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THE "TRANSFER OF TECHNOLOGY"

BY

SAMIR AMIN

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In recent years the problems of "transfer of technology" have been on the agenda both in social research programmes and in international negotiations. The issue is how to accelerate and reduce the cost of the transfer of technology from the developed to the under-developed countries. It is thus implicitly assumed that this transfer is desirable and even necessary. But it seems to me that the question has not been properly stated.

1. It is not possible to analyse scientifically the problems of technology and its possible transfer without first studying the history of the relations between science, technology, production and society.

This history is in fact that of the recent - weakening of the link between technology and production. For thousands of years, in all societies, technical inventions were made by the direct producers. This was so not only until the industrial revolution, but even beyond it, probably up to the end of last century. The first machines - the weaving loom, for example - were invented and improved by craftsmen who triggered off the industrial revolution. Subsequently, throughout the last century, inventions and improvements were largely the result of collaboration between practitioners: heads of firms, engineers (often relatives of the former) and skilled

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<sup>2</sup> First published in French in L'imperialisme et le développement inégal, Mimit, 1976, Chap. 4.

workers. In the 19th century, it was still exceptional for technical invention to be done by specialised research departments separate from production. At the same time, technical invention was not yet directly and explicitly linked to fundamental scientific research, which seemed to proceed without any concern with practice.

There are many reasons for this. Firstly, the real relative simplicity of the production processes may suggest that these were still within anyone's reach. But this is misleading. The reason why the producers were still creators is ultimately because they controlled the production processes. The division of labour was still limited, it operated between trades but not very much within trades. Nowadays it is really only the peasants who remain skilled producers without job specialization. Because there is no division of labour within that trade, the producer can contemplate his product in relation to its entire use-value and, consequently, use creatively his capacity to observe and to reason.

The reason why technology is still largely autonomous with respect to the progress of fundamental science is probably because the techniques in these new branches of activity, i.e. industries, are mainly based on mechanics, which can be grasped by empirical experience without any thorough direct knowledge of its mathematical foundations. Again, in agriculture, observation and experience without knowledge of the scientific secrets of biology have made possible immense progress for thousands of years.

Thus pure science is separated from production practice. It develops autonomously. This does not mean that science is independent of society, of course, but it is related to the ideological superstructure rather than serving the production base. The dominant branch of science is mathematics, the most advanced

formalization of logic, whereas the natural sciences remain at best descriptive. Mathematics go hand in hand with philosophy and attempt to answer the questions raised by it (the infinitely small, for example). Of course, astronomy, which inspires mathematical research, is useful both to agriculture and to navigation; but it is even more necessary to the ideological constructs of cosmogony and religion.

These two sets of relationships have been upset in our country. Technology, having become an object of specialization of labour, has been separated from production. On the other hand, pure science has passed into the direct service of technology.

This is not only because progress in the natural sciences - physical and biological - has made prodigious strides since it were launched in the 19th century; nor even because mathematics has been systematically made to serve science. It is also because technology is now derived explicitly from science. The second scientific and technical revolution shifted the centre of gravity from mechanical engineering to electronics (this basis of automation supplanting mechanization) and applied biology. Mere empiricism is no longer sufficient to ensure the progress of production techniques.

Does this mean that the growing complexity of technology is the reason for its divorce from production? Apparently it is and it is this appearance which suggests that the progress of the productive forces, derived from that of technology, is neutral with respect to the social relations of production. In fact, this separation stems primarily from the internal division of labour among trades, the fragmentation of jobs and the consequent vast downgrading<sup>\*</sup> of labour.

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\* i.e. elimination of the skill element or craftsmanship.

While fifty years ago it was still confined to certain jobs in the mechanized manufacturing industry, this downgraded labour has now invaded the tertiary sector. Hence the worker has lost even partial control of the production process. Moreover the fragmentation of jobs does not only involve only the performance of the job; it has spread to the giving of orders and even to design and policy-making, and to technological research itself. Control of invention is increasingly slipping from the grasp of the scientists themselves.

This evolution is the result of capital's domination of society. We need to rid ourselves of a whole set of myths about the organization of work, efficiency, etc. It has been demonstrated over and over again, with specific examples, that the main purpose of the organization of work as it is now - featuring the separation between the work of design and execution - was to reproduce the relations of domination which determine the relations of exploitation. Efficiency is always in relation to a system: here, the extortion of surplus value.

Thus, while the division of labour by trade or craft necessarily accompanies the commodity form of the product, the fragmentation of jobs within the trade determines the latter's capitalist commodity form. Since technology itself has recently become a commodity - a capitalist commodity - this has been followed by the separation of technological research from production, and by a certain form of division of labour within technological research itself. Technology is an object of buying and selling, in connexion with the buying and selling, of the specialized capital equipment which is its material underpinning and in which it is incorporated. Now, today the monopolies control this technology; they can refuse to sell it, lay down their conditions and, in this way, appropriate some of the surplus value generated by the output obtained by means of this equipment.

2. If, then, the direct appropriation of the means of production was until recently the necessary medium of control by capital, this is no longer the case, at least not at all levels of the production process: it is sufficient to control its strategic focal points to get hold of most of the surplus value generated in the process as a whole.

