

## **The Practice of Science in Latin America: is it Favourable to Human Development?<sup>1</sup>**

*José Leite Lopes*

Centre de Recherches Nucleiares  
67037 – Strasbourg - Cedex  
France

### LA PRACTICA DE LA CIENCIA EN LATINO AMERICA ES FAVORABLE PARA SU DESARROLLO HUMANO?

#### RESUMEN

El autor muestra que la situación actual de la ciencia y de la tecnología en América Latina es consecuencia del hecho de que las naciones de este continente han sido colonias durante más de tres siglos. Como tales, su función era exportar productos primarios, oro, plata y productos agrícolas y así contribuir a la industrialización de Inglaterra y a su desarrollo tecnológico correspondiente.

La Independencia formal de los países de América Latina no eliminó el carácter de dependencia de sus economías y sobre esta dependencia las clases dominantes formularon su ideología y basaron su poder. La ciencia y la cultura no existían en las colonias.

Con la industrialización de las naciones de nuestro continente basada en la sustitución de importaciones, la dependencia económica continuó bajo otras formas. Las máquinas eran y son importadas para producción de bienes de consumo según patentes provenientes de los países avanzados y este hecho impidió el desarrollo local de la tecnología y la ciencia se quedó así socialmente divorciada de la política económica de esos países. La dependencia tecnológica de América Latina continuó y tornóse más profunda en la medida en que su economía es dominada por las sociedades multinacionales, que poseen laboratorios propios de investigación en sus países de origen y que, por lo tanto, no necesitan de nuestros hombres de ciencia, de nuestros institutos científicos y tecnológicos, de nuestras universidades, y las empresas del estado, en una tal economía, adoptan los procesos y métodos de las multinacionales y así no pueden contribuir a la ciencia y la tecnología en nuestros países.

El autor proclama que los programas y estrategias formulados por tecnócratas y expertos del desarrollo no tienen sentido si no se examinan esos aspectos del problema y si no proponen un cambio radical de la situación de dependencia.

¿Qué tipo de sociedad deseamos nosotros?

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Deseamos imitar a Europa y Estados Unidos bajo inextricables mecanismos de dependencia.

El desarrollo que los gobiernos proclaman ¿será para el beneficio de quién? ¿De pocos o de todos? ¿Y la ciencia debe ser desarrollada en nuestros países en beneficio de nuestros pueblos o, en el extranjero, en beneficio de una élite?

I am not going to speak on the history of science development in Latin America. I would not be able to do it as I do not know the specific evolution of each one of the countries of our continent.

I am not a historian. But I dare say that the study of this evolution under new viewpoint, a more precise analysis of the history of our countries based on real facts connected with our people and not on myths invented by and for privileged minorities, are basic for the search for new paths which should lead to the accomplishment of the aspirations of all the men and women who live and work in our countries.

Such studies are a continuous and pressing challenge not only to our scholars but also to our scientists.

What I would like to discuss here is rather whether science, as practiced in Latin America, has been favourable to human development. This is not an easy task. On the one hand there are the beautiful achievements accomplished by many of our scientists most often carried out under difficult conditions of work. These are definite proofs that science in Latin America can contribute to science in the world. But what we must also ask ourselves is about the social significance of scientific research in our countries. This is not an easy task, I repeat.

We are all subjected to the influence of an ever greater number of publications produced by experts and by officials, by personalities belonging to State institutions and certain supranational organizations, which might confuse us in our inquiry. One of the first difficulties we have to face is the easiness with which these experts invent words and make them sound as if they were solutions to problems.

After the well-known classification of the world into rich, *advanced* nations and poor, *backward* countries, the experts in phrasology coined new expressions in the 1950's: the rich countries were now to be called *developed* and the poor ones *underdeveloped* since the word "backward" might sound offensive to sensitive, diplomatic ears. Then the experts decided that the word "underdeveloped" was also pejorative and proposed to use "*developing* nations" instead. Then finally it was decided that the latter should rather be called *less developed countries*. This is the last classification which I have heard of, most often in a sophisticated, abbreviated form, the D.C.'s and the L.D.C.'s. As you see, the rate of imaginative power in this domain seems to be somehow proportional to the length of the growing gap between the rich and the poor nations. It is, therefore, not unlikely that new terminologies have been invented which I am not aware of.

This is perhaps, as it should be, after all: we, mathematicians and physicists, chemists and biologists as well as all other scientists, we have our own language and how many times do we not hide our ignorance in inventing new names?

