

SCIENCE AND DEPENDENT DEVELOPMENT

J. LEITE LOPES

SUMMARY

The author examines the connection between the development of scientific research in Latin America and the process of economic growth which has taken place in most of the nations of this region of the world. He argues that the role of the multinational corporations in this process influences the character of scientific research in these countries.

It is stated that the scientific and technological research work needed for the ultimate production of industrial goods by the multinational firms is carried out in the great laboratories of the mother firm and of universities in advanced countries. Multinational corporations—and the economic system which they dominate—do not therefore need the services of national scientists and national universities in the less developed countries where they settle.

Grants and contracts awarded to research teams in universities belonging to these countries will rather orient the work of their institutions toward the interests and programs of universities and official agencies in the center of the capitalist system which in turn are associated to multinational corporations.

The author considers that science is in this way not an instrument of defense of the national identity, independent development and the national interests of the peoples of the Third World. Like the system of dependent development established in these countries there exists then a system of dependent science and technology based on imported knowledge, for the benefit of a small elite, not of the whole population.

In recent years, with the implantation of authoritarian regimes in several developing nations the multinational societies have moved some of their plants to these countries where they find cheap labor, raw materials and facilities such as the absence of labor strikes and demands, forbidden and repressed by these dictatorial governments. Under these conditions, working mainly for exportation and with imported know-how, the transplanted industrial system is not affected if universities and research institutes are submitted to political purges leading to the exclusion of several of their scientists and professors.

An example is finally given of a text-book in physics where pictures of big machines and laboratories might induce students in the less developed countries to imagine that the understanding of the laws of nature would be possible only through such expensive equipment by the scientists of the rich nations.

It is urged that scientists of the less developed countries be aware of these questions; that they contribute to the elimination of dependence and domination of their countries; and that science cease being a tool of domination in the hands of oppressive forces.

For a long time the process of economic development has been regarded as a kind of free competition where the most intelligent men, the most capable and dynamic peoples of the Earth have been, and are, successful. Peoples of backward countries¹ and regions of the globe were, and are, according to this view, less capable, less intelligent, less attracted by hard work. What one omits to say is that during the colonial period, in Latin America, in Africa, in Asia, Europeans first, Americans later, intervened almost always by force in order to modify the local cultures and civilizations, reorganize the economies of these countries and dominate them in such a way as to ensure the supply of mineral and living resources, the tropical products necessary to the metropolitan economy.

Slowly, propaganda was invented in order to create the habit of comparing the achievements of all communities everywhere to the values developed by the capitalist industrial system and it has been regarded as natural to consider primitive all cultures and civilizations which differ from those of this system.

It was during the XIXth century and in the first half of the XXth century that the industrial capitalist system, which was set up in Europe after the Industrial Revolution, organized a world economic structure according to which the elaboration of goods, successfully improved by technology, was concentrated in the metropolitan areas. The rest of the world, the colonies, the dominated countries, the periphery of the capitalist system, was supposed to supply the raw materials needed by the center of the system. One has thus seen the occurrence of production cycles in underdeveloped countries: sugar, rubber, gold, coffee, iron ore in Brazil, tin in Bolivia, copper in Chile, in Peru, bananas in Ecuador and Central America, petroleum in Venezuela as well as in the Middle East countries.

At the same time, political and economic institutions were established in these countries, which still exist, and the transformation of which constitutes the past and present history of the liberation struggle of dominated peoples.

A first change in the system of international economic relations took place during the years between

the First and the Second World Wars and was stimulated by the world economic crisis in 1929. These events led to the abolition of pacts and conditions against the installation of industries in Latin America. It became clear to businessmen in the largest countries of this region that it was essential to produce locally some of the goods which were imported from Europe and the United States and which could not be brought over during international crises. Thus, the formation of an industrial system the so-called import—substitution industrialization—started in these countries in the 1940's.

