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ANIBAL PINTO
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EUGENIO LAHERA
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Technological change *and structuralist* analysis

Dedicated to Fernando Fajnzylber
In memoriam

Armando Kuri Gaytán

*Associate Professor,
School of Economics,
National Autonomous
University of Mexico
(UNAM).*

This article analyses the approach which ECLAC has taken to the subject of technology. In this respect, the author identifies two different periods. The first starts with the inception of ECLAC and continues up to the 1970s. This period, during which efforts focused on achieving Latin America's industrialization, essentially by means of import substitution, was characterized by what the author terms "technological passivity" on the part of the relevant agents and of mainstream economic thought in the region. The second period, from the 1980s to the present, is marked by "technological activism" arising out of what has been called the Third Industrial Revolution, with its far-reaching ramifications in the world economy, and also out of a substantive change in the thinking of ECLAC, whose main concern is now with the determinants of technical progress and competitiveness together with the achievement of social equity in the distribution of the fruits of that progress. In analysing this aspect, the author draws upon the ideas of Raúl Prebisch and Aníbal Pinto.

I

Introduction

ECLAC's commitment to the analysis of matters relating to technical progress or, if you will, to science and technology, has a number of somewhat paradoxical facets. On the one hand, in terms of its research efforts and writings, it seems clear that the subject has not been one of its primary concerns. Viewed from another vantage point, however, there is no doubt that this subject constitutes one of the main theoretical pillars of what we refer to generically as the thinking of ECLAC.

Aníbal Pinto

Just as in the classical, Marxist and Schumpeterian schools of thought, the analysis of technological change made by the structuralist/ECLAC school is closely linked to the economic and social development process, with the difference that it is based on the specific features of the Latin American case between the Second World War and the present. Far from being regarded as an autonomous and independent phenomenon, technological change is considered to be a substantive part of development strategy which consequently has a strong possibility of influencing –along with other elements– the basic lines of that strategy.

For Latin America, which is where the ideas of ECLAC arose and the source from which they were propagated in the late 1940s, the objective at that time was industrialization based on the import substitution model, whose overall evaluation¹ falls outside the scope of this essay, except to the extent that it helps us to explain certain aspects of the main subject under discussion: technological change. And one of those aspects is undoubtedly the structural heterogeneity stemming from the type of industrialization pursued by the region and the technological pattern which accompanied it. It is precisely that striking heterogeneity which should serve as the starting point for the discussion of the technological options open to Latin America in the coming years.

This essay refers to two clearly differentiated stages in the more than four decades over which the

thinking of ECLAC has been developed, and these stages are directly related to the subject of technological change. The first runs from the founding of the organization through the 1970s and is characterized by what we might call “technological passivity” on the part of both domestic agents (the State and entrepreneurs) and mainstream economic thought. The second stage began in the 1980s and represents a major change in the (by then, critical) attitudes of the State and the entrepreneurial sector regarding that former technological passivity. This change also occurred, and very forcefully so, in the economic thinking of ECLAC, which advocates what we might describe as a type of “technological activism” as the best way for Latin America to attain levels of productivity that will enable it to compete in an increasingly open and globalized world economy.

In this article we will first address the traditional school of ECLAC thought –developed chiefly by Raúl Prebisch and Aníbal Pinto– which advocated and accompanied the import substitution-based industrialization process and in so doing gave rise to a marked degree of structural heterogeneity and an intense concentration of the fruits of technical progress. We will then turn to contemporary ECLAC thinking –represented primarily by the work of Fernando Fajnzylber– in which science and technology form the hub around which the other elements of the system will revolve in the quest for genuine economic and social development.

□ This paper was presented at the Seminar on Innovation, Dissemination and Competitiveness held on 2 and 3 December 1993 at the Centre for Technological Innovation (CIT) of the National Autonomous University of Mexico (UNAM). The author is grateful for the comments made by all the participants in the seminar

and particularly those offered by Sergio de la Peña and Miguel Angel Lara, although of course the ultimate responsibility for the views expressed here lies solely with the author.

¹ An effort to make such an evaluation may be found in Kuri, 1991.

