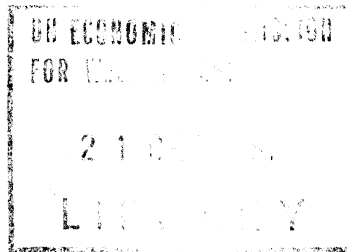




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TECHNOLOGY POLICIES AND THEIR IMPACT
ON EMPLOYMENT IN ALGERIA

by

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



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on Employment in Algeria

INTRODUCTION

The development policies of the past decade have brought into focus the problem of "technology policies", which in a number of ways, have given rise to new forms of dependency.

While most of the development studies of the past decades emphasized the financial form of capital and stressed the need for increasing the flow of direct foreign investment and government assistance, "as though under-development had but one cause, the local inability to save,"^{1/} technology is suddenly discovered as a new parameter of development.

Also, the old debate concerning the selection of production techniques or, more broadly speaking, the selection of investments involved in development models (equilibrium or not, balanced or unbalanced), has in the face of "technological" difficulties been transformed in practice to a debate on "the transfer of technologies"^{2/}. The controversy concerning the selection of investments no longer holds the forefront since many countries that claim explicitly to be capitalist in nature as well as many that are trying to move away from capitalism have ended up by opting in their economic policies for "unbalanced" growth in the area of technology. The result has been a concentration of investments in capital intensive activities, revealing a preference for the creation of a "developed sector" involving massive incorporation of foreign technology^{3/}.

^{1/} M. SALEM and M. A. SANSON: Les contrats "clés en main" et les contrats "produits en mains", Technologie et vente de développement, Librairies techniques, Paris 1979, p.7.

^{2/} The destiny which this term has come to know reveals the preponderance of representations in terms of neutrality and mobility of factors: here we discover just one more factor.

^{3/} This overall evaluation, however, calls for qualification; it is essentially applicable to countries which try to maximize the use of technology.

It is true, as certain authors suggest, that "divergence" of external development strategies, will give way to "convergence" of domestic strategies through imported technologies and the dependence resulting therefrom? Is there a generalized technological "mimicry"? What is its real significance and what especially are its consequences?

It is to be noted then that determination of policies which result from the transfer of technologies, depends, to a large extent, on the definition of the conceptual field of transfer. First of all, we have to be aware that this concept "covers a complex reality, not only technological (technologies of transformation of raw materials, of administration as well as of organization), but also economic, political and cultural"^{1/}.

In the Arab World little work has been done in this field in comparison, say, to Latin America. It is true that the experience in the former is more recent and more localized.

Without taking part in debates which have often been unfruitful, it is necessary in our view to clarify the different problems which come to be posed. With reference to the Algerian experience in the field of industrialization, we will try to show that in spite of a policy of investment and of training which is unprecedented in recent history, many limitations and constraints which obstruct the expansion of employment and more particularly the command by the national labour force of the industrialization process, stem from the intrinsic characteristics of the technological content which is developed by the multinational corporations, within their strategy for a new form of international division of labour that would be in line with their domination.

By the very nature and characteristics of the operation of a national productive system, massive importation of technological products will involve

^{1/} B. KHADER: "Réflexions sur les transferts de techniques". In les politiques scientifiques et technologiques au Maghreb et au Proche-Orient - Aix-en-Provence, 4-6, June 1980. p. 6.

formidable constraints to their absorption by the labour force, both quantitatively due to various forms of accumulation as qualitatively due to the modalities of investment realization.

In such a context, the restraints to the expansion of employment take a new shape. Within the traditional forms of exclusion of unskilled labour (unemployment), there begin to appear new, subtle forms of exclusion, not that of unemployment of skilled labour, but of affecting their full participation in a concrete and effective manner in the realization of a national productive system. So "marginalization" or in demobilization of a part of the labour force which has been trained at a high cost marks the beginning of a brain-drain process which seem, on the part of the labour force, to be a direct manifestation of a new form of dependence. These are internal elements in which such dependence, prompted from abroad (multinationals) finds its roots. It is necessary to identify these factors clearly in order to elaborate, as soon as possible, a policy of technological control which would put an end to the principal means by which those who possess technology exercise domination over the development of our economies.

This paper will deal with the topic in three phases:

- In the first part, an attempt will be made to describe the context into which the technological policy of Algeria fits. This will be done essentially through two complementary and closely related aspects: the implicit technological challenge as one of the major factors in the new division of labour which is in the process of elaboration.

- The second part, will consider the forms of accumulation during the past decade and deduce from them the major characteristics which have influenced the forms as well as the content of technological consumption.

- Finally, the last part will try to evaluate the results in the field of employment, both quantitatively and qualitatively.

I. CONTEXT OF THE ALGERIAN TECHNOLOGICAL POLICY

With reference to the technological content, the industrialization policy in Algeria is marked by certain major characteristics which attribute to it a particular orientation from the point of view of the labour force.

1. Primarily, this policy deals with a technological issue of the foremost importance: As a developing country which strives to build an integrated, self-centered and independent national economy and given its initial conditions, especially from the point of view of manpower, can Algeria break the monopoly of technology? Will it be gradually admitted as a full fledged partner in the economic competition?

But technology trade^{1/} is very special. Though it is not the only kind of trade to escape the law of supply and demand, yet it exposes clearly the inequity in the power to negotiate between two partners: because of inequality between their international situation resulting from the difference in their level of development. Thus it is necessary to take into consideration the relative power and asymmetry in the analysis.

This uneven market has the following characteristics^{2/}:

- The difference between the marginal cost resulting respectively from the increase in sales (by the seller) and the local production of an alternative technology (by the buyer).
- The "fundamental paradox" in the training and demand for information.
- Market concentration.

1/ M. KEMAL BOUGUERRA: "Le commerce technologique entre pays d'inégal développement". Presses universitaires d'Aix-Marseille, 1977, et G. VAITSOS: "Strategie des choix dans le commerce de la technologie: le point de vue des pays en voie de développement". In *Economie et Société*, t. VII n. 11, 1971.

2/ B. KHADER: "Réflexions sur les transferts" ... op. citée p. 8.

- Recourse to sale of packaged technology.

So, it is in this market of a very particular character that Algeria buys a major part of its purchases. In other words, it is in this market that the external manifestations of its technological policy take place.

Because Algeria had no industrial infrastructure, its technological "acquisitions" have to be made through the purchase of equipment; i.e. these "acquisitions", are directly incorporated into a material form and do not come only in non-material forms (patents, licences, etc.).

The availability of financial resources as a result of increases in oil prices, the closure of Algeria's market in the face of foreign products, and in particular the firm political will of industrialization, will force adaptation on multinationals, and that explains the rapid development of the technology market. Given the importance of contracts and the volume of equipment demanded, Algeria will become very quickly a very big importer of technology.

Technology is mainly controlled by industrial multinational groups (capable of furnishing finished equipment), which very often also control the engineering firms.

At the beginning then, there is an uneven level of development: the question of relationships between Algeria and its partners, or in other words, the object of their exchange relationships will be formed by what nobody wants to reduce to a simple merchandise, even if it was so particular, i.e. technology.

In this context, it is to be pointed out that techniques are neither neutral, nor are they simple merchandise that can be purchased without problems^{1/} in specific markets (patents, technical assistance, studies, equipment, turn-key factories and plant in production factories). That is why a great number of transplanted experiences have ended up with nothing but a "pseudo-transfer"

^{1/} Availability of finance is not sufficient to acquire all technologies required, contrary to what is suggested by A. BENACHENHOU in his article "Les firmes étrangères et le transfert des techniques vers l'économie algérienne". Formed C.R.E.A., Algiers.

because everything happens as if the sold techniques were not passed over to the buyer, but continued to be held and maintained by the seller; as if the purchaser (the developing country) paid not to acquire, enjoy and control but to be integrated and made a chain into a net in which one cannot enjoy any advantages unless by buying them again and again^{1/}. Thus, it seems that "the transfer of technology" constitutes one of the major tools in the control strategy of multinationals.

Thus, the capitalist countries, and more particularly the transnationals, will see in these technological purchases a means to develop their invention and innovation capacity in a unique and unprecedented way.

For Algeria, however, it is not just a question of a necessary requirement for its industrialization, and consequently for its economic independence, it is also the only way to achieve after sometime, a certain degree of technological autonomy. It follows then that the autonomy aspired will not be opposed to "the technological transfer", it will rather encourage such transfer as a preliminary step towards eventual reduction in its volume so that the conditions in which the transfer is effected should not entail perpetual dependance. But, in spite of a conceptual approach in terms of "technological control"^{2/}, the process will not take place exactly in this way because the applications elaborated to this end remain still far behind.

^{1/} P. JUDET, J. PERRIN: "Transfert de technologie et développement: La problématique économique". - Librairies techniques, PARIS, 1977, p. 15.

^{2/} Concerning this point, reference is made to the developments mentioned in the National Charter.

2. This will of industrialization involves a new international labour division

This will seems to be going in the direction of a new distribution of activities advocated by the industrialized countries. In fact, the significance attributed to this new distribution of activities is widely different from one party to the other.

For multinationals it is, at best, a question of "redeployment" of activities which does not jeopardize their supremacy. In other words, it is a question of articulating strategies conceived on the basis of international criteria and of reorganizing national productive systems according to this basis. As for Algeria, it is a question of acquiring a new position with regard to its access to and mastery of certain activities considered to be essential to the process of development.

Multinationals will try to promote a certain distribution of production activities in which the demarkation line does not separate vertically between industrial branches, but horizontally^{1/} between the tasks of products conception as well as of techniques which they seek to conserve for themselves and the tasks of executions especially of semi-finished products, which they permit to "delocalise". Mastery of further stages of transformation which generate a greater value added, is also "preserved" from "migration". In this context, the localization of the market is not precise, and this develops a struggle over what seems presently to be the central element of the whole issue: technology, which is far from promoting a new international division between partners of equal levels of development.

In fact, the movement of internationalization of the economy at the global level is accompanied by a social division of labour in industrialized countries, involving radical separation between manual and intellectual work and localizing the latter in isolated centres of production: consulting firms, companies

^{1/} P. GERMIDIS: "Le Maghreb, la France et l'enjeu technologique".
Cujus Editions.

producing equipment, etc. In this era of automation such activities as creation (consulting firms) and organization (engineering design, organization of work place as well as those of adjustment, maintenance and repair of machines, have gained their autonomy during the last decades as a consequence of the volume of projects to be undertaken and of the growing complexity and diversity of techniques to be mastered.

