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Conference Paper

Local development and technological innovation in Algeria: experiences and perspectives

41st Congress of the European Regional Science Association: "European Regional Development Issues in the New Millennium and their Impact on Economic Policy", 29 August - 1 September 2001, Zagreb, Croatia

Provided in Cooperation with:

European Regional Science Association (ERSA)

Suggested Citation: Caruso, Immacolata (2001) : Local development and technological innovation in Algeria: experiences and perspectives, 41st Congress of the European Regional Science Association: "European Regional Development Issues in the New Millennium and their Impact on Economic Policy", 29 August - 1 September 2001, Zagreb, Croatia, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:

<https://hdl.handle.net/10419/115220>

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**EUROPEAN REGIONAL DEVELOPMENT ISSUES
IN THE NEW MILLENIUM
AND THEIR IMPACT ON ECONOMY POLICY**

**European Regional Science Association
41th European Congress
Zagreb, Croatia
29th August – 1st September 2001**

**LOCAL DEVELOPMENT AND TECHNOLOGICAL
INNOVATION IN ALGERIA:
EXPERIENCES AND PERSPECTIVES**

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Local development and technological innovation in Algeria: experiences and prospects.

Human games, the technological, social and political ones, between the two banks, the Arabian and Western Mediterranean ones are too present, too heavy, too burdensome in to keep on - either deliberately or unwittingly – concealing the urgency and the priority of large common action to replace fight with solidarity, uneven exchanges with agreed development.

Chedly Ayari, Enjeux Méditerranéens

Abstract

The starting point of this present paper is the idea that, to define a regional development policy which should effectively respond to the future new challenges -in particular to the economical globalization and to the technological changes acceleration- it is necessary to think about new methods apt to grant a privilege to the local solution, using local skills at their best, as well as national technological strength power, the already existing creative and innovative capabilities. But, referring to the Mediterranean basin, there are major disparities between regions and countries in the innovation and R&D's field, as well as in the level of modern information diffusion and communication technologies. In particular if some Third Mediterranean countries -as well as some South European regions- have, on one side, clear difficulties in developing modern forms of industrialization able to insure an access to the international markets, on the other, they need to increase their firms competitiveness, to improve their strength's points and to put in balance the disadvantages due to their periphericity by developing their international contacts with the neighbouring countries of the Mediterranean Basin. This study identifies and analyses the policies adopted by Algeria in the development of technological and managerial abilities -to highlight the facilities and the constraints- for implementing and managing advanced technology and innovation in the economic lagging regions and to explore ways of innovative co-operation in this field.

1. Introduction: the concept of technological innovation

The analysis of technological policy pursued by Algeria cannot disregard some considerations on what are seen as common problem areas, in this purview, to all the developing countries, especially the Arabic ones.

This issue is generally approached in three different ways:

- the first one refers to the cost of technology transfer towards these countries. It is generally recognized that the price paid to secure means, knowledge and technical skills is way too high and therefore, the International Community should work out new rules in order to reduce this cost, regardless to which way might be chosen to transfer the technological supports;
- the second one highlights the insufficient features of used technology, with a particular reference to its proficiency to create the available manpower's full usage in these countries. It is so underlined the necessity to support the application of appropriate or median technologies;
- the third way points out developing countries' weak technical and scientific development, meant as process of local production of scientific and technological knowledge, measurable through the expense met for research and development, or labour qualification level in different economical activities. In this case the aim is to increase general education, as well as financing devoted to scientific and technical research.

The truth is that we often have an instrumental point of view of technology as something belonging to the means' area regardless of the social development purposes area. On the contrary, developing countries technological troubles come exactly from the complex articulation between development aims and means. So we can define technology as a socially articulated set made of qualified manpower and equipments, in an economical process structured through ways of domestic and external organization of the production units. In this case, technological means have been so identified:

- equipping and production processes whose knowledge is vital to use them;
- qualified manpower (to define, maintain, transform and use the equipping and their related procedures);
- technical and scientific research and training systems;
- engineering (structures to define, to plan and to realize the production's units).