II

Structural heterogeneity and the concentration of the fruits of technical progress

The Latin American industrialization process had, in one sense or another, strong repercussions on the region during the three decades following the end of the Second World War. On the positive side, major advances were undoubtedly made which led to an increase in industrial production and in per capita GDP, a decrease in infant mortality and the creation of infrastructure to meet the housing, education and health-care needs of the major cities, with their emerging middle class at the fore (Hirschman, 1987). This marked a far-reaching change in the economic and social structure of the region, which was swiftly transformed from a basically agrarian society into an urban-industrial one.

The State was not indifferent to these changes, nor was the ECLAC school of thought that was beginning to take form in the late 1940s. Indeed, the views of ECLAC became the dominant paradigm, and their influence on the future of Latin America, for better or worse, was to be decisive. Through the medium of a strong State apparatus which intervened in and planned the development process, the ideas of ECLAC about industrialization as the axis of growth began to play an important role.

This influence made itself felt in all fields, but particularly in trade and industry. The prime objective was to attack the causes of the region's backwardness, which, according to this view, stemmed from its failure to attain a level of industrial development capable of overcoming the centre-periphery relationship, in which the terms of trade for the latter were invariably disadvantageous. Thus arose the region's zeal for industrialization, and protectionist and industrial development policies were to be the chief means of pursuing it.

It is in this context that we should consider the importance assigned to import substitution as the most appropriate strategy; it was thought to be the best policy because of the international situation at the time and also, perhaps, because the challenges to be posed later on by the more advanced stages of industrialization were underestimated. These challenges

would have been formidable even without the harmful effects of the development measures implemented during the first stage of import substitution, outstanding among which was the creation of an uncompetitive, unintegrated industrial structure as a consequence of extreme protectionist policies that gave entrepreneurs a captive market and thus spared them the trouble of making any effort to improve their productivity.

State support in the form of fiscal and credit subsidies and subsidized prices for public goods had much the same type of effect. All this resulted in higher earnings at the cost of a growing government deficit, thus continually adding to a problem which eventually proved to be unsustainable and about which there has been an intense debate in recent years: the State's involvement in the economy (Ibarra, 1990). A third effect of these industrial development policies – an effect which is even more directly related to the subject of this article – was the configuration of a fundamentally imitative pattern of technological development in which there was no possibility (since neither the State nor entrepreneurs even considered doing so) of adapting, much less creating, technology on any scale that might afford some measure of internal control.

Instead, the job of promoting technological development was assigned to foreign investment, which was given untrammelled entry into the front-line sectors. At first, this made it seem as though Latin America's production structure contained an element of technological dualism.

It was Aníbal Pinto (1976) who ruled out this hypothesis, which he considered to be a better explanation for the conditions associated with the primary-exporter stage than for those of the industrialization phase. In the latter stage, unlike the former, not only did appreciable differences exist among the various sectors of the economy (of which there were more than two), but important relationships of various types were established among them which influenced their development – something which was not possible in a dualistic structure (ECLAC, 1974). It was in this context, in an effort to describe this more com-

plex situation, that Pinto proposed the term "structural heterogeneity".

This term accurately describes the type of industrialization process that was being pursued by the region, which was bound to lead to a concentration of the fruits of technical progress if the larger gains in productivity in the centres were followed by an increase in their income in excess of the rise in productivity rather than by a reduction in the prices of manufactures. This meant that the central countries would not only retain the fruits of their technical progress but would also take a portion of the benefits corresponding to the periphery, since income in the peripheral countries would rise by a smaller amount than productivity (Pinto, 1965).

It followed from the above that the increase in domestic saving would be too small to meet the need for investment in modern technology, which would tend to perpetuate the technological gap between the central and peripheral countries. From the very beginnings of ECLAC, Prebisch recognized this fact when he pointed out in 1949 that although a century earlier the central countries' income levels had been low, the level of capital per employed person which they had needed for investment in the technologically modern sectors of the time had also been low.

In contrast, as early as the mid-twentieth century, savings in the periphery were insufficient to cover investment in modern technology. This situation was exacerbated in the ensuing decades by the speed of technological change, which was not only not coupled with a matching rate of increase in income, savings and investment levels but was even, during what has been called the "lost decade" of the 1980s, accompanied by a major downturn in those indicators.