But, it is with the evolving and development of continuous production processes that engineering has affirmed itself as an independent function of conception with development of engineering firms which design industrial complexes, engineering design offices (for machines) and equipment building plants which produce the necessary materials for automation systems^{1/}. Even innovation activities do not escape this social division of labour, they tend to be concentrated in specific enterprises.

It is by this means that the new division of labour is sought to be realized, with developed countries specializing in the production and supply of equipment, along with the related specialized services (engineering, software), and developing countries having the tasks of producing and supplying certain consumer goods or, at best, semi-finished and intermediate products. Standardization of techniques and products, as Judet and Perrin rightly say, is one of the important bases for the realization of the international division of labour^{2/}.

In fact, at the international level, acquisition of technology is not sufficient in itself. Its importance is related to its role with reference to the strategy of big capitalist groups; it is one of the keys of monopolistic power and in this respect, it represents a fundamental issue. As for Algeria, the will of independence requires diversification of economic relations and instigating competition between different partners so as to avoid being alone together with the old colonial power or more broadly speaking, with a single partner.

^{1/} P. JUDET et J. PERRIN: "Développement économique et technologique..." op. citée, p. 34.

^{2/} Ibid., p. 44.

Meanwhile, on the contractual level alone, it is being realized that concluding contracts with firms, whatever precautions are taken trying to take advantage of antagonism between different firms and interest conflicts between different capitalist countries, does not bring about the conditions necessary for an even exchange. The attitude, then, will be to conduct "better negotiation" of the contracts. But transnationals take advantage of the lack of knowledge on the part of national firms to introduce into contracts clauses which they know well how to turn to their benefit when the right moment comes. Thus, experience has shown, for example, that the guarantee system based on the principle of penalties, which Algeria resorts to, offers in fact no real guarantee. The breach of a contract which is under execution and the recourse to arbitration will entail bigger losses. The fear of suffering such losses makes national firms yield to even the most unjustifiable demands such as reevaluation, which are generally presented at a moment when the work being undertaken is at such a stage that any interruption means a penalty for the client and a compensation for the supplier. It is to be noted that most of our technology purchases come from the giant firms of the capitalist countries.

In fact, this is a consequence of the will to diversify trade, which dominates the whole policy of technological imports in Algeria. It is based on the hypothesis that there exist inter-imperialistic contradictions on rivalry between industrialized countries. The aim of such policy is to maximize the overall efficiency of technological imports.

Given that "through loans, studies, execution, supply of equipment, technical assistance and exportation markets, multinationals influence the strategic sectors of our economy", the most evident result of the diversification policy as practised throughout this decade seems to be a diversification of dependence more than anything else.

Table 1

Major Capitalist Firms involved in the Implementation of
Projects during the Second Plan (1974-1977)

Firm	Countries of origin	Amount of contracts	Share in the country of origin	Share in total contracts covering light industry	Major contracts won during the period
1- Famatex	Germany (Federal Republic)	2 093	56%	9,3%	Blue-Jeans SEBDOU-Weaving-Finishing Souk-Akras-Weaving-Finishing-Biskra Reject textile Sidi-Aich
2- Marubeni	Japan	1 431	65%	6,5%	El-Asnam Cement Factory-Saida
3- Sybeta	Belgium	1 254	62%	5,6%	Cement-asbestos unit of Bordj-Bou-Arreidj LAGHOUAT spinning and weaving factory AKBOU Velvet Complex
4- Creusot-Loir Enterprise	France	1 106,7	26%	4,9%	Beni-Saf and Constantine cement factories
5- C.T.I.P	Italy	879,8	19%	3,8%	MEDEA antibiotics complex
6- ITECO	Italy	791,4	18%	3,6%	Khenchela weaving and finishing unit and MEROUANA carded wool spinning unit
7- Fritz-Werner	Germany (F.R)	705,9	19%	3,1%	Miliana special products unit
8- Italconsult	Italy	676,3	15%	3 %	Detergents units of CHEIGHOUM LAID, SOUR-El-Ghozlane and Ain Timouchent
9- Agache Willot	France	659	15%	2,8%	Colouredthreads unit of APPRIS
10- Krabs	France	617,6	14%	2,7%	Spinning units of TEBESSA and AIN-BEIDA and washing and carding unit of MESKIANA
11- SACM	France	483,8	11%	2,1%	Linen industry complex of M'SILIA
12- General IMPIANTI	Italy	468,2	10%	2 %	BOUGAA's sewing thread unit

Table 1 (Cont'd.)

13-	CFME	Italy	423	9%	1,8%	Flour mills and semolina factories of Sidi-Aich, BACHLIA and FEDJ-AL-AIA
14-	Mirsui	Japan	409	18%	1,8%	Earthen ware unit of MILA and MAGHENIA
15-	Speichiem	France	404,4	9%	1,7%	Resin and ink complex of LAKHARIA
16-	CITOH	Japan	381,3	17%	1,7%	De Lux silk complex of NEDROMA
17-	Buhler	Switzerland	350,8	39%	1,6%	Flour mills and semolina factories of LAGHOUAT, M'SILA, TOUGGOURT, ARRIS, OULED MIMOUN, SAIDA and MAHDIA
18-	Salini Icensa	Italy	301	7%	1,4%	Spinning (Civil engineering) units of AIN BEIDA and TEBESSA
19-	Becsa	Belgium	272,9	13%	1,2%	Paint units of SIG and SOUK-AHRES
20-	Sodetec	France	264	6%	1,1%	Prefabricated-houses unit of AIN M'SILA
21-	Ingeco	Italy	250	6%	1,2%	Folding bags and boxes unit of BORDJ BOU ARRERIDJ
22-	Verkor	Belgium	243,5	12%	1,1%	Wood Panel unit of KHENCHEIA and enlargement of wood complex of BEDJAIA
23-	Aceh	Spain	228	37%	1,1%	Flour mills and semolina factories of DJEIFA and EL-KANTARA
24-	Occr Inter.G	France	223,4	5%	1%	Cerk units of JIJEL and OUED MARSA and wood panel units of TELAGH and DJEIFA
25-	E.C.A.	Spain	212	35%	1,1%	Flour mills and semolina factories of EL-HARROUAH and OUM-EL-BOUGHI
26-	Zhokke	Switzerland	209,9	23%	0,9%	Supply of basic structures and civil engineering for the silk complex of TELEMEN
27-	Sulzer	Switzerland	204,7	23%	1%	(Equipment of) TELEMEN silk complex
28-	Eff	France	192,5	5%	0,9%	Civil engineering of cement factories of EL-ASNAM and CONSTANTINE

Table 1 (Cont'd)

29-	Someri	Algeria	175,2	5%	0,9%	Feasibility studies for complexes of cigarettes, matches and chewing tobacco in KHROUBS, SIG and BLIDA, for flour mills and semolina factories in SAIDA, and Ouled Mimoun, for semolina factories of BEL ABBES and for the biscuit factory of CHERCHELLE.
30-	Klockner	Germany (F.R.)	167,8	5%	0,8%	MAGHNA maize unit
31-	Odessa	Spain	167	27%	0,8%	Enlargement of the bakir.g powder factory in OUELD SMAR and the industrial bakery unit of CORSO
32-	BUM	Germany (F.R.)	140,20	4%	0,7%	Furniture fabrication units of NEDACMA and LARBAA NATH-IRATHEN and general carpentry unit of AIN BEIDA
33-	SACMI IMPIANTI	Italy	137	3%	0,6%	Ceramic squares unit of EL-ACHOUR and ceramic sanitary furnishings of TENES
34-	INTERCOOP	Italy	126,3	3%	0,6%	Flour mills of BECHAR, SIDI ALSSA and KSAR-EL-BEUKHARI
35-	KNAUF- ENG	Germany (F.R.)	123,36	6%	0,5%	Fleurus plaster producing unit
36-	SAMIC	Belgium	108	5%	0,5%	Tile and brick field works of TIARET and EL-MILIA

Table 2

Contracts by national firms and by groups of countries (1974-1977)
(Light Industry)
(by millions of AD)

Part one	Capitalist Countries											U.S.A.	Total
	Italy	France	Germany (FR)	Japan	Belgium	Switzer-land	Spain	Sweden	Great Britain	Aus- tria	Canada		
SONITEX	282,58	1782,47	2158,61	550,20	1134,54	483,21	-	-	0,79	-	-	-	7.671,77
SNMC	765,56	1541,45	243,77	1261,01	378,98	34,40	5,52	91,77	3,32	-	6,08	6,51	3.798,08
SN, SEMPAC	2.039,59	12,80	-	-	-	373,95	607,00	-	76,67	-	-	-	1.805,06
S.N.I.C.	271,01	404,44	989,06	404,98	275,60	0,12	-	-	-	33,98	7,28	-	3.671,60
S.N.L.B.	33,32	487,73	155,29	-	243,48	-	-	-	-	-	-	-	888,50
S.O.N.I.C.	63,33	62,37	38,91	-	0,56	-	-	-	-	-	1,08	-	403,74
SOGEDIA	201,47	1,76	6,99	-	5,06	-	0,78	0,44	-	0,07	-	4,20	49,43
SOMIPEC	11,38	67,19	124,75	-	-	-	-	-	-	-	-	281,04	-
S.N.T.A.	119,60	-	-	-	-	-	-	-	-	-	-	-	-
SN. EMA	50,66	12,13	52,06	-	1,01	-	-	0,14	-	-	-	-	65,34
SNERI	24,75	6,37	2,88	2,00	0,33	-	1,58	0,12	-	-	-	-	15,14
S.N.A.T.	4,45	2,56	-	-	-	-	-	-	-	-	-	-	2,56
General Total	3.867,70	4.499,19	4381,27	2218,19	2039,56	891,68	614,88	92,47	80,78	33,05	15,16	10,71	18.650,26

Table 2 (Cont'd)

(by millions of AD)