However, at the same time that this process took place in Latin America, the United States, changed after the Second World War, into the most powerful center of the capitalist world. With Roosevelt's "New Deal", the industrial production for war and the growing intervention of the U.S. Government in the American economy, conditions were created in the U.S. for an extraordinary growth of the industrial complex as well as of science and technology. New big industrial societies, which now took a new name—the multinational or transnational or

J. Leite Lopes, is Director of the Division of High Energies at the Center for Nuclear Research and Professor of Particle Physics Theory at the University of Strasbourg, France. Formerly he was President of the Brazilian Physical Society, Scientific Director of the Brazilian Center for Research in Physics (CBPF) and Professor of Theoretical Physics at the Federal University of Rio de Janeiro. He was dismissed from the latter positions in 1969 by the Military Junta of Brazil. Address: Centre de Recherches Nucléaires, Division des Hautes Energies, 67037 Strasbourg-CEDEX, France.

global corporation² —emerged, endowed with a great economic and technical power. The big industrial societies had started their activities by exporting their products. As soon as difficulties in the balance of payments of the importing countries induced protection measures against importation these societies rented their patents to enterprises in the underdeveloped countries so that these could produce their goods locally. In a second step, the multinational corporations buy these —and other, previously independent— enterprises and change them into affiliates.

The Chilean economist Oswaldo Sunkel (1972) has expressed this process in the following way: "trade between national firm X_A of country A and national firm Y_B of country B is replaced by the internal transfers of firm X_A to countries A and B"³. In the process, firm Y_B disappears.

In this way, at the same time that an intensive campaign is periodically made in favor of free enterprise, the significant national industrial societies in developing countries are absorbed by the transnational corporations; and national policies of economic development in these countries are replaced by projects and programs which reflect the interests and the global policy of these corporations. In the commercial and political relations between a big capitalist country and a dominated, developing nation, the interests of the multinational societies are predominant. As a compensation, support is given by these corporations and by the governmental agencies of the industrial country to the social groups in the dominated country with whom the corporations are associated —their local representatives and partners. If conditions are created in a dominated country for the installation of governments with a national program of social and economic reforms in the interest of their peoples, support is given to military officers —many of whom have been educated in certain military and intelligence schools abroad such as the counter-insurgency school in Panama— to overthrow these governments and establish dictatorships favorable to the policies of the transnational corporations (See, for example, Fagen, 1975; Steiner and Trubeck, 1971; Rositzke, 1975).

And thus one is often forced to contemplate the installation of a set of military dictatorships in many countries of the Third World as if, in correspondance to them and as an image of their structure, the multinational societies inspired the establishment of a transnational military power capable of stimulating and directing the above dictatorships in the defense of their global interests, the democratic regime in the center of the capitalist system providing a cover for this military power. At the same time a significant part of the national bourgeoisie in these developing

countries —including university professors and scientists— gradually becomes a branch of a transnational bourgeoisie which loses its identity "as part of a national ruling class" (Sunkel, 1972).

Consequences For Science

What are the consequences of the above picture for the development of scientific research and for science education in the developing countries?

Traditionally, science is taught as a social process common to all civilized societies. Western Europe and the United States are described as the heirs of Greek science and culture. One omits to say that during certain periods other peoples —among them Chinese, Viet-Nameese, Indian, Persian, Egyptian, Toltec, Aztec, Inca, and their descendants— have been subjugated by imperialist powers and have thus been blocked from independent cultural development.

In the capitalist countries, science contributed to the transformation of the relation of productive forces and to the development of new means of production. Science is, however, presented exclusively as the sum of our knowledge of the natural phenomena. Science, and physics in particular, would thus be neutral, independent of and above economic and political forces, class interests, ideologies (Vitale, 1974; Lévy-Leblond, 1974). But science is not a passive set of knowledge, it is a whole dynamic process which includes the choices of research subjects, the means of searching for, acquiring and utilizing knowledge. This sum of activities is not neutral, it reflects the interests and the ideologies of the society.