Subsequently technological *production* is the ability to give life to a fraction or a whole of the technological means listed above.

Technological autonomy or dependence of a country can be therefore measured, in this case, through the obtained technological level.

Technological *circulation* is formed by the real conditions in which the specific means are put at users' disposal.

Technological *consumption* is the employment of the technological means made somewhere else. It is through the study of these three elements that it is intended to analyse technological development and the connected issues in developing countries, and, in this present paper, in Algeria.

2. Obstacles to technological development in Algeria: production, circulation and consumption.

Also in Algeria, as in other developing countries, where a statist model has prevailed, technological development has been strongly influenced by economical policy choices. These brought the Algerians, the day after their independence, to address themselves towards a socialist inspiration option, based on the concept of the "industrializing Industries" and on just one means: the income from hydrocarbons, oil and gas, resources that Algeria has in a considerable quantity. This led the Country to have an industrial sector extended from siderurgy to metallurgy, passing through petrolchemical and mechanics industries, electronics and other processing industries, but carrying countless and serious unbalances, both related to the other sectors of the productive structure and to the different branches of industrial sector itself, and also within a same sector. Besides, dependence towards abroad increased; a multifarious dependence, but above all a technological, commercial and financial dependence.

The official strategy in the technological field -made explicit also in the National Chart, major paper of government's

reference- provided the realization of the technological development into two phases:

- the first one whose aim was to reach the so-called “autonomous pilotage”, by creating a basic industry able “to reduce, if not to eliminate, dependence from the technical knowledge and *savoir faire* of developed countries”;
- the second phase whose intentions were to reach the upper stage of the technological mastery through engineering development.

The first stage had to be realized through the heavy import of sophisticated facilities to built very complex and modern economical units. The second stage would be accomplished through the development of the training system, that is the local creation of national means to run studies, to think and to make plans operative, to reach, successively, the ability to elaborate and to improve the production’s technique in an autonomous way.

Nonetheless, analysing this technological policy from a critical point of view, we can notice that, as a matter of fact, this led to the instauration of a cumulative process of dependence. The heavy import of sophisticate equipments, indeed, brought – as a consequence – a development of the export sector, in order to give the equivalency of the exchanges, as well as to the increase of indebtedness.

In 1978, 85% of the existing equipping in Algeria had been imported and represented the 36% of the whole import; or the 54% if we also consider the percentage relevant to the import of services. These last ones were mainly made up of technical assistance, for which Algeria used to spend, during the period from 1973 to 1978, 79.4 thousand million dinars (of which 60.7 thousand million as foreign exchange), a record of this kind of expenses among the DC. The agreements signed with European, American (USA and Canada) and Japanese firms represented more than 84% of the totality of agreements, with a total cost of

70.673 thousand million dinars, or better, more than 89% of technical assistance total cost. If the sectors that employed this assistance are analysed, it is ascertained that the industrial sector alone represented 94.4% of expenses, for an amount of 75 thousand million dinars of which 58.2 thousand million dinars negotiable, that is the 96% of total expenses in foreign exchanges. The whole set of the other sectors, such as environment, hydraulics, public works, etc., totted up to only 5.6% of the global cost, that is 4.4 thousand million dinars. Because of the development choices made, there appeared; in the course of those years, a negligence relevant to the technological standards, since science and technology had been too often yoked to industry. This brought, wrongly, to minimize too many cases their role and prominence of the economical strategies relevant to the agricultural and facilities sectors, subsequently this carried to unsuitable or highly expensive equipments.

With reference to the first case, this brought to worsen phenomena such as soil's salification and the subsequent desert advancement, in the second one it intensified the development of both sectors. Following the growth of payments' needs, oil and gas became prevalent in the economical activity. In 1978, the hydrocarbons sector represented 32.7% of GDP and 96% of exports, while the foreign debt was equal to two years' export and the debt service was equal to about 30%.

This so shaped technology import generated a technological dependence that expressed itself in a "treacherous way" through an economical and financial dependence.