National firms	Socialist Countries							Total
	Hungaria	Romania	Bulgaria	China	Poland	USSR	Democratic Republic of Germany	
SONITEX	-	-	1,38	-	-	-	-	1,38
SNMC	72,41	2,82	14,62	7,95	-	-	3,10	98,90
SN, SEMPAC	08,23	104,00	-	-	-	-	-	212,23
S.N.I.C.	-	-	-	-	-	2,39	-	2,39
S.N.L.B.	-	-	-	-	-	-	-	-
S.O.N.I.C.	-	-	-	-	-	-	-	-
SOGEDIA	46,35	-	-	-	-	-	-	46,35
SOMIFEC	-	-	-	-	-	-	-	-
S.N.T.A.	-	-	-	-	-	-	-	-
S.N. EMA	-	-	-	-	-	-	-	-
SNERI	-	-	-	-	1,02	-	-	1,02
S.N.A.T.	-	-	-	-	-	-	-	-
General Total	126,99	106,82	14,62	7,95	2,40	2,39	3,10	362,27

Table 3

Contract by country and planned investments during
the Second Pland(1974-1977)

(by millions of AD)

Countries	1977		1974-1977			
	Total	%	In AD	In foreign currencies	Total	%
Italy	2300,93	28	914,46	3584,73	4499,19	20
France	1301,81	16	823,99	3557,28	4381,27	19
Algeria	1986,93	24	3868,20	-	3868,20	17
Germany, Federal Republic	123,90	2	758,54	3013,18	3772,32	16,5
Japan	786,14	10	258,37	1959,82	2218,19	10
Belgium	850,48	10	384,93	1654,63	2039,56	9
Switzerland	34,50	-	130,01	761,67	891,68	4
Spain	608,55	1	94,05	520,83	614,88	3
Hungaria	50,82	1	15,12	211,87	226,99	1
Romania	104,00	1	61,32	45,50	106,82	0,5
Sweden	0,14	-	5,21	87,26	92,47	-
Great Britain	0,79	-	0,90	79,88	80,78	-
Austria	-	-	2,08	31,97	34,05	-
Canada	8,35	-	5,05	10,11	15,14	
Bulgaria	2,02	-	13,48	1,14	14,62	
U.S.A.	-	-	0,04	10,67	10,71	
China	7,95	-	-	7,95	7,95	
Bangladesh	1,34	-	4,87	2,51	7,38	
Poland	1,02	-	-	2,40	2,40	
U.R.S.S.	1,12	-	0,49	1,90	2,9	
Democratic Republic of Germany	-	-	-	1,10	1,10	
Total	2177,63	120	7341,29	15546,90	22888,11	100

II. ACCUMMULATION FORMS: CHARACTERISTICS OF THE PROCESS

1. The rapidity and magnitude of industrialization

Algeria has deliberately opted for rapid and massive achievements. But is that enough to conclude, as certain authors indicate, that this was the most effective choice to bring about the expected industrialization effects^{1/}? The situation deserves to be seriously examined and discussed, especially that the problems involved are so considerable.

One of the major characteristics of the industrialization process in Algeria is its extremely rapid pace which is taking place within an economy whose production capacity in equipment and in civil engineering as well as the availability of qualified personnel in innovation, execution and maintenance are so poor; hence the contradiction between the will to go fast leading to certain achievements (turn-key and plant-in-production projects and the control over the industrialization process.

Let us try to define the rhythm and volume of investments.

- The strong tendency to accumulate can be seen from the magnitude of investment flows realized by the public sector. Taking 1966 as base year, total public investments in 1977, i.e. the state budgetary investments together with planned investments of public enterprises, attained the index of 2974, an increase from AD 1493 millions to AD 44,400 millions, at an annual growth rate of 270 per cent. At the same time planned investments of public enterprises increased more rapidly and reached the index of 5931, which is something absolutely unprecedented in the history of national productive systems.

The investment rate or the relation between gross fixed capital formation and GDP which reflects the intensity of activity in relative terms, rose from 19 per cent in 1967 to 28 per cent in 1968 and to more than 50 per cent in 1977.

1. G. DE BERNIS. "Le gaz naturel est-il facteur d'indépendance économique", Application à l'Algérie. In les hydrocarbures et le développement des pays producteurs, p. 332.

Such an effort could not have taken place had there not been an acceleration in our hydrocarbon sales.

- The tendency to accumulate can also be measured by the number of projects launched simultaneously every year, the rhythm of which has accelerated sharply with the Second Four-Year Plan^{1/}.

- The same tendency can also be seen from the volume of industrial investment. Thus, in the field of financial achievements we have:

- The 3-Year Plan (1967-1969): AD 6,057 millions for industry out of a total of AD 7,651 millions or 79 per cent achievement.
- First 4-Year Plan (1970-1974): AD 20,100 millions out of a total of AD 35,906 millions (or 55.98 per cent of the total).
- Second 4-Year Plan (1974-1977): AD 65,314 millions out of a total of AD 110,612 millions (or 59 per cent achievement).

There is a phenomenal acceleration from year to year, which has pushed the average annual industrial investment from AD 3.2 billions during the 3-Year Plan to AD 8.5 billions in the first 4-Year Plan and to AD 28 billions during the second 4-Year Plan. Industrial investments have been so dynamic that this aspect itself has inevitably made itself felt through the size of employment. It has generated an employment market in which two distinct sections can be identified: a local or regional dimension in the case of unskilled labour and a national dimension in the case of skilled labour as far as the Algerians are concerned; but it also involves a considerable "international" element in some of its components when one takes into consideration the aspect of "technical assistance" and concrete forms of investment achievements.

1/ F. YASSIR. "Les flux d'importations de technologie dans le secteur industriel public en Algérie". Revue Algérienne des Sciences juridiques, économiques et politiques, Vol. 4 décembre 1980, p. 657.

An examination of sectoral allocations of investments shows a growing polarization around the export sector, i.e. extrovert accumulation which drains at least half of the funds allocated for industry. Therefore, the question of optimizing the rhythm of valorization of energy resources on the international market must be treated explicitly because it affects in particular the size of the management and technical personnel assigned to it, bearing in mind, not only the temporary aspect of the exporting industry but also, in particular, the development priorities in a perspective of controlling the technological processes in the long run.

All this should be related to the more considerable difficulties of establishing mechanical and electrical industries (32.5 per cent of the average level of physical achievements, against 52.7 per cent for steel industry and primary transformation of metals. While the hydrocarbon sector, on the contrary, has registered the highest realization rates § 1/). With the emergence of electronics, micro-mechanics and petrochemicals during the second 4-Year Plan, technology control problems have been reduced. Furthermore, the acceleration of investments has increased this dependency and made it more difficult to arbitrate between the different fields to be mastered. For example, the volume of contracts signed in the industrial sector between January 1974 and June 1975 amounted to AD 24 millions, which equals the whole volume realized between 1963 and 1974^{2/}.

Apart from the volume and localization of realized investments, the absorption rhythm of the labour force depends on the nature of equipment employed. This takes us back to capital intensity: the high degree of capital in relation to labour is not, initially a consequence of a technological choice in itself but of sectorial investment choices mainly in the hydrocarbon sector.

1/ A. MEBTOUL: "Le mode d'accumulation" in l'étude industrialisation Emploi et repartition du revenu. M.I.L., Oran, 1978.

2/ A. BENACHENHOU: "Les firmes étrangères et le transfert des techniques vers l'économie algérienne". Cahier du C.R.E.A. No. 2, p. 47.

2. Organic composition of capital

Since the means of production are not well developed, the organic composition of capital, i.e. the relation between constant capital, consisting of production materials, and variable capital, consisting of remunerations paid to the labour force, has been in direct relationship with employment during the last decade. At the same time, this organic composition of capital determines both the degree of utilization of the labour force and the degree of reliance on the importation of equipment .

In addition to this, there is the fact that a solid capital organic composition in itself does not create much employment; it has grown up within developed capitalism precisely as an answer to the prevailing weak elasticity of labour supply, whereas Algeria faces a structural surplus of the labour force.

Thus, concerning Algerian industry between 1966 and 1979 and since national capacities of equipment fabrications are not very significant, any increase in fixed capital meant an increase in importations and consequently a stronger insertion into the international capitalist market, while leading to less use of the labour force.

In relation with the very rapid rhythm of investments, the production capacity of civil engineering itself will create bottlenecks hindering investments realizations and constitute a restricting factor for the full and permanent utilization of the installations of S.N. METAL. This leads to falling back on foreign companies and consequently to a lesser demand for national manpower which is estimated to be at least 30 per cent of the sector's achievement.

As a result of the absence of the means of production sector, the greater part of employment created by the equipment fabrication was generated abroad. The weak development of the means of production section, which has great difficulty in getting established, (contrary to the exporting aspect of the hydrocarbon section for example) and more particularly the weak development of mechanical, electrical and electronics industries recall into focus the employment problem in relation to capital intensity, and under the same conditions

during the forthcoming decade. Since the greater part of equipment should be imported, a considerable fraction of employment will be transferred abroad.

Had the industrialization process taken place under more control, the first units would have had the time to increase their production capacity. This would have permitted Algeria to have better control over a process which, once started, reveals a dangerous tendency to escape being mastered, as a consequence of counter-strategies implemented by multinationals. Furthermore, given the fact that the material base has not been sufficient during this first stage of industrialization, seeking supplies of high technology component from abroad can be analyzed as an exportation of potentials of **technical** progress which is implicit in the investment efforts.

But depending on abroad has not meant the importation only of machines, but also of creativity, of realization means, of formation etc.; and all that means so much employment "exported". Indeed, the huge production units chosen by Algeria necessitate a phase of important creativity and studies which have been imported. Even the implementation phase requires not only elaborated technical knowledge, but also a long experience in industrial techniques. It follows that the formation of capital in big units or in units of sophisticated technology requires a large, wide variety of qualified labour, which tend to concentrate in the form of engineering companies which are closely controlled by the equipment construction companies.

The latter has been defined as "the whole body of methods and structures permitting the control of scientific, technical, technological, economic and financial information necessary for the conception and optimum realization of capital in a coherent productive whole^{1/}".

Was it realistic to think that such a vital function as engineering could be trusted without risks to capitalist firms whose interests are exactly opposite to the establishment of such a coherent productive whole?

^{1/} P. JUDET and J. PERRIN: "A propos du transfert des technologies pour un programme intégré de développement industriel. I.R.E.P., 1971, p. 8.

