.

The course of action called for in the indigenous application of science and technology is strikingly different from those needed to build a road or a factory through the agency of a foreign firm. For HLM has to be organized and structured in specialized institutions in order to undertake developmental projects. It is through consulting, engineering and research institutions that technology is acquired, developed and applied. The process of building such institutions is facilitated by the very structure of science and technology: knowledge and expertise may be acquired in measured steps as part of a systematic and sustained policy. But the existence of well established international firms that supply these technological services provide the decision-maker with an easy transnational route[1].

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1. During the prolonged period of Ottoman and Western control over most of the Arab states, full decision-making power was assumed by foreigners. Each subgroup - tribe, village, city or region, - became dependent on the political, economic and social policies formulated and implemented by the military and civil servants. Food supplies, expropriation of land, taxation, control of trade, the distribution of wealth and many others were dependent on these foreign agents. In a country such as Egypt its people, who had invented the science of irrigation and agriculture and whose farmers had practised it successfully for millenia, suddenly found British engineers and army officers in complete charge of the irrigation system from 1882 to 1925! During this period, the total cultivated area increased by only 4 per cent and the cotton yield in quantars/feddan decreased almost monotonically from about 5.6 (1895) to 3.6 (1919). P.M. Tottenham, C.B.E., The Irrigation Service, its Organization and Administration, Ministry of Public Works, Egypt, 1927. (Tottenham was the last British Under-Secretary of State for Public in Egypt).

The transnationalisation route consists of utilizing the services of foreign firms and institutions to study and execute projects (social, economic and technical) in the community, thereby short-circuiting the existing institutions and undertaking these tasks in a manner that is deleterious to the establishment and development of national institutions[1]. Thus the entire Arab transport and petroleum sectors were developed as foreign technological enclaves. The internal and external Arab brain drain of scientific and engineering manpower is a consequence of the continued dependence of Arab states on these established patterns of technology transactions. Obviously, then, the pursuit of self-reliant technology policies would have enormous social, economic and political rewards, over and above the ones under discussion here.

As a consequence of the isolation of national institutions from the processes of problem-solving, decision-making, project design and execution, most "solutions" suffer from grievous limitations. Expensive hospitals provide health services only to the wealthy; the development of capital cities cause massive rural migration to swell the city slums; new dams increase soil salinity and the spread of bilharziasis; the importation of mercury-treated wheat to protect it against fungus result in mass poisoning; and, finally, the massive purchase of military hardware does not lead to victory.

The new bureaucracies established by colonial powers were mainly agencies of control, rather than agencies established to provide services. The power base of the decision-maker was the military and the ministry of interior, rather than public support and control; the educational system was often planned by foreigners and aimed at training an adequate supply of clerks and civil servants for lower echelon positions; and the labour force consisted mainly of unskilled labour living at the edge of subsistence. The population and all its institutions became mere objects to be manipulated for certain ends that were of no importance to their lives - safety of the route to India, cotton for Manchester, or some European squabble being fought out in Fashoda.

1. It is clear that the relationship between developing countries and transnational corporations evolved in response to the conditions of the countries as well as to the capacities of the firms. The advantages to the decision-maker in pursuing this route are numerous. For one thing he assumes that by utilizing the transnational route he eliminates all risk. For in general, the firm in question can exhibit a record of previous performance. Furthermore, IBRD, national and international financing institutions condition the loan of funds upon the projects being designed and executed by approved consulting and contracting firms.

After three decades of development planning, most Arab countries have a larger population, and more people are under-privileged and unemployed. Although enrolment in the educational system has increased, the youth have not been provided with cultural consciousness and the necessary skills to participate in a national economy. Those countries that have attempted some industrialization, find themselves more dependent on the advanced countries for their capital goods, and few indeed have acquired some measure of technological independence. The duality of the economy has intensified: the modern sector supports a small, fortunate middle class; and the traditional sector that was expected to fade away has, on the contrary, increased in number.

The intensive difficulties that Arab governments have faced in meeting their chosen objectives and the claims of their citizens have led to a variety of upheavals, food riots, urban terrorism, coup d'etats, and millenniar movements. Most of these eruptions, however, have led to nothing. Scientists, scholars, leaders and teachers are gloomy, discouraged and frustrated by the apparent insurmountability of the challenge.

The time available to bring to a satisfactory conclusion the prolonged state of cultural discontinuity in the Arab world is running out not so much because of political events but because of the high rate of change in knowledge. To date, no Arab state has mastered even the early nineteenth century mechanical sciences, not to speak of the chemical and biological revolutions of the nineteenth and early twentieth centures. Yet the cybernetic, genetic, nuclear and space revolutions are elsewhere ushering in totally new scientific and cultural environments. The intense social and philosophical debates in the West on the social function of science are a measure of the depth of the cultural transformations underway there[1].

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1. Whereas the arts of designing and implementing effective science policies in the Third World are in their infancy, advanced countries are becoming increasingly concerned with the social assessment of science and the relationships of scientific expertise to the public. Although these dimensions are central to the brain drain phenomenon they are rarely considered in this context.

   Jean-Jacques Salomon, "The social function of science today", Technology in Society, I, (1979), pp.205-218.

   E. Mendelsohn, D. Nellain and P. Weingart (eds.), The Social Assessment of Science,/ Bielefeld, (1978); Hans Skoie (ed.), Scientific Expertise and the Public, Conference Proceedings, The Norwegian Research Council for Science and the Humanities, Oslo (1979).

The many restrictive conditions that limit the creative productivity of Arab manpower, the state of learning in Arab society and their excessive technological dependence lead one to the conclusion that the causes of the external brain drain are far more important than the actual outflows. With the expectations of a ten-fold increase in the present population of highly skilled manpower, it is doubtful whether the Arab world will suffer from manpower shortages. Only a shift from the person-centred model to a nation-centred approach would clearly exhibit those actions and policies that are the sine qua non of cultural authenticity and technological self-reliance.