Clearly, the industrial capitalist system developed in Europe and in the United States with the support of technical inventions. Little by little the laboratories for testing materials and manufactures gave way to research laboratories in universities, in industrial establishments, and finally in the great multinational corporations, where teams of scientists and technicians conceive new ideas and their practical application, create new products, new techniques, new machines.

In the dominated countries, the establishment of affiliates of multinational societies does not imply in any way the establishment of research laboratories in these subsidiary companies (Leite Lopes, 1966). The role of the latter is to import, assemble or locally produce goods and sell them, to dominate the local market. How to improve these products, modify techniques so as to win competition with other companies, is not the business of the branches of transnational societies in the Third World. This is the role of the great research laboratories at home, in the United States or in Europe, which will transmit the

final results of their research, the final instructions and products for sale by the affiliated companies.

It is thus clear that the multinational corporations —and hence the economy which they dominate— do not need the service of national scientists and national independent universities in the underdeveloped countries where they settle. If they eventually make some research contracts with some research groups in some universities in any one of these countries, the work which will develop will be in the service of the interests of these corporations.

If science as a whole in the center of the capitalist system reflects the interests of the corresponding societies, in the developing countries it reflects the character of economic and political domination which characterizes these countries. The lack of employment of local scientists in industry and in research for industry in these countries contributes to dissociate the local universities and research institutes from the economic processes. These institutions do not feel, in general, useful to the economy of the country —with the possible exception of medical institutions— and scientists are led to look abroad for the general content of their programs. In recent years, with the establishment of agreeable governments in certain developing countries, such as the above mentioned branches of the military transnational power, the multinational societies have moved some of their plants to these countries where they have cheap labor, raw materials, facilities provided by local governments, such as the absence of labor strikes and movements forbidden or repressed by these governments.

In this process the multinational societies bring into these developing countries not only management, design, marketing and financing but also all that is needed concerning technology and scientific knowledge. Grants and contracts may be given to specific groups in local universities in certain scientific and technical domains such as solid state physics and satellite and space research. But the work of these groups will be quite clearly connected with the interests and programs of universities and official agencies intimately connected in the center of the capitalist system to the transnational corporations. Science is in this way not a defense instrument of national identity and the truly national interests of the peoples of the Third World.

And if a naive observer might be led to believe that the space program in the United States is conceived to extend "the revolution in thought that was initiated by Copernicus and continued by Newton and Darwin", in the words of Jastrow and Newell, 1972, let him beware that according to the same authors: "Multibillion-dollar annual returns to the American economy from weather satellites may be matched

by the yield from satellites employed in prospecting for valuable mineral deposits. (...) The stakes are high in this game". And satellites have led to the discovery of large deposits of mineral wealth in regions covered by trees and vegetation as in Brazil, equatorial Africa and Southeast Asia. Space research programs in the United States are thus another tool for the domination of the international market in communications and the discovery and exploration of mineral deposits as in the Amazon basin. And solid state physics research programs, which are generally advertised by a majority of physicists in the Third World as the only appropriate physics research to be stimulated in their countries —for being financially accessible and potentially useful to their economies— are essentially coordinated to programs in big universities and research laboratories associated to multinational societies in the center of the industrial system. They do not contribute to the progress of the people in question; they are part of the enterprises which dominate the country

to which they belong. Here is a statement by Professor Harry Johnson: "The corporation... has no commercial interest in diffusing its knowledge to potential native competitors nor has it any interest in investing more than it has to in acquiring knowledge of local conditions and investigating ways of adapting its own productive knowledge to local factor to price ratios and market conditions. Its purpose is not to transform the economy by exploiting its potentialities (especially its human potentialities) for development" (cited in Sunkel, 1972).

Science and Domination

The classical concept of economic development thus seems to be associated with the notion of domination. The division of the world into rich industrial nations and developing, dominated countries, seems to have been essential for the ideology of the capitalist system, a kind of holy, Tordesillas treaty signed not by the Pope but by God himself. It is interesting to watch the

present reaction of the representatives of this system against the flux of money reserves toward the petroleum-producing countries.