This means that although the technological wealth of the advanced countries was theoretically within Latin America's reach, it did not have effective access to that wealth. In this respect the Latin American countries have differed from those nations which, in the past, have managed to make use of the "advantages of coming from behind" to close the distance separating them from the leading country and even to take over the lead themselves, as Maddison (1986) shows in the cases of England in the eighteenth century, the United States in the nineteenth and Japan in the twentieth. The backwardness of our region has undoubtedly been due to much more deep-rooted—or, in the jargon of ECLAC, structural—factors which, far

from being potential advantages, have clearly worked to our disadvantage.

To round out this brief overview of the perspective on technical change developed by ECLAC during its early years, however, it should be emphasized that, in ECLAC's view, it is essential not to lose sight of the fact that technical progress is a subject whose true importance becomes evident when it is analysed within a concrete social and institutional context: i.e., when there is a clear awareness of for what purpose, for whom and in what ways a given technological potential is to be used (Pinto, 1976). This approach seeks to guard against the kind of technological fetishism that lays all possibilities of good or evil at the door of technical change.

Thus, the results of the technological strategy that may be chosen at a given point in time will depend upon the development style that serves as its context. If this style is of a type that fosters structural heterogeneity, as has been the case in Latin America during the past 50 years, then the use of technology will heighten, rather than prevent, inter- and intra-sectoral, regional and external disequilibria, thereby exacerbating problems in the areas of employment and income distribution (Pinto, 1976).

ECLAC therefore reached the conclusion that the solution was to adopt a development style in which "...the centripetal forces that drive forward the concentration of technical progress and its benefits must be succeeded by a force that promotes the sustained dissemination of such progress and benefits throughout the production system, an appreciable reduction in regional and urban/rural imbalances, greater internal integration, new, less unstable and more fertile types of external relations and, last and most importantly, a better distribution of income" (Pinto, 1976).

Although the role thus assigned to technological policy is, up to a point, a passive one² in that it is dependent upon the development style, Pinto recognizes the leading role it can perform when he states that "...it is clear that technological policy should not passively await the complete or comprehensive definition of a new development path but should instead set about laying the foundations for its own reformulation" (Pinto, 1976).

² Technical progress, says Pinto (1976), "is a dependent variable. The term is, however, somewhat inapt in that it suggests a passive or reflectional phenomenon. It is neither one nor the other, as we well know, for the compelling reason that the development style and technological activity influence one another, even though the former element may be the dominant one".

This last statement seems to reveal quite clearly the ambivalence of ECLAC thinking, which I have attempted to reflect throughout, starting with the epigraph with which this article opens. If this trait is considered in conjunction with another highly important characteristic –the fact that, during this initial stage, ECLAC was more concerned about the distribution of the fruits of technical progress than about the

determinants of that progress (Rodríguez, 1991)– we will then have a fairly comprehensive idea of the strengths and weaknesses of structuralist thinking about technology up through the 1970s which will allow us to analyse, in section III, the ways in which ECLAC's thinking was updated during the 1980s in the light of the events of the "lost decade" and the rapid advances made in new technologies.

III

Competitiveness, technical progress and social equity

If, as suggested in the preceding section, the traditional ECLAC school of thought focused more on the appropriation of the fruits of technical progress than on the determinants of such progress, then the heirs to that line of thought were those who developed this latter facet during the 1980s without, however, neglecting the main concern of their predecessors.

Thus, as a result of both its own evolution and the changing world environment, contemporary ECLAC thinking has focused on the factors that play a part in technological change because this element is regarded as being of key importance in shaping a more integrated and competitive production structure. Although the emphasis is on manufacturing, since it is the sector most directly linked to technological development, ECLAC has not ignored other structural components which together determine the level of competitiveness.

One of the authors who developed the concept of structural competitiveness in greatest depth in Latin America was Fernando Fajnzylber (1988 and 1989b), who based his hypotheses on exhaustive comparative studies of the most industrialized countries of Europe, the United States and Japan, as well as the nations of South-East Asia, the Nordic countries and the less industrialized countries of Europe, in an effort to draw lessons from their experiences that might help Latin America succeed in its attempt to attain high levels of competitiveness, technical progress and social equity.