Even at a lower level of analysis, could one think that the leaders of an industrial branch will accept to create for themselves a competitor in a market which is getting internationalized and in a country where the size of domestic market does not allow anticipation of absorbing the totality of the planned production while its production units have the same maximum capacity as that attained by countries with vast markets and running at their full capacity? One understands easily now that if transnational firms accept without much reluctance to sell machines, they will act in a parallel way so as to hinder the normal functioning of the expected process^{1/}.

In fact, the range of production capacities required by Algeria corresponds generally to the optimum achieved by most developed countries. This often implies the need to export a part of the production. But such a perspective is directly in contradiction with the interests of technology selling groups who exploit for themselves such operations on the international market. In such cases, their counter-strategies will be either trying only to prevent the realization of projects of this kind or working against the flow of Algerian production into the markets that they control.

Finally, it can be said that insofar as industrialized countries monopolize both the production of means of production and the engineering, and as long as their largest firms act for the maximization of their profit rates, they will not only pay no attention to an industrialization-independency process (from all points of view, including that of mastery of techniques by national labour force), but they may very rapidly become the main obstacle hindering such process.

1/ One of the well-known examples is that the ammonia and nitrogenous fertilizers complex of Arzew which is composed of 4 units: (1) ammonia, (2) nitric acid, (3) ammonium nitrate, (4) Urea. Units 2, 3 and 4 are conditioned by unit 1. Because of some technical defects, Unit 1 could not function, and consequently the functioning of all other units was interrupted, with the result that ammonia had to be imported and is no longer produced with Algerian natural gas. The result of all this has been a higher fertilizer cost and a necessity to subsidize their production in addition to the fact that the integration effect has not materialized.

3. Modalities for investment realizations

In order to measure the impact of the technological policy from the employment point of view, one must begin with the fact that all technology is based on a specific articulation of a whole body of means of production with a specific labour force.

Concerning manpower, three categories of functions are particularly expected to be problematic in the case of Algeria.

- Engineering, or the capacity to create and to set up production units, the control of which is evidently fundamental because it determines the performance of all technological aspects, and consequently the forms of technology consumption. In addition to the exaggerated technological "mimicry" which generates considerable extra charges, the virtual absence of engineering on the part of Algerians also explains the emergence of intrinsic "difficulties" which take the form of an actual organization by multinationals of dependency through technology^{1/} even in the field of an accumulation process which they do not (fully?) control from the financial point of view.

- The skills which workers need to use and to maintain equipment, hence the importance of adapting education and training content to the requirements of industrial realizations.

- Forms of organization, management and distribution.

On the other hand, to get the full picture of the reality of technology transfer, it is important to probe its exact content^{2/}.

- Is it simple displacement in space of the functioning of techniques which remain a prerogative of a few firms?

^{1/} C. DESTANNE DE BERNIS: Relations économiques internationales. Dalloz, 4th edition, 1977.

^{2/} Ibid.

- Is it at least the beginning of conveying to the economic agents of developing countries the ability of setting at work as well as of reproducing such technology? The Algerian experience shows that these two levels should be treated separately.

- Is it the transfer of the capacity to produce a new technology?

It is evident that depending on the hypothesis assumed, the implications in terms of employment structure will be radically different.

In fact, the term "transfer" of technology implies a wide range of forms, starting from the acquisition of patents and licences to the implantation of affiliates of multinational firms which in this case are left masters of the forms as well as of the content of the transfer.

In practice, the national firms have systematically resorted to "turn key" contracts which M. BENBOUTA defines as "the supply of an industrial complex comprising the conception, the study, the construction and the delivery of the totality of equipment in an operational form in specific production conditions for a total contract price"^{1/}.

This form of realization leads to the consumption of an immense volume of imported technology on which there is little information available, since such figures are not often published in Algeria, contrary to the situation in certain Latin American countries.

On the basis of the rates of the technical budget of an industrial investment^{2/}, A. LARBI^{3/} tries to make an estimation, the major elements of which are quoted hereunder.

^{1/} M. BENBOUTA: "Situation et rôle de l'engineering dans l'intégration du système industriel Algérien" a doctoral thesis, Grenoble, 1973.

^{2/} S.R. THIERRY: "Les biens d'équipement dans l'industrie algérienne". Séminaire C.R.E.A., Oran 22-24 Mai 1979.

^{3/} A. LARBI: "La planification de la recherche scientifique et technique dans les formations sociales scientifiquement sous-développées (cas de l'Algérie)". These Doctorat 3^e cycle - I.R.E.P. Grenoble, 1980.

Table 4

Global technology consumption in Algeria by purpose
of use and by origin, in the industrial system -
1967/1977

By millions of AD

Purpose of use	Percentage of technical budget	Industrial investments	Rate of imports	Volume of importation
Engineering studies	10%	5,500.00	70%	3,850.00
Mechanical equipment	25%	13,750.00	90%	12,400.00
Electrical equipment	15%	8,250.00	90%	7,400.00
Earthwork and civil engineering	20%	11,000.00	0%	-
Structural work	10%	5,500.00	80%	4,400.00
Other work	10%	5,500.00	0%	-
Miscellaneous	10%	5,500.00	50%	2,750.00
Total	100%	55,000.00	60% (weighted average)	30,800.00

Table 5

The sectional distribution of imported technology consumption,
1967-1977

Purpose of use	Volume of imports	Sectional distribution			
		Hydrocarbons 47%	Section 1 10%	Section 2 27%	Sections 3 & 4 16%
Engineering studies	3,850.00	1,810.00	385.00	1,040.00	615.00
Mechanical equipment	12,400.00	5,830.00	1,240.00	3,350.00	1,980.00
Electrical equipment	7,400.00	3,500.00	740.00	2,000.00	1,160.00
Structural work	4,400.00	2,000.00	440.00	1,200.00	760.00
Others	2,750.00	1,330.00	275.00	720.00	425.00
Total	30,800.00	14,470.00	3,080.00	8,310.00	4,940.00

The table shows that technology imports represent an estimated 60 per cent of the technical budget of investments realized throughout the decade (the 30,800 AD millions). In fact, as a consequence of importations by localized works in the country (earthwork, civil engineering and other works), national participation which is shown as 40 per cent, is in fact overestimated. This dependency which varies according to the purpose of use, is particularly evident in the fields of mechanical and electrical equipment (90 per cent), structural work (80 per cent) and engineering (70 per cent) in view of the weakness of the section related to the means of production, of design capacity and of conception in the metallurgical industries. Thus, in occupations related to "engineering studies", the deficit in technical skills in 1978 is estimated at 13,000 technicians and engineers, while the available personnel at the same date were around 5,000. Leaving out

the distinction between general engineering and process engineering, and keeping in mind the proportion of two technicians for each engineer, the shortage in engineers alone (4,300) will not be met in a short time at the present rhythm of training.

As a result, Algeria has not been able to realize the technology choices which are imperative for establishing its industrial base. This situation will create problems of inter-industry compatibility^{1/}. Furthermore, since the enterprise is basically oriented towards increasing production capacities and marginally towards increase of production in physical terms, it is doubtful that such aims will have favourable effects upon building up of autonomous skills and production techniques.

The mere fact that a factory has been installed does not resolve the problem of national acquisition of technology; it is necessary to have the capable manpower to operate the factory. Thus the idea of "plant in production" factories has developed. In such projects the supplier is asked to train the personnel required to run the factory at certain profitability rates, observing international market quality norms. The supplier is also asked sometimes to secure the supervision over the performance of industrial complexes.

At the time of the inception of a project, it is presented as having a lot of advantages. However, practical experience often proves no such advantages really exist. This was the case with the "turnkey" projects. Then came "plant in production" projects, which were presented as being of better performance, but have shown no better quality, there is now intensive search for other forms which would probably provide magic advantages and would be qualitatively superior to the former ones.

^{1/} At the economic level, it is the independent sectorial integration which has failed; this is manifest in the well-known and very significant example of the tubes fabricated for Sonatrach by S.N.S. which were finally not used by the former because of different norms adopted by the two firms.

The rapidity of industrialization has thus come to mean the rejection of a progressive process which is the only way to achieve, with time combined with that of formation, the dissemination of technology, principally in terms of collective know-how. It could also help in the establishment of an industrial network with the functioning of all its multiple complementarities as well as the establishment of homogenous labour training. For some time, there was a tendency to believe in the reluctance of the idea of multinationals, but the proliferation of such contracts seems to prove the opposite, it is rather an evidence of counter-strategies meant to "encompass" our development and to undermine our efforts to get rid of the capitalist international division of labour. Since technology flow is not operational without a flow of know-how, which is very carefully "distilled" by multinationals, they organize the relationship in such a way that recourse to them as masters of technology becomes a permanent feature through the implications of technological supplies, i.e. spare parts, processes, know-how, etc.

The application of such subtle tools with the appearance of mentality gives multinationals great flexibility of intervention.

On the other hand, foreign companies try hard to recommend the use (and consequently the sale) of those processes which they know and practically those of which they own the patents, without consideration of any other process of which the required equipment, the sub-products obtained, etc. would be more amenable to integration into the national economy (the case already mentioned of the S.N.S. tubes made for S.K and which were not used because of different nouns adapted by the two firms). In this way a great deal of potential employment is exported, and the expected effects of industrialization are not fully reflected in the national economy. Those firms do not heed the fact that they themselves have their own suppliers to whom they are related through complex networks of implicit or explicit integration. The result is that equipment orders received by national industry, even when it can execute them with the required conditions, are systematically turned down. It is not surprising then that throughout the years, the existing industry has not adequately participated in equipping the other sectors, which means a loss to the national economy of employment, production and value added.

It may also be emphasized that "the realization even of a great number of projects in such conditions has no chance to ameliorate the initial conditions and the recourse in all stages to the same kind of turn-key contracts imposes itself without ever giving national engineering teams the chance to test their ability to gradually or even partially **substitute** foreign engineers^{1/}".

The above shows clearly how big firms adapt themselves to the evolution of their dominant conditions. It also shows clearly that there is no real rupture with multinationals based only on the exploitation of inter-capitalist competitions and contradictions or on the control over the possession of means of production by means of available finance. It should be kept in mind that, such finance may come rapidly to an end, given the current exploitation rhythm of energy resources. It has also been demonstrated above that industrialization is the process of domestic building up national manpower by national teams of engineers, architects and technicians who progressively become capable of realizing this industrialization through their practical participation (though limited at the beginning) in all the phases of its process.