When a significant change against this division takes place, when a new equilibrium is achieved in the world breaking with domination and social injustice, science, the approach to science, the methods of education, will change correspondingly.

In the meantime, if scientists and educators cannot change the world, they can at least —chiefly those in the Third World— contribute to an analysis of the situation in their own countries and try to understand the social significance of their work.

In the elaboration of text-books for physics education it would be important that excellent manuals which have been published in the United States, such as the Berkeley and the Harvard physics course volumes, be adapted and not simply translated for the developing countries. Thus the fact that the volume on Mechanics of the Berkeley

LA CIENCIA Y EL DESARROLLO DEPENDIENTE

J. LEITE LOPES

RESUMEN

El autor examina la relación entre el desarrollo de la investigación científica en Latinoamérica y el proceso de crecimiento económico que ha ocurrido en la mayoría de las naciones de la región. Argumenta que el papel de las corporaciones multinacionales en el proceso influye sobre las características de la investigación científica de esos países.

Se dice que el trabajo de investigación científica y tecnológica que se requiere en última instancia para la producción de bienes industriales por las firmas multinacionales es realizada en los grandes laboratorios de la casa matriz y de las universidades en los países avanzados. Las corporaciones multinacionales —y el sistema económico que ellas dominan— no necesitan por tanto los servicios de científicos y universidades nacionales en los países de menos desarrollo donde se instalan.

Las subvenciones y los contratos otorgados a equipos de investigación en las universidades que pertenecen a tales países preferirán orientar el trabajo de sus instituciones hacia los intereses y programas de las universidades y agencias oficiales en el centro del sistema capitalista, el cual a su vez está asociado a corporaciones multinacionales.

El autor considera que la ciencia así desarrollada no es, de esta manera, un instrumento de defensa de la identidad nacional, del desarrollo autónomo y de los intereses específicos de los pueblos del Tercer Mundo. Igual que el sistema de desarrollo dependiente establecido en esos países, existe pues un sistema de ciencia y tecnología dependientes basado sobre el conocimiento importado, para el beneficio de una pequeña élite, no de la población entera.

En los años recientes, con la implantación de regímenes autoritarios en varios países en vías de desarrollo, las sociedades multinacionales han mudado algunas de sus plantas a tales países, donde encuentran trabajo barato, materiales primarios y características tales como la ausencia de huelgas y demandas laborales, que son prohibidas y reprimidas por los gobiernos dictatoriales. En esas condiciones, trabajando principalmente para la exportación y con "saber-hacer" importado, el sistema industrial transplantado no queda afectado si las universidades y los institutos de investigación son sometidos a purgas políticas que resultan en la expulsión de varios de sus científicos y profesores.

Para terminar, se da un ejemplo de un libro de texto en física en el cual las ilustraciones de grandes maquinarias y grandes laboratorios podrían inducir a estudiantes de los países menos desarrollados a imaginarse que la comprensión de las leyes de la naturaleza sería posible sólo por medio de tan caro equipo por los científicos de las naciones ricas.

Se incita fuertemente a que los científicos de los países menos desarrollados estén conscientes de estos problemas; que contribuyan a la eliminación de la dependencia y la dominación de sus países; y que la ciencia deje de ser un instrumento de dominación en las manos de las fuerzas opresivas.

by the yield from satellites employed in prospecting for valuable mineral deposits. (...) The stakes are high in this game". And satellites have led to the discovery of large deposits of mineral wealth in regions covered by trees and vegetation as in Brazil, equatorial Africa and Southeast Asia. Space research programs in the United States are thus another tool for the domination of the international market in communications and the discovery and exploration of mineral deposits as in the Amazon basin. And solid state physics research programs, which are generally advertised by a majority of physicists in the Third World as the only appropriate physics research to be stimulated in their countries—for being financially accessible and potentially useful to their economies—are essentially coordinated to programs in big universities and research laboratories associated to multinational societies in the center of the industrial system. They do not contribute to the progress of the people in question; they are part of the enterprises which dominate the country

to which they belong. Here is a statement by Professor Harry Johnson: "The corporation... has no commercial interest in diffusing its knowledge to potential native competitors nor has it any interest in investing more than it has to in acquiring knowledge of local conditions and investigating ways of adapting its own productive knowledge to local factor to price ratios and market conditions. Its purpose is not to transform the economy by exploiting its potentialities (especially its human potentialities) for development" (cited in Sunkel, 1972).