In a recent paper published in *Interciencia*<sup>1</sup> a distinguished engineer and social scientist proposes, in order to formulate a development strategy which will take the scientific and technological activities into account, that the countries of the world be regarded as belonging to two categories: the countries with an *endogeneous* scientific and technological

patrimony – corresponding to the developed countries – and those with an *exogenous* scientific and technological patrimony. A solution of our problems would then be “the endogenization of the scientific and technological revolution in underdeveloped countries”. It is stated: “Desde este punto de vista sólo se podrá lograr un desarrollo autónomo en la medida en que se adquiera una capacidad científico-tecnológica propia, es decir, se endogenice el proceso de generar tecnologías de producción basadas en descubrimientos científicos”. I think that no one would be against this statement.

Let me take another paper which was also recently published in *Interciencia* by a distinguished colleague, an eminent Director of the Organization of American States<sup>2</sup>. It is said: “Several decades ago, economists and planning experts conceived the idea of a world composed of an economic “nucleus”, formed by the more industrialized countries and a “periphery” composed of countries which furnished raw materials to the nucleus in exchange of manufactured products from the latter. This model of the world is of course no more valid (nor was it ever) but has been replaced instead, *in fact*, by another one in which the nucleus is composed of the countries with more capacity of innovation, which have organised in a systematic way the production of technology, of the “know-how-to-make”, combined with a great capacity for manipulating the information at their disposal; and the “periphery”, formed of those countries with a very weak innovation capacity, a consequence in general of a feeble social utilization of their best prepared human resources and of the adoption of inadequate development models”. You see with me that the author, although stating that this model was never valid, affirms in fact its validity.

Of course, there are some of us who do not like to say that our countries, throughout their history, were essentially producers of raw materials and had this rôle imposed by what was to be called later an international division of labor. There are also some of us who prefer to say that the separation between rich and poor nations, between the poor and the rich in a given country, has nothing whatever to do with political forces, with subjacent political and economic conditions. There are many of us who insist in saying that they are apolitical – and thereby they adopt a very definite political attitude.

This is not necessarily a deliberate decision, it is often the result of prejudices acquired in the course of professional life. We have all received – those of my generation at least – an education, from elementary school through university, essentially oriented towards admiring and unconditionally praising the civilization and culture of Europe and – lately – of the United States.

On the other hand no place was given – at least in my country in my student time – to the study of the precolombian civilization such as the Incas, Aztecs and Mayas, their extraordinary architectural, artistic and technological achievement, their astronomy practice.

Science was taught to us as a common acquisition of the European civilized societies, as a unique and universal body of knowledge, and of attitudes and methods for gaining knowledge, politically neutral and standing above ideologies.

You know that this neutrality is not true – we all know, to quote just a few examples in my own field, of the political atmosphere surrounding nuclear physics as a result of the work on peaceful and military uses of nuclear energy: solid state physics, as a result of the industrial applications of research in this domain in the industrialized countries: space physics, which is pregnant with work related to the communication industry as well

as with military strategies. The biologists will tell us if genetic engineering research has no political implications whatever.

Science, we have been told by our teachers, works for mankind, for the benefit of man. Science and technology are, indeed, so powerful as to send man to the moon. Are they, however, not impeded to improve the life conditions of the poor and exploited masses in Africa, Asia and Latin America? Is science then, in fact, not a part of the social and political system of the advanced nations; the results of scientific and technological research, are they not primarily and chiefly applied for the promotion of their model of society, for their mankind?

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Many of us had the privilege of receiving specialized scientific training abroad and returned to our countries to take part in efforts for their so-called economic development. Some of us found out later that there were obstacles to the progress of our work conceived along these lines, such as lack of adequate funds for scientific research, absence of plans for technological research and for a relationship between science and technology as between technology and industry; undeveloped universities, lack of the right to health and education for the major part of the population of our countries. Only slowly, however, did we find out that these problems, which are an integral part of what one calls underdevelopment, arise not only from internal, historical factors but mainly from the fact that the economy of these countries is dependent and that the predominant social and cultural forces are mobilized to give rise to a political system which imposes this dependence. Therefore, the questions that we used to ask such as those about the wisdom and vision of men of government were not quite appropriate.

Must we not ask, first of all, for which kind of national project, for which society, does one want development? Must we not ask who benefits from the so-called development policies and strategies, whether the possible fruits of research as well as the profits resulting from labor in the national scale are equitably distributed among those who work or whether they end up into the hands of a small privileged elite? According to the answers to these questions one will have a corresponding development project, a different strategy for scientific-technological research.

Which type of society then do we wish for our countries? Must we necessarily imitate the consumer societies of the United States and Europe? Are we then not integrated, more and more, in the economic-cultural market of the industrial capitalist nations and this integration, is it not achieved through mechanisms of dependence?