For such a task, we cannot rely upon foreign firms. At best they make us buy (the maximum of) their products without any consideration for our real needs nor for our absorption capacity (even if this latter should not be thought of in static terms).

Algeria runs the risk of getting completely caught in the trap of technical assistance with all its multiple "services"^{2/}.

All precautions taken in the elaboration of industrial projects (setting countries at competition) have not prevented Algeria from acquiring a technology which is highly expensive. The high prices paid to buy technology packages and to have "turn-key" or "plant in production" factories, are far from being offset by the advantages of setting the selling countries at competition with each other.

1/ G. de Bernis "Le gaz naturel est-il facteur ..." op.cit. p. 334.

2/ This can be illustrated by the tendency to decrease the degree of control over technology imports, which is reflected in underutilization of the initial potentials of qualified industrial labour force. Abandoning the over-all responsibility of acquiring technology with benefits to foreign firms amounts to the destruction of the value of using national labour force. When "imported technology does not represent a first installation of production capacities but a means of modernizing the industrial branch, then it implies a devaluation of the production means and of the labour force of this branch". Compare the note of F. Yachier in his article cited above.

Are we really sure that a product or technology which is recent at the moment if its acquisition will continue to be so a few years later? Nothing is less certain. Indeed, it becomes more and more clear that the duration of the useful life of technologies elaborated by transnationals is limited because "new transfers of industries involve equipment and processes that are characterized by very rapid obsolescence^{1/} if not a rapid obsolescence which is planned in advance^{2/} because of the effects of low cost of raw materials, which in turn has caused the rapid saturation of markets by accelerating the rate of introducing new products. R. VERNON^{3/} has become the theoretician of this process. This same process implies also an explicit will to maintain at each stage an important technological advance by keeping hidden from the offered and sold techniques some other technique which will render the former ones obsolete. This is the way Professor T.H. HANER recommended very seriously to "plan technology obsolescence".

As a result, the vertiginous increase in the cost of acquiring an ephemeral technology may become a more serious obstacle than patent royalties. Besides, in the absence of a science policy, there is no guarantee that the personnel under training will adapt themselves to new techniques. Consequently, a policy of complete acquisition of processing and know-how coupled with the formation of cadres and of autonomous research units, will not be effective without innovation^{4/}.

In 1974 Algeria paid about AD 800 millions, or about 5 per cent of its GNP (almost US \$ 200 millions), for the importation of foreign technology (patents, licences, engineering). Calculations show^{5/} that Algeria with its population representing 0.5 per cent of the Third-World population, consumes or buys about 12 per cent of the volume of technology exported from industrialized countries. This means that its technology imports are 25 times those of the other countries of the group. This very index reflects an important

1/ D.C. LAMBERT: "Le mimétisme technologique du tiers-monde", Economie, 1979, p. 24.

2/ P. JUDET, J. PERRIN: "Transfert de technologie et développement", op. cit.

3/ R. VERNON: "Les entreprises multinationales", Calmann Levy, Paris.

4/ D.C. LAMBERT: op. cit., p. 20.

5/ Secrétariat d'Etat au Plan: "Seminaire national sur le transfert de technologie", 1973 - Final document: N. JEQUIER: "Quelques problèmes de politique de la technologie: le cas de l'Algérie", stensilled document, Centre d'études industrielles - February - 1973.

phenomenon which shows, on one hand, Algeria's will to industrialize, and on the other hand, either that Algeria imports too much technology, or that the prices it pays are too high, or that both assumptions are in full play. It is also estimated that Algeria consecrates only 0.5 per cent of its GNP to applied research. This gives an idea as to the size of imports, the financial implications of which spread out over all the "transfer" phases: the knowledge required during the pre-investment phase, investments (feasibility studies, market research, etc.), the choice of techniques and equipment, the installation of units' production materials, training, management, marketing and maintenance.

There is a lack of co-ordination, which encourages each firm to import its own technology. Progressive consciousness of the danger is sometimes expressed at certain national levels: "During the last decade, Algeria had to face this dependency while taking into account the target date which it has set for the realization of its objectives. The need for engineering personnel continues to increase at a very high rate, and if no solution is found, the direct effects of dependency will increase at least as much^{1/}. This has already occurred if only judged by the increasing cost of technical assistance services as far as our balance of payment is concerned; it rose from AD 690 million to AD 4,200 million (more than 600 per cent) or more than expenditure on education, training, higher education and scientific research during the same year.^{2/}

So, it is vital and urgent to elaborate the necessary elements for the development of our own innovation capacity. In fact, the fundamental point in a development - independence concern, is to acquire and to develop systematically the mechanisms which permit at least the reproduction of the technology transferred, whether dealing with processing or with products, because the geographical localization of a technique is less important than having material and political control over it. That is why it is necessary to have a policy of creating such capacities of reception, adaptation and control over the imported techniques, not

1/ The national seminar on the transfer of technology, S.E.P., Document SNERI.

2/ A. AKKACHE: L'Algérie à la veille du troisième plan: La lutte contre les Multinationales. Conference à l'I.S.E. d'Oran - 16 April 1979.

only with reference to "cadres" but also to control agents, workers, etc.

The pertinent question is how can this process be carried out? How long will it take?

It is indispensable to face the problems of conception and technology control, calling into play all fields of research. "This is the only way to get out of a situation in which the existing technical branches polarize dynamics and innovations for the benefit of domineering countries and at the expense of new branches which are better adapted to the needs of many developing countries"^{1/}.

Such a policy is not to be reduced to mean a science policy. The many examples of recuperating this science policy through "inverted transfers" or through brain-drain are now so well-known that one does not need to elaborate on them here.

Yet, at present, it seems that the first step in the creation of a simple industrial capacity is to organize the diffusion of technology among national companies. This would avoid certain duplication where the same technology is simultaneously bought by two national companies.

Such policy may be centred around institutes (some already exist) of certain branches of specific activities, which are closely related to production units whose engineers have supplemented their training with experience in production units. But one should not stop at this point and consider the branches separately. Even with co-ordination organs, a control and innovation policy should be elaborated at the national level since it has to determine the role and position of each industry within the objectives of the Plan.

But, it should not be forgotten that "the very narrow way of autonomization is a result of the fact that the will of apprenticeship is prior to the will of appropriation"^{2/}. Consequently, the less prestigious but more sure and more

1/ Transfert de technologie et développement, op. cit., p. 547.

2/ D.C. LAMBERT: "Le mimétisme ...", op. cit., p. 98.

effective method is to go through a determined and systematic apprenticeship. A pertinent example is that of Japan which, after having accomplished its apprenticeship of technologies between the end of the nineteenth century and till around 1950, it has succeeded in a very short period - twenty five years - to overcome its technological dependency and has become a threatening competition on the international scene.

III. IMPACT ON EMPLOYMENT

In the light of the above argument, the industrialization policy takes place, in terms of employment according to contradicting movement between:

- massive investments conducive to generation of employment; and
- a very strong capital intensity which is a source of restrictions to employment creations not only because it limits employment creation itself but also because it is coupled with the necessity of importing equipment (which means exportation of employment).

The technological content of the industrialization policy also gives it a doubled characteristic:

- the multiplicity and levels of qualifications required in all the stages of conception, installation and operation of plants, and
- the partial or total non-availability of human elements capable of realizing this rapid and massive industrialization, translated in "importation" of employment in the form of consulting firms and engineering and technical assistance.

Let us then examine the overall result in its quantitative form:

1. The evolution of overall employment

With respect to the development policy, what has been the final result as far as employment is concerned? How has the sectorial redistribution of the labour force taken place? Has there been a reintroduction of the labour force into the production process, and in what proportion? In what way has industrialization contributed to that?

It is necessary first of all to study the evolution of global employment in order to determine the dimensions of the labour force redistribution.

The two censuses of 1966 and 1977 will help in making a direct comparison.

(a) There is a great regression of agricultural employment both in absolute terms as well as in relative terms. This sector represented less than 30 per cent of global employment in 1977 against 50.5 per cent in 1966. Such a decline is a consequence of the powerful attraction of non-agricultural employment, which partially explain the volume of internal migration. This "elasticity" of the labour force of rural origin has helped in responding rapidly to a massive demand part of which is localized at specific points: particularly at development centres. This has not occurred without causing various kinds of strong tension in the qualified labour market which takes a national dimension.

Table 6

Evolution of Total Employment between 1966 and 1977 According to the 2 Censuses

Activity Sectors	1966	1977	Absolute Variation	1966 Index	Rate of annual growth
Agriculture	873.600	692.160	- 181.440	79,2	- 2,08%
Manufacturing	172.400	401.462	- 229.062	232	-13,2 %
Construction and Public Works	90.900	345.816	+ 254.916	380	28 %
Commerce	140.100	183.580	+ 43.480	131	31 %
Transport	75.500	132.420	+ 56.920	175	7,5 %
Administration	336.800	397.017	+ 60.219	117	1,7 %
Others	<u>56.900</u>	<u>184.500</u>	<u>+ 127.600</u>	<u>324</u>	<u>22,4 %</u>
Total	1.846.200	2.336.955	490.755	126	2,6 %

(b) Industrial employment has largely increased but the figure of employment 401.462 is overestimated as a result of including into manufacturing, employees of commercial monopolies under the control of the national enterprises. The annual survey of industrial employment mentions only 345.901 workers in this sector (in which case, we would be having an annual growth rate of 9.36 per cent and the index would be 203).

Evolution has not been regular throughout the whole period.

It is noticed only from 1969 onwards, and in relation to the first Four-Year Plan that real growth of industrial employment began (growth rates between 5 per cent to 8.2 per cent per annum), it accelerated with the second Four-Year Plan (annual growth rates between 12.7 per cent and 15.7 per cent).

Capital intensity in Algeria is particularly high in comparison with other parts of the world because of multiple overcosts (as the cost of creating a single job will illustrate) though the reason for such overcosts may be attributed to internal factors (slow administrative action) as well as to external factors (overcharges, non-respect of delivery dates, price readjustments, etc.). However, employment in production units is far from being commensurate with the investment volume, in spite of the tendency by firms to develop subsidiary employment (in marketing, consumer co-operatives, social and particularly health services).