Science and Domination

The classical concept of economic development thus seems to be associated with the notion of domination. The division of the world into rich industrial nations and developing, dominated countries, seems to have been essential for the ideology of the capitalist system, a kind of holy, Tordesillas treaty signed not by the Pope but by God himself. It is interesting to watch the

present reaction of the representatives of this system against the flux of money reserves toward the petroleum-producing countries.

When a significant change against this division takes place, when a new equilibrium is achieved in the world breaking with domination and social injustice, science, the approach to science, the methods of education, will change correspondingly.

In the meantime, if scientists and educators cannot change the world, they can at least—chiefly those in the Third World—contribute to an analysis of the situation in their own countries and try to understand the social significance of their work.

In the elaboration of text-books for physics education it would be important that excellent manuals which have been published in the United States, such as the Berkeley and the Harvard physics course volumes, be adapted and not simply translated for the developing countries. Thus the fact that the volume on Mechanics of the Berkeley

LA CIENCIA Y EL DESARROLLO DEPENDIENTE

J. LEITE LOPES

RESUMEN

El autor examina la relación entre el desarrollo de la investigación científica en Latinoamérica y el proceso de crecimiento económico que ha ocurrido en la mayoría de las naciones de la región. Argumenta que el papel de las corporaciones multinacionales en el proceso influye sobre las características de la investigación científica de esos países.

Se dice que el trabajo de investigación científica y tecnológica que se requiere en última instancia para la producción de bienes industriales por las firmas multinacionales es realizada en los grandes laboratorios de la casa matriz y de las universidades en los países avanzados. Las corporaciones multinacionales —y el sistema económico que ellas dominan— no necesitan por tanto los servicios de científicos y universidades nacionales en los países de menos desarrollo donde se instalan.

Las subvenciones y los contratos otorgados a equipos de investigación en las universidades que pertenecen a tales países preferirán orientar el trabajo de sus instituciones hacia los intereses y programas de las universidades y agencias oficiales en el centro del sistema capitalista, el cual a su vez está asociado a corporaciones multinacionales.

El autor considera que la ciencia así desarrollada no es, de esta manera, un instrumento de defensa de la identidad nacional, del desarrollo autónomo y de los intereses específicos de los pueblos del Tercer Mundo. Igual que el sistema de desarrollo dependiente establecido en esos países, existe pues un sistema de ciencia y tecnología dependientes basado sobre el conocimiento importado, para el beneficio de una pequeña élite, no de la población entera.

En los años recientes, con la implantación de regímenes autoritarios en varios países en vías de desarrollo, las sociedades multinacionales han mudado algunas de sus plantas a tales países, donde encuentran trabajo barato, materiales primarios y características tales como la ausencia de huelgas y demandas laborales, que son prohibidas y reprimidas por los gobiernos dictatoriales. En esas condiciones, trabajando principalmente para la exportación y con "saber-hacer" importado, el sistema industrial transplantado no queda afectado si las universidades y los institutos de investigación son sometidos a purgas políticas que resultan en la expulsión de varios de sus científicos y profesores.

Para terminar, se da un ejemplo de un libro de texto en física en el cual las ilustraciones de grandes maquinarias y grandes laboratorios podrían inducir a estudiantes de los países menos desarrollados a imaginarse que la comprensión de las leyes de la naturaleza sería posible sólo por medio de tan caro equipo por los científicos de las naciones ricas.

Se incita fuertemente a que los científicos de los países menos desarrollados estén conscientes de estos problemas; que contribuyan a la eliminación de la dependencia y la dominación de sus países; y que la ciencia deje de ser un instrumento de dominación en las manos de las fuerzas opresivas.