The examination of technology import evolution in Algeria during the following years shows an increasing trend, indicating the turning out of a cumulative process of import itself, due both to direct and indirect causes. Among the first ones we reckon the big multinational companies practices, that, in order to get the market granted, either secured a monopoly position (both real

and fictitious) or adopted various solutions, and among these, legal clauses for assistance after sale, that, if on side, assured the buyer the equipment's maintenance, on the other forbid any kind of intervention by local technical abilities. Anyhow, also at a national level, such were the existing conditions as to make the employment of strangers necessary. Referring to the creation of employment in the industrial sector, as a matter of fact, on a quantitative level, the "Office National des Statistiques" reported that industrial employment had grown from the 123,000 units in 1967 to the 401,000 units in 1979, with an enhancement of 278,000 units. Nevertheless industrial employment was insufficient in comparison with the remarkable volume of the industrial investments during the period 1967/1979 and that have been evaluated equal to 179 thousand million dinars. On a qualitative level, the inconsistency of training and employment, due to the absence of an effective training policy, created a situation of shortage of technical management and qualified manpower. The indirect causes of technology import cumulative process have, contrariwise, to be connected to the economical integration of work implied in the acquired equipment. As a matter of fact, the realization of a production unit raises some problems related to the economical integration up stream and downstream the unit, since the development weak level of the local production manpower did not allow its natural insertion. The unit integration, then, had to be realized through the installation of other units upstream and downstream the first one, and the consequence of this process was a reiterated import of technologies. Besides, in this process the timing factor has to be considered and its consequent technological improvement and rejuvenation in a worldwide perspective, so that new units could not be integrated with the old ones, or, at least, it was necessary, in this case, to import only technologies belonging to the same generation of the first ones. What was implied in this process is an adequate

competence level in negotiation and information acquisition related to the choice of partners, to the contract conditions, to the same technology to be imported. This competence level often lacked, and put the technology providers in a position of unquestionable advantage.

Following the economical crisis of the 80s, that saw at its highest peak the dramatic fall of the hydrocarbons' price in 1986, Algeria had to face a strong reduction of foreign financing, that consequently caused the fall of investments and production, an inflation rate close to 30% and an unemployment rate equal almost to 25% of active population. So a revision of the economical functioning became necessary and this - after many autonomous efforts of turnaround and reformation, that did not produce positive effects, - turned out in a drastic change in development options towards the market economy and brought to the adoption of the Structural Adjustment Program, proposed by the International Monetary Fund and the World Bank. Consequently, the Government adopted several pump priming tending to promote development of the investments, especially the private and the foreign ones. The aim was to create the conditions favourable to realize technologies and know-how transfers, so to better the basic socio-economic level. In the perspective of a larger economic integration among the different productive sectors, and of a balanced regional development, planning primarily tended to rigorous investments in re-organizing the industrial production system. This last characterized, except for hydrocarbons and siderurgy, by a persistent under-utilization of production abilities of the installed industries equal to 50% and made fragile by its almost exclusively orientation to the satisfaction of a small domestic market and by its strong dependence from spare parts outsourcing, but overall by intermediate consumptions.

Then, concerning technological means circulation and consumption, it is necessary to point out the issues related to

technological insertion in Algeria and the ones coming from the use of mainly imported technological means, since they reflect the economic and social reality of the developed countries that produced them, a quite different reality, if compared to the Algerian one.

This country, as a matter of fact, is economically characterized by a poorly developed productive manpower and of socially assimilated technical knowledge, and besides:

- by a destructurement due to their colonial past,
- by a population mainly made up of rootless peasants and youngsters,
- by the availability of just one great natural resource,
- by a peculiar way of reproducing manpower (family, relationship, origin's village),
- by a state economic protectionism;
- and it is culturally characterized by the absence of an industrial culture and by a cultural model focused on community, patriarchy, clan and Islam.

The imported technology included in this society is, in its turn, separated in its economical aspects from the society that has produced it (it has been deprived of the manpower and technical knowledge that generated it, fractioned it and isolated it from the capitalistic global working process). In its cultural aspects - cultural values of profit, of individuality and of goods, diversity of the consumption model- and in its political aspects, it has been deprived of the institutions and legislative machine that originated it).