This author wrote that "In the medium and long term, competitiveness is a country's capacity to sustain and expand its share of international markets and

at the same time to improve its people's standard of living. This requires increased productivity and therefore the incorporation of technological advances (...) differences in international engagement are due to a large extent to structural factors which also affect the modalities and results of the national strategies and the use which each country makes of specific tools of economic and industrial policy" (Fajnzylber, 1988, pp. 12-13).

A basic element in the analytical scheme used by this author is the distinction he draws between two types of competitiveness: spurious and authentic competitiveness. Whereas spurious competitiveness may be evidenced in a situation where expenditure on technological research and development, investment and per capita income are all declining, as occurred in Latin America during the 1980s, authentic competitiveness entails the absorption of technical progress and thus requires an environment in which the above-mentioned variables are positive and are on the rise. This analytical scheme has two main components: a basic core, made up of the agrarian structure, the industrial system, consumption and investment patterns, and social equity; and the factors that determine the dynamics of that basic core, which include a country's endowment of natural resources, demographic trends, its entrepreneurial capabilities, the development of scientific and technological knowledge, foreign direct investment, the financial system and international consumption patterns (Fajnzylber, 1989b).

The interaction of all these elements can generate a virtuous circle of a cumulative nature which

carries the system towards a dynamic of growth, competitiveness and social equity involving increasing absorption of technical progress, as has occurred in Europe, Japan and the Nordic countries. When this interaction is not complete, certain problems will arise, as they have in connection with competitiveness in the United States or with regard to social equity in South-East Asia; but when the synergy breaks down almost entirely, a vicious circle is set up which prevents not only the achievement of this set of objectives as a group but also the attainment of any one of these objectives individually. This is the situation in Latin America, whose striking heterogeneity and disjointed production structure are proof that its achievements in this respect have been incomplete and have occurred only in very isolated cases. The result has been Fajnzylber's famous "empty box" or, in other words, the fact that not a single Latin American country has thus far managed to combine growth with social equity.

The comparisons made by Fajnzylber (1989a and 1989b) on the basis of per capita GDP growth rates and trends in income concentration indexes over the past 25 years indicate that, while countries such as Sri Lanka, Indonesia, Egypt and Thailand –not to mention the economies of China, the Republic of Korea, Hong Kong, Israel or Spain– have carried forward their development by combining growth and social equity, none of the Latin American countries has succeeded in doing so.

If other types of comparisons are added to this form of analysis (e.g., the metal products and machinery and chemical industries' share³ of the value added by the manufacturing sector, industrial export coefficients or productivity indexes), the extent to which Latin America lags behind stands out even more clearly. What are the reasons for such a poor production performance according to contemporary ECLAC thought?

The main cause lies in the import-substituting industrialization process pursued by the region from the 1940s onwards, which was primarily based on the utilization of natural resources and indiscriminate protection. This type of protection was branded as "frivolous" by Fajnzylber, in contraposition to the

type provided for their producers by such economies as those of Japan, the Republic of Korea or Taiwan, which he termed "learning-oriented" because it provided for technology transfer and the creation of a sound production apparatus with a sizeable national component.

This view is borne out by comparisons based on the shares accounted for by large locally-owned private enterprises, which as of the mid-1980s amounted to a mere 6% in Brazil and 3% in Mexico, the region's two largest countries. In contrast, the corresponding figures for the Republic of Korea and Taiwan were 96% and 28%, respectively (Fajnzylber, 1989a). The main difference lies, of course, in the types of industrial, trade and technological policies that were applied in these countries and in the interaction among the various productive and social agents in pursuit of a common objective –something which is non-existent in Latin America.

The outcome of all this for the region was a very tenuous entrepreneurial spirit which did little or nothing to spur forward a search for product or process innovations that would boost competitiveness, because thanks to their captive markets and subsidies, national producers had no need to do this. When these flaws in the industrial development style were compounded by the effects of the external debt crisis and the orthodox adjustment policies that followed in its wake during the 1980s, the result was, at best, the stagnation of production, while in other cases actual decreases were recorded due to steep downturns in investment, public expenditure, real wages and GDP. This led to a sharp increase in poverty and extreme poverty (affecting over 40% of the population) and caused this period to be termed "the lost decade" in terms of development.