Table 7

Average Cost of the Creation of one Job

(In current dinars)

Branches	1967-69	1970-73	1974-77	I N D E X	
				Base 1967-69 = 100	
Hydrocarbon	1.621.882	387.832	524.312	24	32
Mining and quarries	338.444	4.067.816	22.222.222	1.201	6.566
Electricity	951.807	827.587	579.820	87	61
Steel Industry	1.700.000	401.543	497.315	24	29
Mechanical and electrical installations	38.519	119.686	332.920	311	862
Chemistry	172.537	245.288	887.527	142	514
Food Industry	62.722	110.391	109.129	176	174
Textile Industry	10.069	45.635	436.028	453	433
Leather and hides	13.338	39.502	101.003	296	737
Building materials	11.225	355.243	570.398	316	508
Wood, Paper, etc.	8.498	280.818	170.555	330	200
Total	138.796	260.531	444.168	208	320

(c) The constructions and public works sector is the most dynamic, and plays a leading role in this respect.

As far as employment is concerned, a good part of realized investments relate to construction and public works. The development of this sector is evident from the laying down of the bases of industrialization and of industrial units, since the real-estate infrastructure has not been affected so much during this decade. However, it is not clear whether this kind of employment will be durable, even if one observes a certain continuity due to the maintaining and to the acceleration of investment rates.

It is obvious that once the production system has been realized, there will be no such massive need for this kind of employment unless new diversions are found (habitat, social infrastructure...).

If, in order to make a comparison, we classify agriculture and all extraction industries in the primary sector, all other industries and construction and public works in the secondary sector, and the rest in the tertiary sector, it can be shown clearly that a significant structural change is taking place: the emergence of a strong secondary sector with a solid industrial composition.

Table 8

Percentage Population Distribution According to
The Three Sectors

Activities sector	1954	1966	1977
Primary sector	75	52	30,5
Secondary sector	7	12	31
Tertiary sector	8	33	35
Other activities	10	3	3,5

But, it is construction and public works which seems to be the receptacle of the population transfer from the primary to the secondary sectors . For parts of the population of rural origins, it constitutes an obligatory bridge to pass over towards industry (if not towards emigration). This question will be the subject of further probe hereunder.

2. Evolution of industrial employment

With reference to the starting point, the volume and the rhythm of investments and employment creation by branch will be very different, but can be classified into three industry groups according to the employment growth rate in each group.

(a) The first group includes roughly all those so-called light industries. This covers, in fact, most consumer good industries of which the employment index is between 100 and 200 and which have been in relative regression from 1969 till 1976-77. Contrary to a familiar opinion, such industries have a weak employment demand, and as we have seen, the cost of creation of one job is increasing, almost parallel to that of "heavier" branches.

(b) In the second group of industries the number of workers has more than doubled from 1969 to 1976, through the branch of metal production and transformation together with that of building materials have continued to constitute impediments for accumulation during the decade.

(c) In the third group of industries employment has more than trippled, industries of this group have constituted the branches of accumulation "par excellence", with a tendency for polarization around the hydrocarbon branch.

Table 9

Employment of non-agricultural salary-earners
by branch of activities

Branches	1969	1973		1977	
		Base 1969 = 100		Base 1969 = 100	
		absolute value	index	absolute value	index
Extraction industries	12.500	15.459	124	19.746	158
Petroleum and natural gas	10.179	31.661	311	73.870	726
Food industries	27.309	30.607	112	43.804	160
Textiles industries	24.264	29.407	121	33.699	139
Leather industry	5.602	5.471	100	7.366	131
Chemical industries	7.534	7.568	100	14.704	193
Building materials	8.026	15.373	192	22.780	285
Steel industry	6.275	13.151	210	29.554	420
Metal production and transformation	18.970	35.540	187	53.160	280
Wood industry	10.471	7.213	69	23.631	154
Paper industry	4.780	5.239	111	6.994	381
Other industries	1.836	4.764	259		
Electricity, gas, water and sanitary services	6.132	5.593	124	16.593	270
Total	143.978	211.407	134	345.901	240

The section of intermediate goods (index 899) and that of means of production (index 280) are half way between the hydrocarbon section (index 726) and that of consumer goods (index 156)^{1/}.

Another kind of classification otherwise applied^{2/} shows a progressive predominance of basic industry which in 1976 represented 20.18 per cent of the personnel in the secondary against 14.88 per cent for traditional industries, 31.76 per cent for construction and public works and 14.02 per cent for other activities (). Yet, given the characteristics of employment generated by this kind of industrialization, the problem of the evolution of qualifications level reemerges acutely in spite of the importance of the education and training policy which adopts renewed methods, if one is to judge by the continuous resort to technical assistance.

3. Evolution of level of qualifications and foreign employment

Given the realization modalities which have been analysed earlier, the problem of qualification levels and contents becomes a major one from the point of view of capacity, maintenance, renovation, management of means of production, reproduction and adaptation; yet, it is more true with regards to the ability to select the technology for consumption and its production in an increasingly progressive proportion, if we do not want the problem of "transfer" of techniques and of their control to become a continuous one under the same conditions.

If it is almost impossible to measure the content of this problem of qualification levels with the present state of our knowledge, we can still grasp its quantitative evolution.

1/ F.Z. OUFRIHA-BOUZINA: Pression démographique et capacité d'absorption de la force de travail par l'industrie - Institut Sciences Economiques, ORAN, 1980. p. 38.

2/ F.Z. OUFRIHA-BOUZINA: Industrialisation - emploi et répartition du revenu national en Algérie - Livre II - Offre et demande de force de travail, M.I.L. ORAN, 1978.

Table- 10

Levels of qualification of industry workers

	1969			1973			1976		
	Personnel	%	Index	Personnel	%	Index	Personnel	%	Index
Administrators and Professionals	3,599	22,50	100	9,148	4,33	254	14,341	4,63	398
Technicians	5,136	33,57	100	13,709	6,48	267	23,025	7,43	449
Senior Technical Staff	-	-	-	18,860	8,92	-	30,778	9,91	-
Skilled Workers	54,286	37,70	100	62,752	29,68	150	91,840	29,58	226
Supporting Staff	39,480	27,45	100	61,031	4,14	129	66,520	21,42	168
Unskilled Workers	41,377	27,75	100	55,898	26,44	135	84,061	27,03	203
TOTAL	143,978	100	100	211,407	100	147	31,591	100	216

Made out on the basis of data from the inquiry on employment-salaries.

Table 11
Structure of Qualifications According to
1977 Census

Sectors	Total	Construction and public	
		Works	Industry
Administrators	1,84	0,83	2,71
Middle-Level Professionals	6,61	3,95	8,92
Staff	11,87	5,83	17,09
Skilled Workers	8,21	5,17	10,83
Craftsmen, etc.	54,91	63,49	47,50
Temporary Manpower	7,09	13,01	1,98
Others	9,74	7,72	10,97
Total	100	100	100

In order to appreciate correctly the efforts made in training, it may be worthwhile to reflect on the initial conditions following independence:

- A horizontal mobility consequent to decrease in activities, resulting in redistribution of the industry labour force towards services and administration.

- An ascending vertical mobility balanced by a very strong professional promotion in all sectors of activities.

- An increase of emigration having its origin in the sector of construction and public works which was developed by the Constantine plan.

At the beginning, then, there was a general under-qualification phenomenon which necessitated in-service complimentary training.

The evolution has taken place in a zig-zag way. This seems to reflect national training capacities as well as the demand of the production machinery. The latter is progressing by successive leaps (undertaking new projects), and is trying to cope with market insufficiencies in two ways. First it is developing its own training structures (creation and development of firm's internal professional training services). It has also resorted to modifying the nature of contractual relations with foreign partners entrusted with implementation ("turnkey" contracts imply professional training and even a rather special "monitoring"). In addition it has allowed over-qualification; and that is why there is a problem of shifting between categories and consequently net statistical duplication which distorts the content of items surveyed. Yet, considering the direction of the evolution process, it seems that, contrary to prevailing opinion, the industrial sector does not suffer from a quantitative shortage, since it has been able to draw the majority of those provided by the training system who were attracted by better pay as well as direct or indirect benefits.

During the period under review, a technological "leap" has taken place. It has created a very strong appeal to a certain type of personnel. Financial ability to recruit and pay professionals and technicians has not been uniform in all branches of industry. Thus, the variations in the nature of techniques has been reflected in variations in salary scales.

However, it should be noted that, while it is important to upgrade the qualification levels of industry workers, that in itself is insufficient not only because the professional cadre is relatively recent and lacks experience, in addition to the lack of industrial traditions, but also, in particular, because of the high mobility of professionals resulting from accentuated rivalry in terms of salaries offered. This situation has led to over-qualifications in certain posts. The high rates of turn-over among skilled workers constitute a discentive to acquisition of competence and efficiency in the work because

of lack of seniority. Worse still, it is a stumbling block in the face of accumulation of "collective know-how". We have already brought into focus the other factors which stand in the way of such experience, which are due to the realization forms of investments, and which practically exclude Algerian cadres from decision-making process (design, choice of material, preparation of site, etc.). The result is that a general attitude of passivity on the side of the personnel is encouraged by the fact that the (foreign) contractor is required to evaluate the performance of the Algerian personnel of a factory which is under construction or in operation^{1/}.

Finally if, theoretically, the labour force supply is very elastic, in reality it is very attractive for employment categories created by the industrialization process because, in spite of intense and multiform training efforts, the real level of qualifications is still below the required level and the problem of collective experience remains at stake in renewed terms.

Indeed, the weak development of the productive forces, which, from the point of view of this study, was a formidable hinderance to the diffusion of science and technology among the Algerian population during the colonial period, has become after independence and with the application of an industrialization policy, one of the links through which a new form of dependency will develop vis-à-vis multinational corporation.

With the implementation of the industrialization policy, the problem of manpower training has come into focus from two aspects:

- quantitatively: the number of specialists in each discipline;
- qualitatively: in view of the "incomplete" nature of the educational and training system. It was not possible, in the beginning, to elaborate a variety of training programmes. The problem has been addressed as follows:

^{1/} H. SERRADJ: "La toile d'araignée". Dossier pour la commission nationale des étudiants, Commission culturelle universitaire, ORAN, p. 31.