Consequently, two different and contradictory trends have been produced: on one side technology tends to bend society to its ratio, on the other social resistance makes technology useless. Even if they have the equipments, these generally are not used at their best in a matrix characterized by:

- lack of machinery maintenance and restoration,
- distribution and purchasing problems,

- irrational management due to the burden of bureaucracy in financial and commercial institutions,
- weakness of professional organization and schooling due to too young personnel and to too short industrial experience,
- manpower's poor disposition to technological requirements.

In the long run, dealers find themselves with the need to buy a larger and larger technique and *savoir faire* package. The evolution of the type agreements is an example of this stopover. Besides, the progressive orientation of imported technology towards a development of the social sectors (environment, transportation, health and hydraulics) tends to soften the contrasts between technological means and society.

Anyhow, it would be rash to believe that the Algerian economy has no real experiences and potentialities for the technological development. First of all, because the country, thanks to the remarkable efforts made, starting from the '80s, in professional training and research development, mainly at an enterprises level, has at its disposal –while workers in charge of maintenance, fixing and storage are not so largely represented - a plentiful and qualified manpower, particularly engineers and workers. Secondly, because Algerian enterprises and public services (telecommunications, electricity, road network), in spite of the very difficult functioning of economy, caused by the existing financial and political crisis, keep on being the core of the planners' debate. The issues are rather connected to the actual context of uncertainty that sees, on one side, technical specialists and Algerian scientists not employed in developing the technological abilities of their country, both because busy with different activities at local level, and because lacking the adequate conditions; they left Algeria; on the other side it can be understood that the growth of the country at risk syndrome could lead to a greater isolation of Algeria in the international market, as its negative consequence.

3. Priority sector and merging sectors in technological innovation.

The siderurgy and the hydrocarbons sectors have always been considered as priorities in technological innovation are beyond any doubt.

The oldest of the Algerian industry has always been siderurgy and, with it, metallurgy. They have been the sectors privileged by Algeria's investments after independence. So far as today, in the last development plans, these branch's enterprises have been interested by an important investments plan, assigned both for responding to the National need and to create an integrated production fabric, and for pursuing, in co-operation with foreign partners the technological follow-up. We point out that metallurgic industry products have had a positive evolution in terms of technological upgrading. This is underlined by the absolute and relative growth of Algeria's export of ferro-steel laminated in the total of the metallurgic branch. This Country mainly imports reinforcement rods, shapes and alloy steels, for a quantity close to one million tons per year. Most important techniques of steelwork – blast furnace, oxygen converter, electric-arc furnace, furnace lining, bars meltdown, continuous meltdown of slabs, billets, and tods such as hot-rolling of wires, tods, plates, spools and weldless pipes, and the cold rolling of steel spools, their zinc-coating and tin-plating - are realized and managed from the set of Algerian workers, technicians and engineers.

Experience built up by the personnel, like the specific and available potential for training about siderurgy techniques and its installations maintenance, allows to dispose of competent human resources to assure both the continuity of the actual production progression and the success of the investment's plan provided.

Besides, the Algerian siderurgy has been developing for twenty years a large net of good and services sub-supplying, creating a great number of branches specialized in the production of instrumental goods and spare parts, in the scrap irons collection and processing, in building industrial edifices, in engineering studies and their subsequent realization, and more in raw materials and siderurgy products negotiation. At the same time a vast net - for storage and distribution of siderurgy product and for those deriving from the first steelwork – was realized, a net that run through the whole set of the Country regions. A Center of applied research was founded in 1979, close to El Hadjar development: it has material, means and human resources that allow to make, through different pilot-installations, metallurgic tests of minerals, their pelletization, fusion and refining, as well as, different tests for foliation. Relating to infrastructure, the El Hadjar development, the Orano manufacturing establishment and the Arba mini-siderurgy dispose of connections to the road network, to railroad and to electric network and are fed with natural gas through gas pipelines.