I know that this word is not appreciated by many people. They prefer not to hear it. This reminds me by the way of something I have only recently learned namely that Ruy Barbosa – a classic myth of culture in the traditional history of Brazil – was instrumental in the approval of a law which ordered the destruction of all documents concerning the slave trade after the slave abolition in 1888. And thus under the excuse of erasing this “black page” from the national memory, documentation invaluable to scholars was lost, on this period of the history of my country.

Some people will perhaps tell you that one should not invoke dependence since the Latin American nations obtained their political independence some time ago, most of them in the last century. Many of you certainly know – to take the case of my country which is

the one. I know best – that as a colony of Portugal the main rôle of Brazil was of course to supply raw materials to the metropolis. In 1703, however, the Methuen Treaty signed between Portugal and Great Britain gave practically to the latter the monopoly of the trade with Brazil. The gold produced at the time in the Brazilian mines went directly to England to pay for the manufactured products that Portugal imported from Great Britain, to re-establish the equilibrium of their balance of payments. I shall quote an English scholar W. Conningham. *The growth of modern industry and commerce: modern times*, Part I. Cambridge 1921, page 460) who is cited by a Brazilian social scientist (page 112) and I permit myself to translate this citation from Portuguese back into English: “The extent to which Portugal acquired our manufactures and thus encouraged the industry in our country could seemingly be evaluated by the enormous volume of Brazilian precious metal which was annually imported from Portugal. This was estimated to be £ 50000 per week. We cannot be astonished that the achievement of Methuen was, in accord with the ideas of that time, highly appreciated: he induced a great foreign demand for our products and thus stimulated jobs inside our country; at the same time, a good part of the return from Portugal came to us in the most necessary form to recuperate our currency and most convenient for conducting the great European war”.

Brazil was thus a colony of Portugal and Portugal kept, mainly after 1703, a dependent, semi-colonial status with respect to Great Britain. To use an expression by Velho<sup>5</sup>, page 111, “Brazil tended thus to be a kind of <<hidden>> British colony”. In his words: “The Brazilian independence in 1822 was, from the British viewpoint, a way of completing a direct bond (with Brazil) which was begun in 1808–1810 with the opening of the Brazilian ports to trade with the <<friendly>> nations and with the imposition of customs taxes upon the British products (15% ) which were smaller than those on the products coming from other countries (24% ) and even smaller than those imposed on the Portuguese products (16% )”. And it is another scholar, Eric J. Hobsbawn (*Industry and empire*, Penguin, 1969, page 146, cited by Velho, 1976, page 112) who says:

“(Latin America), it is not unjust to say, saved the British cotton industry in the first half of the nineteenth century, when it became the biggest market for the English exportations – reaching 35% of them in 1840, mainly for Brazil”.

As it has been clearly analysed by Octavio Guilherme Velho, the political independence – which was rather an adaptation to the international panorama – did not change the nature of the political domination inside Brazil. Changes occurred in the interior of the dominant class. New native partners appeared for the new foreign domination partners and the unrest which followed the proclamation of independence for about twenty years was connected with the transition from Portuguese to British domination as well as with the change from an economy based on sugar cane plantations and mines to that based on coffee.

Velho states: “The agrarian interests kept a practically complete control on the State and during this crucial period some attempts to accompany the Industrial Revolution ended either in a complete failure or — specially when they were of interest to exportation as in the case of railways and navigation —; they became under foreign control (mainly English)”. And again: “*According to the dominant ideology*. Brazil had an <<agricultural vocation>> and had to remain faithful to it. *It was accepted that we would never be able to produce industrial goods so well as England and other countries and that if we*

*attempted to do so and became protectionists we would certainly suffer retaliations against our agricultural exportations*". (The underlining is mine).

Now I should like to ask you: is this not a description of dependence? It is not due to such political and economic domination from abroad, accepted and imposed by the national ruling class, that industries were not developed? Is it not clear the existence already at that time of an economic center – Great Britain – and a periphery formed of nations which although proclaimed independent were still in fact colonies? And how could anybody develop innovative capacity under these conditions? For “at the beginning of the twentieth century Brazil imported all that could undergo some kind of industrial processing, from locomotives to matches”<sup>5</sup>. (page 122).

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It was the first World War, as well as variations in the price of agricultural products, the great world economic crisis of 1929 and the Second World War, that favoured a change in the international economic system and led, as you know, to the so-called import-substitution industrialization of Brazil and other countries in Latin America. Another change of dominant partner, the United States replacing Great Britain, started to take place since the end of the last century.