The solution for this situation that has been proposed by ECLAC is to undertake a comprehensive realignment of production, with emphasis on the manufacturing sector and, in particular, those branches of activity capable of absorbing technical progress and disseminating it to the rest of the economy. The point of departure for this proposal is the belief that during a stage such as the present one, in which sweeping changes in all spheres of life are being driven forward by an unceasing technological revolution, countries will not be able to compete unless they have an efficient production apparatus and can offer quality products and services, which cannot be attained without assigning high priority to expendi-

³ "The paramount vehicles of technical progress –the chemicals and capital goods sectors– are virtually absent in Brazil and Mexico whereas they account for 73% in the Republic of Korea and 24% in Taiwan" (Fajnzylber, 1989a).

ture on research and development and, more generally, to technological, industrial and trade policy.

Other factors which have a direct bearing on structural competitiveness and therefore warrant special attention include the educational system, ongoing occupational training, corporate management, the financial system, and the establishment of an institutional framework that will back up the changes in the region's production patterns and facilitate the interconnection of all the agents involved in order to prevent the dispersion of effort that is so common in the

region. These tasks should be shared between a modern, enterprising and innovative private sector and a strong, efficient public sector which is fully aware that, as well as having a crucial role to play in ensuring a stable macroeconomic environment, it must serve as the central liaison among the various agents. Moreover, the actions of these agents need to be in keeping with an economic policy whose different facets are all directed towards the ultimate objective of economic growth coupled with higher levels of competitiveness and social equity.

IV

Some final thoughts

In general terms, from the early days of ECLAC up to the present time, there would appear to be a certain continuity in its thinking about the role of technical progress in economic development, although each stage exhibits specific features and nuances that differentiate it.

During what we have called the traditional period, for example, the main concern was over the concentration of the fruits of technical progress, but the policies that carried the industrialization process forward emphasized growth over distribution, because it was felt that wealth first of all had to be accumulated; once that had been accomplished, it could be distributed more equitably.

As we all know, these policies led to a heavy concentration of income which, after the "lost decade" had further intensified it, left almost half of the Latin American population in a socially marginal position. The modern ECLAC school of thought therefore sees social equity as being consubstantial with competitiveness and postulates that the achievement of both these objectives hinges upon technical progress.

The other issue which provides a somewhat contradictory link between the two stages of ECLAC thinking is the solution proposed by the contemporary school of thought for the competitiveness/social equity equation. As noted earlier, in principle this formula is based on support for the modern manufacturing sector, since this is the vehicle for technical progress, which can then be passed on to the rest of the production apparatus. However, as noted by Pinto

(1989), the marked structural heterogeneity of this apparatus may jeopardize such a strategy and cause it to fail, as in the past when, far from lessening existing inequalities, support for the modern sector tended to magnify them.

This is why Pinto recommends that, in addition to promoting increased productivity in technologically sophisticated sectors in order to improve the region's international trade position, support also be provided for the other sectors. These sectors' technological requirements may be much lower, but the results—in terms of greater social and productive homogeneity—will probably be much more effective than those of the modern sector alone.

Finally, a policy of this sort obviously requires a significant level of determined, soundly-based State participation in order to balance the workings of the market forces and ensure effective results within a fairly short time-frame in crucial areas such as education and the scientific/technological system, as well as to furnish an institutional framework for the concerted efforts of the various productive and social agents involved.

What Aníbal Pinto said regarding the false distinction between the neoliberal State of the 1980s and the State as it was in earlier times is very enlightening in this respect: "What does appear to be both abundantly clear and quite disturbing is that something akin to a phobia against the State has taken the place of the idolatry of the State which is said to have existed in the past. It would appear to be vitally important to lay this false distinction to rest so that

measures and instruments may be delineated that will be capable of vanquishing the forces that foster the 'concentration of technical progress and its fruits', as ECLAC puts it" (Pinto, 1989).

Overcoming these and other false distinctions or dilemmas arising out of the conditions discussed here is a *sine qua non* for giving not only Mexico but all of Latin America a decent chance of fulfilling the

imperative need to forge a position for itself in today's globalized world economy and deal successfully with the urgent issues of competitiveness and extreme poverty, which are perhaps the greatest challenges that must be met by the region as this millennium draws to a close.

(Original: Spanish)

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