What can cause some worries about the Algerian siderurgy development is related to the weakness of domestic potential of scrap irons (70% of the current need per year) and the purchasing of rich minerals to produce iron sponges. Besides El Hadjar's two furnaces still need to import 1.5 million tons of coke per year. The effect of coalfields exploitation in the south-west of the Country, as a matter of fact, revealed to be vain because of the mining high costs and of the weak metallurgic quality of the coal itself.

With relation to the hydrocarbons' sector, SONATRACH, the public enterprise that has control upon the exploration activities and upon the coalfield exploitation, with its branches in charge of exploitation, drilling, production and canalization-transportation, was able to place itself among the first tens of the world hydrocarbons' cartel. Technology and abilities do not

lack, therefore, do not lack to the managers of this national company, whose most urgent need sits in the purchasing of equipment and materials necessary to the activities development, particularly the research ones and the new oil wells' research.

From a technical point of view the personnel is qualified to take in charge all the specific activities that are managed right now. An example comes from building technology of the storage pits: engineers assure the supervision , both on workers and on mechanics works. Are SONATRACH's mechanics the ones who take all the steps of the supervision – total and partial – and make all the operations on turbines, in case of need. So the technical staff is 100% Algerian, the foreign experts are consulted just in case of purchase of new technology materials. But these limit themselves to install the new equipping acquired in the agreements' frame and proceed to the general revision in the presence of national technicians and engineers. In a second moment the Algerian staff will assure functioning and maintenance. One of SONATRACH's most important tasks concerns the plan of the installations' renewal and updating, to allow the progressive increase and growth of gas and oil export. In this regard has to be pointed out, talking of gas export, that Algeria became one of Europe's main gas suppliers.

In connection with manufacturing industry, even if they register a higher technological gap than basic industries, they anyhow present, in some branches such as the agricultural and food industry, the pharmacology industry and the mechanics one, some examples of possible application of median technologies.

Concerning the agricultural and food branch, industries maintenance and development is almost completely dependent on foreign markets -regardless of the raw materials purchasing- due to the scarcity of the agricultural sector. The rationalization of the used technologies, the development of the produced products' range, the promotion of the import substitution

industries are today considered as the goals essential to guarantee a better production of the Algerian industries on side, and a better competitiveness in the international market on the other. Even if in some sectors, such as the aviculture, the feeding of animals, the canning industry and beverages one, it can be registered, talking about equipping, quite a discrete local level of realization; in others still lack some production factors.

That is the case, for example, of the milk processing industries, for which, do not exist locally, as far as today, providers for the needed equipment. Vice-versa, it has to be pointed out that oil processing industries have been equipped with completely modernized machineries, through the recent purchasing of oil processing equipments, but they remain totally dependent on foreign Countries for the spare parts.

Contrariwise, it has to be also pointed out that oil processing industries are mainly characterized by the preponderance of traditional oil processing industries – 95% of the whole potential – whose performance is very poor –from 6% to 7%- in comparison with the performances reached in the modern installations. Some interesting areas –not needing high technology- are showing up in the industrial sector with reference to halio-food equipments. Besides, remarkable efforts have been made to give value to products and by-products. In details, starting from 1990, Algeria has been exporting reclaimed products such as citrus fruits skins and pulps, by-products of trees cutting, etc.

Besides Algerians committed themselves to develop packaging industries that, nowadays, are carrying high over-costs and registering, because of their poor growth, great profit's losses in the marketing sector of agricultural and food products. A further goal to reach is, for the whole agricultural and food sector, the substitution of some imported products through bio-technological activities and their related enterprises. Countless are the measures adopted to favour the production of substitutive

products, such as the synthesis sweeteners. Is coming to realization an important plan, headed by the national enterprise ENASUCRE, to produce corn-based sweeteners.