The transition from the old oligarchic State to the modern State of Authoritarian and Dependent Capitalism, the recent alternation of the political regimes in most of Latin America between populist democracies and military dictatorships, the intervention of the State in the economy just before and after the Second World War, the ability of the national ruling classes to adapt themselves to internal and external ruptures and to keep power, its transformation into representatives of a transnational bourgeoisie, all of this will be presented to you in a deeper fashion by our specialists in this domain.

In this evolution, the economic dependence of the Latin American nations did not favour the development of science.

Our universities were founded very late — with exceptions which do not change the general feature of lack of university influence in the life of our nations. But given the picture described above, could it be otherwise? Without industries (remember that we were taught that we could never make industrial products so well as Great Britain) there were no research institutes, no university organizations until this century. It is perhaps not an exaggeration to say that the universities founded earlier in Spanish America, in the 16th and 17th centuries, were essentially centers for the medieval character of culture developed in the metropolis. Education was — and is still largely so — a privilege.

If independence was not achieved as a result of deep ruptures breaking economic domination, if a national self-reliant development was not begun as a result of formal independence, how could we develop our capacities of innovation, our abilities in technology and science?

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Technological dependence has recently been aggravated by the policy adopted by most of our States to base development on the implantation of affiliates of powerful transnational private enterprises which produce goods for exportation — taking advantage of

certain favourable conditions — as well as for consumption by a small fraction of our populations. Which fraction of our population 10%, 15%, 20% are the benefits of these policies directed to?

Technocrats speak much nowadays, as you know, of the technology transfer which is implied by the installation of plants of multinational enterprises.

The fact that our workers will have to learn how to handle imported machines needed to make cars, television sets and other products, is of relative importance if these machines are invented, designed and built abroad, if the plans for making the goods cannot be changed by local engineers.

Even if *we discard the basic question of whether these industrial products are really those which are needed by our population*, it is clear that the important thing is the capacity of technological innovation and this is not transferred by multinational enterprises. Research is carried out abroad and technology comes in locked in packages and black boxes.

And technological domination tends to be self-perpetuating. Once machinery and equipment are installed in underdeveloped countries, the need for spare parts, for maintenance and repair services, for replacement of old machines by new machines, which all will have to be imported, will continue the domination, sometimes under the name of modernization reforms. The question of patents illustrates perhaps more clearly the rôle of control of affiliate firms of multinational enterprises by the parents firms. The agreements which give patent licensing determine the terms of production and distribution of goods by the affiliate company and often limit the geographical area where these products can be sold. Thus the importation of cars, or spare parts of computers produced in country A by country B, both of Latin America, will depend on permission by the headquarters of the multinational society which controls the enterprises of country A. In a country of dominated economy, the control of technology by the industrially advanced nations usually extends the technological monopoly into a market monopoly and this is achieved by requirements included in the patent licensing agreements such as that which obliges the affiliate enterprise to buy raw materials and other products to other enterprises belonging to the parent multinational society.

I cannot resist the temptation of quoting a reviewer of a book recently published on weapons (Anthony Sampson. *The Arms Bazaar*, Hodder and Stoughton, London). According to this author, an engineer in Great Britain named Amstrong, was, in the 19th century, against selling arms to foreigners, on both moral and patriotic grounds. But Mr. Rendel, a brother of his partner, formulated the doctrine that “the manufacture of arms for foreign powers was far from an unpatriotic act, for the country (Great Britain) was benefited to the extent to which its experience and power of production were increased whereas foreign countries were disadvantaged to the extent to which they were dependent on us for their munitions of war”.

Is this not the doctrine, “*mutatis mutandis*”, which regulates the present policy of technology transfer?

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As a result of the specific evolution of our countries, of their passage from a status of colonies to a new status of dependent nations (a kind of “hidden” colonies) we see that

our scientists, our engineers, our universities, our research institutes never had a chance of being an essential part of our economic and social systems.

How can one formulate a strategy for a successful scientific and technological development without a corresponding political strategy for changing the economic pattern of our nations? How can we possibly achieve endogenization of that development without discussing the basic political and economic forces which have prevented — throughout our history — the liberation of our potential capacity for creation?

If we have done our best — as individual scientists — is it not true that science and technology as a whole were not allowed to flourish among us in such a way as to help our common man?

Must we not inquire, must we not discuss, must we not ask again and again: which type of society do we aim at, must we imitate the industrialized nations for the benefit of a small elite?

Let us discuss intensively. If in some of our countries this is not presently possible, it is a great chance that other countries of Latin America, such as yours, respect the right to freedom of thought and speech. Let me thank you from my heart for the opportunity to participate in your annual reunion.

Let us then keep on in our debates. That is why we are here.

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