Parallel to the extension of existing training capacities, efforts were oriented towards the creation of training units which are totally new with respect to the content of training (specialized colleges and institutes of technology); especially during the period of the great economic, social and educational reforms (1979). Such movement had a two-tier strategy that of education and enrolment, school and that of professional training.

(a) At the educational level

In view of the conditions that were prevailing at the beginning, a tremendous effort was launched to promote school enrolment. This was reflected in a great increase in school attendance at all levels. (In primary education, enrolment rose from 777,636 in 1962 to 2,891,084 in 1977/78, an index of 373, whereas enrolment in secondary education rose from 135,336 in 1966 to 728,761 in 1977, an index of 540. As for higher education, enrolment rose from 3,200 in 1963 to 50,200 in 1976/77, or 16 times in 13 years, the increase has been more impressive from 1970 onwards, as a consequence of the High Education Reform.

If the progress achieved in enrolment in primary and secondary education is controversial^{1/}, the situation regarding high-school is different.

One should observe the "weight" of social, family and economic structures in favour of studies leading to liberal professions or professions of prestige, which are more remunerative than those related to industrial labour, since "industrialist" categories are not adequately appreciated.

There is no real vocational guidance to direct the largest possible number of students to scientific branches. On the contrary, a selection in the opposite direction (though this tends to reverse the argument) acts against such branches because of a greater selection which takes place at the beginning as well as at the end of their studies. This is reflected in the number of students who pass such exams^{2/}, even if the tendency seems to have declined in 1976).

^{1/} F. Z. OUFRIHA-BOUZINA: "Offre et demande de force de travail" l'étude de l'industrialization, emploi et répartition du revenu national, M.I.L. ORAN, 1978.

^{2/} Ibid.

Yet, the problem of preparing a national corps of qualified teachers is acute at all levels. Here, as in other cases, systematic recourse to technical assistance renders itself as an easy "solution". Nevertheless, this technical assistance has a tendency to self-reproduction through dynamics inherent in its very nature and composition.

(b) At the level of training professionals

A large movement of professional training has been undertaken, especially beginning with 1970, in order to produce the required categories of workers to meet the needs of the production system. Higher institutes and colleges were established to produce high level personnel, technological institutes for the middle level workers (senior technicians, middle-level technicians and technicians), training centres for skilled workers and craftsmen.

Concerning the objectives of technical training, two objectives seem to be explicitly or implicitly aimed at throughout all the efforts made to adapt such training to the needs of the production system; These are:

- Importing technical knowledge and greater efficiency;
- Integrating persons thus trained into a social hierarchy.

If we judge by what is being said constantly about the inadequacy of training in spite of all the reforms carried out to improve it, then the first objective seems to be more difficult. This makes certain people wonder whether such situation is not deliberately maintained in order to satisfy some justifiable aims, especially the need continued for foreign technical assistance to operate imported techniques or to make them profitable^{1/}.

1/ N. REMAOUN: "Formation et transfert de technologie: le cas de l'Algérie", Colloque sur les politiques scientifiques et techniques au Maghreb et au Proche Orient. p. 2 note fin de page.

On the other hand, the training effort is atomized. It has been possible to count 700 branches of different training and in this respect, the "Ad hoc Group on Training of Qualified Manpower" of the Ministry of Planning, speaks of "pulverization". It gives a critical analysis of noting the frequency of double employment, the non-codification of specializations and the high cost of operation. Such a situation, even if it gives certain functioning elasticity to the training system, still does not necessarily involve, as one seems to think, a great capacity to respond rapidly to the expressed needs. The large variety of types of training adopted and the desire of several ministries to have their own autonomous training organs, have ended up with a multiplication of establishments. In 1974 (end of the first Four-Year Plan), there were 243 such establishments with a capacity of 51,804 places, while persons under training at the same date were 36,078. This shows that a large number of these establishments were of recent creation; but it shows also that the expected recruitment of personnel for training did not take place. Awareness of this situation and the will to have a better co-ordination in this field have led to the creation of a Ministry for Professional Training.

However, it is to be underlined that a good part of the training needed by industrial firms is secured either within the firm itself in connexion with the development of new methods of implementation, or abroad through arrangements with the same firms.

Employment of highly qualified foreigners, as a result, remains to be high, even if one considers only the number of such jobs which have been counted, particularly those of very highly qualified personnel (engineering, etc.) intervening who work in the implementation of contracts, and other supporting staff. According to estimations of the Ministry of Labour and Vocational Training, capitalist firms alone "import" labour for Algerian market from various origins (Asians, Europeans, Americans, etc.). The number of such expatriates is estimated to be more than 26000 workers.

Foreign personnel directly employed by Algerian firms, represent 1.5 per cent of total workers, though their percentage can reach 56 per cent in a particular branch. While their numbers is decreasing, they were still no less than 27 per cent of total high-level personnel in 1976. This dependency phenomenon, while normal to a certain point, is no longer so, especially with the emergence of a brain-drain phenomenon. This poses the question of the effectiveness of management of labour force with reference to social efficiency.

Contrary to the impression one may get from a hasty reading into the progress of qualifications, the shortage in real qualifications remains far from being absorbed. It rather continues to increase and to include not only the highly qualified personnel, but also, and increasingly, mid-level personnel and technicians. Once again, we come across this problem because of the gap between the education-training system on one hand and the production system (in relation to a certain kind of technology) and the methods of organizing the work process on the other hand.

The firms' "response" which consists of emphasizing specific training related to various industrial projects apart from being a source of considerable overcost^{1/}, does not seem to bring about the anticipated solution^{2/} because of foreign firms' "reluctance". They confine their training programmes to a narrow and partial scope which, at best remain training for, and not on, the operation of a factory, to quote A. BENACHENHOU^{3/}. Furthermore, this kind of

1/ Training for the Constantine tractor complex realized by DIAG "has saved it from failure" but has cost AD 30 millions.

2/ As an example among so many others: at the plastic manufacturing complex of Skikda, 350 national workers including management and professionals were dismissed for "inadequate training". Japanese technical assistance was then sought.

3/ A. BENACHENHOU: Les firmes étrangères et le transfert des techniques vers l'économie algérienne. Cahiers du C.R.E.A. No. 2 Alger, 1978.

Table 12

Distribution of foreign workers in Algeria by qualification
level in all activities

Qualification level	% in the branch			% of high level personnel and technicians			% of professionals and control technicians			% of skilled workers			% of specialized workers			% of personnel without qualifications			
	1969	1973	1976	1969	1973	1976	1969	1973	1976	1969	1973	1976	1969	1973	1976	1969	1973	1976	
																			1969
Branch of Activity																			
Extraction industry	2,73	3,44	3,30	75,0	63,0	56,34	51,0	9,35	3,06	3,07	1,53	0,66	0,05	0,38	0,26	0,29	0,29	0,26	0,26
Petroleum and natural gas	9,15	4,49	3,60	48,76	36,71	43,24	26,64	7,08	-	6,68	1,43	-	0,01	-	-	-	-	-	-
Food industry	2,16	2,48	0,55	37,57	30,01	11,03	22,72	4,81	1,77	2,25	1,45	0,2	0,7	0,17	0,38	0,42	0,04	0,04	1,01
Textiles industry	1,46	1,14	0,4	34,46	10,22	13,64	29,31	6,13	0,77	-	0,72	0,14	0,65	0,06	-	0,32	0,37	-	-
Leather and hide industry	2,40	1,09	0,9	74,64	23,21	29,91	67,53	7,32	4,37	0,9	0,87	0,49	0,34	-	-	-	-	-	-
Chemical industry	5,62	2,89	1,0	34,5	36,74	19,3	26,78	8,28	4,45	4,9	1,1	0,49	0,9	1,13	0,12	0,52	0,83	0,09	0,09
Building materials	1,76	0,61	0,33	25,53	6,08	10,84	30,08	0,4	0,22	2,94	0,37	0,21	0,26	0,33	0,17	0,4	0,17	0,03	0,03
Steel industry	2,18	2,31	1,13	26,89	37,23	22,25	14,61	1,4	1,1	0,52	0,2	0,1	-	0,11	-	-	0,02	-	-
Metal production and transformation	4,5	1,99	0,92	56,64	31,7	13,46	35,53	6,24	1,12	2,6	0,8	0,4	0,55	0,11	0,1	0,62	-	0,08	0,08
Wood industry	3,56	1,08	0,68	54,60	30,0	12,19	56,17	6,09	0,96	5,85	1,09	0,62	0,13	0,16	0,28	0,09	-	0,07	0,07
Paper and printing industries	4,89	1,95	0,81	34,78	16,33	6,62	33,45	6,71	0,47	4,31	1,57	0,42	-	-	-	-	-	0,05	0,88
Other industries	3,59	2,24	-	15,76	30,5	-	24,32	7,40	-	2,32	0,03	-	-	-	-	-	-	-	-
Electricity, gas, water and sanitary services	1,72	2,19	1,46	33,33	32,78	15,42	10,06	0,6	2,73	0,32	0,03	0,03	-	0,17	-	-	-	-	-
Total industries	3,28	2,19	1,44	42,65	31,98	26,53	28,85	5,75	1,07	2,62	0,92	0,23	0,42	0,18	0,13	0,28	0,12	0,05	0,05
Construction and public works	2,35	1,50	1,19	57,45	46,75	44,53	27,05	18,07	11,72	2,55	0,75	0,38	0,04	0,13	0,08	0,06	0,03	0,01	0,01
Banking insurance and real-estate	4,05	2,48	1,65	72,60	22,92	13,96	8,52	8,16	2,31	3,04	0,57	0,58	-	0,03	-	-	0,13	0,13	0,13
Transport and communications	1,90	1,89	1,24	37,59	31,45	20,99	8,83	4,93	7,18	1,11	1,36	0,72	0,09	0,01	-	-	0,9	-	-
Total all activities	2,86	3,03	1,35	42,96	33,73	22,52	24,56	7,89	3,53	2,35	0,90	0,35	0,15	0,15	0,11	0,16	0,09	0,04	0,04

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

developing of alternative techniques better adapted to the natural endowments of a country. When a country buys technology, it has either to adopt it to its own circumstances or to rebuy it again a few years later.