Within chemical industry, another interesting case, from a point of view of not correctly employed technological potential, is related to pharmaceuticals branch. SAIDAL, the national enterprise for pharmaceuticals production was commissioned to produce medicaments and compared products, as well as reagents meant to be used both for human medicine and veterinary. They actually produce a range of about 200 medicaments, hold three production units – situated in the Algiers Region-, a development for antibiotics production in Medea and a research and development center. The productive power of the existing units is of 180 millions sale's units and the current national production satisfy less than 20% of the national need. In 1990 this production has been equal to 66 million sale's units. Nevertheless, we can notice that the business numbers of the enterprise SAIDAL have been increasing, passing from 189 millions dinars in 1986 to 414 millions dinars in 1990. It is also interesting to note that, with the creation of production enterprise in Medea, SAIDAL have at their disposal the highest production power all over Maghreb and hold modern installations that collect the essentiality of pharmaceuticals industries technologies. But, the reach of the unit's full development implies solving the financial related issues, and that means not only the purchasing, but also the ones connected to a non-full technological mastery of the entire antibiotics production processes. The Bulgarian technical assistance, which presided over the enterprise's launch, did not give the hoped results. In this connection, one of the goals of this sector development plan is the realization of an integrated research and development foundation. Starting from 1985, as a matter of fact, SAIDAL worked out, in co-operation with the ONUDI experts, a development plan that should allow, at the end of its

application –provided in 2005- to give the Country a satisfying independence (80%) in the field of pharmaceuticals products. The global investment cost (esteemed on 1988's price basis) is 1.5 thousand millions dollars. This plan, besides, provides for the realization of a series of new production units, the rationalization of the old ones and the reinforcement of the support units (maintenance, research, etc.).

In the fields of mechanical industry has to be highlighted PMA the national enterprise for agricultural materials production, not as much as for their consistency, but mostly because from 1970 they represent one of the rare example of co-operation South-South, in this case within Maghreb. Through three production settlements, PMA produce tractors from 45 to 65 horsepower, engines from 45 to 100 horsepower, destined to industrial vehicles, different ploughing equipping and materials, etc.. Many plans are either on their studying course or on their realizing way, according to different formulas of joint ventures, either with a commercial nature or with the intent to coordinate production of parts and components. In Morocco PMA are present through one of their branches that promotes exchanges of agricultural means and eventually other products of the mechanical sector. In Tunisia, a joint venture is already productive for the manufacturing of thermal engines. In PMA provisions there is also, in the short terms, the widening of the production power of Costantina's and Sidi Bel Abbès' establishments, some units re-distribution and some partnership new plans development.

4. Final remarks

During the two last decades, Algeria, like other Maghreb or Machrek countries, facing the Mediterranean Sea, after having given life to a process of structural measures, addressed itself towards the market economy and towards more liberal systems, more open towards the outside world. So Algeria merged as one

of the most promising market of Africa, in despite of the economical instability, of the limits given from import of non prior consumption goods, the financial agreement with the international organisms and the minor incidence of service on the debt. Now the process mentioned above should help to direct the available resources towards the import of instrumental goods and raw materials, necessary for the productive systems resumption. Besides, the forecasted increase in the hydrocarbons export -connected to the doubling of the gas pipeline to Italy, to the real beginning of functioning of the Maghreb-Europe gas pipeline and to the increasing ability of gas liquefaction- should give additional resources to an economy already relatively advanced in the liberalization process. In this case, a very good occasion might show up for Algeria's integration in the supposed area of free exchange. Algeria, on its side, is very interested in joint ventures' establishment and to agreements' stipulation for technological transferrals. This is especially true for those sectors where this kind of need is higher, that is the agricultural sector and the agricultural and food one, in the health sector and in the pharmaceuticals one, in mechanics, electrics and electronics and in mining engineering. These branches are, as a matter of fact, essential to create added value, employment and, consequently, income and to create also intermediate technological progresses. At the same time, in these industries the western technological contribution will be less expensive and more effective in term of returns and propulsion to the development of economical life other sectors.

To reach such a concrete synergy –productive, commercial and technological- among the partners, it is, though, necessary to address the co-operation model towards partnerships' ways deriving from the reinforcement of the bonds between the two worlds: the production one and the academic research one belonging to the countries of both Mediterranean shores, through financing of fundamental and applied research

programs. It is, besides, necessary that -from the point of view of a productive progressive integration of the areas at different technological development level, and for an effective use of new production techniques, suitable to the socio-economical reality of the receiving country- the technological contribution, united to joined plans, is clearly set and respected according to the ways and the formalities agreed together.

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