Briefly speaking, if collective control over technologies turns out to be so difficult, it is so because these technologies continue to be "technological enclaves". Controlling them passes by controlling the production of equipment and their adaptation to the specific conditions of the economy, and this can be realized only by national professionals and workers.

In this respect and on the same line of thinking, it becomes necessary to reinforce and develop groups of national engineers in order to avoid too much dependency on foreign firms. The control over national industrial structures by foreign engineering has become the most subtle but also the most efficient way of regaining external control over national investment efforts. For, in a way, dependency through technology results more from the subjugation of national economy to external decisions than from utilization of advanced technique with all that they bring with them: overcharging, materials bought abroad, or long delays in their delivery^{1/} etc.

Finally, attention should be paid to the fact that certain techniques may implicitly carry with them certain models of production and consumption^{2/}, which explains partially some of the problems we face in this field. Therefore, it is necessary to be selective with reference to characteristics of technologies.

^{1/} Conference on "transfert de technologie.." op. cit.

^{2/} F.Z. OUFRIHA-BOUZINA: An essay on the structure of consumption model in Algeria: ONRS - CREA, 1979.

(c) The situation of engineering in Algeria

The development of national engineering capabilities is a prerequisite for the integration of the chain: training-science-technology-industry. The development of these capabilities has taken three distinct paths^{1/}: autonomous enterprises, integrated enterprises and companies working in the field of construction and public works.

- Autonomous enterprises are three: principally the SNERI (Société Nationale d'Etudes et de Realizations Industrielles), and secondarily the I.N.P.E.D. and B.E.R.G. The latter was created to cater for the needs of the army in 1967 was entrusted of some civil constructions. The range of activities of these companies is confined to light industries.

- The integrated enterprises within national firms are relatively concentrated, (6 national firms have 84 per cent of the engineering personnel and 3 of these, SONATRACH, S.N.S. and SN. METAL - which are the most important in this respect, have alone 53 per cent^{2/}). These are engaged in heavy industry.

- The companies of construction and public works.

In general, throughout this decade Algeria has developed its capacities only in general engineering (essentially civil engineering) whereas process engineering and production engineering have not been very successful. This explains partially the acceptance of technology packages.

It may be interesting here to analyze the experience of our two largest firms.

^{1/} M. BENBOUTIA: op. cit., p. 299 and following pages.

^{2/} H. FARDEHAB: Les problemes de technologie dans l'industrialisation de l'Algerie: les lecons d'une decennie d'industrialisation 1967-77, Doc. stensilled, 23 Oran, April, 1980.

As far as the S.N.S. is concerned the research-development group was born in Al-Hadjjar complex, in direct confrontation with production technology and on this basis it has been able to resolve many problems. Thus, there rose the problem of obtaining on the spot continuous casting steel from killed steel. According to suppliers of know-how, only rimming steel is likely to be cast continuously and since this rimming steel was not produced on the spot, it had to be imported.

The work of the research-development group, ended up with the elaboration of a procedure permitting the production of killed steel from the galvanized steel sheet which has been cast continuously on the spot. Apart from the most visible and immediate success of the operation, there was an economy of currency thus saved by the non-importation of 40,000 tons per annum of rimming steel reels^{1/}. Furthermore, one must before all take into consideration the capabilities of design and of innovation which are, in our opinion, more imported and should be underlined. Yet, one should at the same time underline the fact that we have not been able to achieve similar results within homogenous and stable teams to solve problems.

As for Sonatrach, we can trace the evolution of this experience on the basis of an internal document which the firm submitted to the Ministry of Energy and Petro-chemical Industries.

In reading the table below, it will be seen that the essential part of engineering activities seem to have been absorbed by the follow-up of projects. Therefore it seems difficult to judge: is it the beginning of accumulating experiences or is it simply a question of techno-administrative management?

Table 13 is not based on concrete data, but rather of impressions and partial data.

^{1/} Based on internal document of Sonatrach, entitled "Engineering et Realization - Division Engineering et Development".

Table 13

Sectors with Engineering activities within the M.E.I.P.

Sectors	Feasibility engineering	Basic engineering	Execution engineering	Management or the follow up of projects
Power stations	X	X	X	X
High tension lines and posts	X	X	X	X
Conduits	X	X	X	X
Electricity distribution	X	X	X	X
Canal constructions		X		X
Liquefaction				X
Refining				X
Fertilizers				X
Petrochemicals				X
Elastomers				X
Plastic				X
Logistics				X
Infrastructure				X
Branches	X	X	X	X
Hydrocarbon prod.				X
Industrial zones (Arzew-Skikda)	X	X	X	X

Table 14

Phases of Applied Engineering

	Feasibility	Basic engineering	Execution engineering	Follow up of projects
Sonelgaz Qualitative	90%	70%	variable	100%
Sonelgaz Quantitative	70%	5%	"	100%
Sonatrach Qualitative	80%	50%	25%	100%
Sonatrach Quantitative	60%	15%	10%	100%

In particular, (and this expresses in fact the view that different tasks of engineering can be undertaken in certain proportions by our own means), it is mentioned in the document cited above that qualitatively practised phases deal with "repetitive fields" in which technology was bought once or several times, in realization of investments, dealing with whole sets of equipment of the same or of identical nature. However, this includes foreign experts integrated in the structures of the two firms (Sonatrach et Sonelgaz).

It is also mentioned that the quantitative part of engineering in Sonelgaz is really executed by their own means, whereas in Sonatrach, "it would be possible to be realized by their own means, if the scattered resources were pooled and if they concentrated on a limited number of repetitive projects".

The pressures analyzed in the document point out, on the organization level alone:

- High centralization with no clear priorities; a range of activity which is too vast, diluting the availability of human resources.
- Lack of specialization and of concentrating the efforts of available resources on limited and realistic projects.
- The inexistence of management for the engineering function as well as for research and engineering methods.

Furthermore, many other points are stated in the above mentioned document; human resources are quantitatively and qualitatively below the minimum requirements necessary for the functioning and development of engineering activities; training suffers from "the insufficiency of specialized training programmes and structures necessary for engineering (designers, projectors, work supervisors)"; the nature of industrial relations does not stimulate the cadres motivations (and this supports our analysis^{1/}).

^{1/} We have got the document while the essential part of this paper has already been written and was getting typed.

- The nature of contracts of implementation of large industrial complexes is in contradiction with the object of development of the firm's personnel themselves; consequently it is in opposition with the possibility of accumulating know-how.

- The rapidity of industrial expansion and the variety of processes and contractors have compromised the development of engineering activities in favor of "project follow up" which is limited to a techno-administrative management of contracts.

- Lack of training of homogenous and stable teams likely to become reception sources of technology as well as of the foreign partners' know-how.

Finally, among the problems posed by the environment, let us be aware of the slowness and complexity of administrative procedures which represent a considerable waste of energy, whereas the very large variety of norms and standards used in the engineering of implementation makes the establishment of our own norms and standards a difficult task.

We will not extend our analysis to cover the policy and approaches proposed in order to remark the pressures suffered, since in our opinion it seems that awareness of this situation within Sonatrach itself and at its highest levels represents a most positive sign. Only a determined, continuous and sufficiently enlightened will is capable of promoting this policy efficiently. The time of learning swimming by just jumping into water should be over; Algeria is already down in the water and it should systematically learn the right movements which make a good swimmer. The development of engineering activities begins with full awareness by all operators that it is one of the imperatives of the next decade, to be carried out in accordance with the orientations and guidelines of the National Charter.

Difficulties encountered in the field of transfer and control of technology have contributed to the development of mixed-economy firms in increasing number since 1970; they are going to be present in most important industrial branches with a net concentration in the field of hydrocarbons (59 per cent).

But, besides the prior development of a means of production producing sector, the objective of capitalization on engineering requires, as A. LARBI^{1/}, rightly remarks the combination of:

- A foreign partner, being autonomous vis à vis large and dominating industrial groups; so that such partner will have no objective reason to reproduce technological dependency which is the source of repetitive interventions and consequently of additional profits;

- A national partner, conscious of the role of engineering in technological dependency and capable of selecting for production unit the engineers and technicians who are likely to become oriented towards conception and design tasks. Capitalization on engineering passes principally through human support which should be able to stabilize, scientifically ameliorate and reproduce.

Consequently, the basis for breaking up with imperialist domination reside less and less in material accumulation (through increasing production capacities considered as "things" that we buy) and more and more in the control over imported techniques and in autonomous production of technology.

^{1/} A. LARBI: "La planification . . ." op. cit., p. 181-182.

Conclusion

The Algerian technology policy has now reached a stage where evaluation is in order so that its effectiveness can be objectively analyzed.

The desire to go quickly through industrialization, accompanied (initially) by a relative availability of financial resources, have turned into a will of technology acquisition, emphasizing, in the first place, the maximization of technology absorption.

In the absence of general-guidelines that delineate and define ways and means governing technology consumption, such consumption has been characterized by the liberalism which had consequences at several levels.

- The most obvious and the most recognizable aspect is the cost of this technology consumption; which explains the high cost of the Algerian industrialization.

Indeed, the way industrialization has been implemented has left it to the sellers of technology to decide on the necessary means of production as well as their prices. These sellers had direct and indirect interests in supplying the most expensive and most sophisticated equipment with no consideration whatsoever for our financial and human capacities and capabilities.

- This has also necessitated recourse to and maintenance of a very expensive engineering, and the maintaining at high costs of a considerable technical assistance which seems to be enduring and to have set the mechanism of its own reproduction (even if its volume tends to decrease), since it has confined the Algerian cadres to techno-administrative management of projects. There is the risk that such Algerian cadres will end up becoming technocrats without technology, and cut off from the world of work and of technology.

This poses the critical question of shifting the decision-making process on choices of techniques to foreign hands.

- More fundamentally, our industrialization experience raises the problem of articulation between technology consumption and technology production. In other words, it brings into focus on one hand the problem of building up an equipment producing industry which alone can give a relative autonomy to our production system (without forgetting the question of coherence) and on the other hand it raises the problem of absorption by the Algerian manpower of all components of processes and techniques so that the operation, reproduction and design of production equipment gradually become the domain of the Algerians themselves.