It is in this context that the problems of the transfer of technology must be placed. Transfer of what? Transfer to whom? If it is a question of modern technologies, we will have to bear in mind that these are capitalist technologies, and that they are, moreover, controlled by the monopolies. Hence we will be transferring, at the same time as the technology, the underlying capitalist relations of production. Moreover, by this transfer we will not be escaping the domination of imperialist capitalism. On the contrary, we will be extending the scope of its action by integrating the periphery more firmly into the imperialist system. The work done in the last few years on the cost of this transfer is evidence of this. The cost turned out to be exorbitant: for example, the Andean group of States has been paying prices for this kind of equipment, and the relevant patents, which are many times their real cost of production. By this means, the surplus value generated at the periphery by "modernization" is mainly transferred to the monopolies. Hence the countries of the periphery cannot hope to be able to take over and ensure for themselves ultimately their own autonomous dynamism. This could still be done in the 19th century: Germany, Japan and others began by importing British capital equipment and quickly succeeded in reproducing the technologies incorporated

in this equipment. But, in this field as in others, imperialism involves a qualitative break. So we cannot really speak of "transfer" but only of the geographical shift of the place where the technology operates.

It is not a question of reducing the cost of this transfer: even if the cost was zero, the technologies of the imperialist centres would not be able to solve the problems of under-development at the periphery. For this technology is excessively costly, not only because of its capital-intensive nature, but because of the wasteful consumption patterns it brings with it, the excessive exploitation of natural resources that it implies, etc. In other words, this technology presupposes imperialism, i.e. the excessive exploitation of labour in the periphery. Thus it can only reproduce the relations of unequal development within the imperialist system.

If this transfer is not desirable, can we envisage another type, that of less advanced technologies? The debate about "intermediate technologies" suggests this course. But we know that, since history is not a linear advance, the present situation of the underdeveloped countries, shaped by imperialist domination, is not the same as that experienced by the developed centres of today at a previous stage of their evolution. So it is no solution to borrow the technologies of 19th-century Europe, apart from the fact that they too brought with them capitalist relations of production.

3. There is no choice: we have to invent a new technology which is able both to establish socialist relations of production and to develop the productive forces even beyond the level reached by capitalism.

This problem is not specific to the under-developed societies; it is a problem of the world system as a whole. We have mentioned the mass downgrading of labour involved in the fragmentation of jobs. Automation does not involve a higher average level of skill than mechanization; on the contrary. As automation eliminates the simplest manual jobs in some sectors, the capitalist system develops new parasitic sectors of activity - usually in connexion with the "selling costs" of monopolistic competition - which are in their turn affected by gradual downgrading because of the fragmentation of tasks. Overall, the whole of social labour is devalued. Thus concrete and complex labour, creator of use-values, gradually gives way to abstract and simple labour, a uniform expending of energy, which makes still more realistic the analysis of value in *Das Kapital*.

For this reason a specific contradiction is developing in our time, which is evidence that the capitalist mode of production is really becoming an obstacle to the development of the productive forces. To do his job, the 19th-century worker needed to be able to read and to count. The downgraded worker of our day has a better output if he is stupid or has an obsession for repetitive gestures. But at the same time the number of years of post-primary education has more than doubled. Not only is education no longer useful, but it is becoming a motive for resistance - passive for the moment - to the work imposed by capitalism. Yet it also reveals what it could become: an overall enrichment of the creative capacities of society. The progress of the productive forces now requires the gradual abolition of the division of labour which determined their previous development. Society is ripe for communism.

Where can this superseding of the technologies of advanced capitalism find a way to penetrate? A linear mechanistic view of history implies that this revolutionary breakthrough can only come from the



most advanced capitalist societies. But there are powerful obstacles to this breakthrough. The societies of the capitalist centres are sufficiently rich, the interlocking of interests sufficiently complex, the feeling for privileges which imperialism stimulates sufficiently shared, for these societies to be able to wait for some decades yet in a kind of slow decomposition.

On the other hand, the societies of the dominated periphery have no longer the time to wait. With every passing year, the material conditions of their vast masses becomes more intolerable, while the palliatives of capitalist integration become increasingly paltry.

4. The correct solution of the problems of transition from capitalist under-development to the blossoming of the classless society involves the development of creativity with respect to socialist technologies.

It is not difficult to list the obstacles to this flowering of technological creativity. The main obstacle is the gradual deterioration of the scientific and technical abilities of the societies dominated by imperialism. This assertion may seem surprising in view of the quantitative progress of school education in the Third World. But it is a fact that this progress remains limited and ambiguous: quantitatively limited, still lagging behind the progress of the centre; ambiguous because of the alienation and "dispossession of the world" which are its necessary concomitant in the forms in which it operates.

Let us take an example. The history of the "modernization" of agriculture in the Third World is that of the dispossession of the

peasants. Highly skilled producers in all times and places, the peasants of the three continents have been capable, for thousands of years, of adopting foreign products and techniques. True, these processes of adoption by empirical observation of results and of exercise of the talent for reasoning and conducting experiments have always been limited by the requirements of domination by the exploiting classes; but they have nevertheless been real. But what is happening in our period of imperialist domination? The new techniques are developed in isolation, in the laboratories and experimental farms of the monopolies and governments. Then, when these techniques prove useful, i.e. likely to extract surplus value from the peasants' labour, they are spread to the peasants, i.e. imposed by the government authorities. Dispossessed of the world, alienated the peasant resists. He is accused of being a "reactionary traditionalist". He is sent teams of sociologists and, more often, policemen. He finally gives in and allows himself to be exploited, until such time as he rebels - unless he simply flees to the towns. Yet surely we could imagine a different organization of agronomic research, less centralized, established among the producers themselves, which would enable the technical revolution to go hand in hand with the revolution of relations of production and that of culture and ideology?

These real obstacles must be countered by the powerful potential forces operating in the opposite direction. First, a less rigorous division of labour. There are still many peasants and craftsmen; and they are still much less "downgraded" than the workers of the developed world. Of course, certain specific forms of division of labour (division between ages, the sexes, sometimes castes, etc.) are still a hindrance. But the difficulty here is related to two spheres: that of the relations of production and that of the ideological superstructures, rather

than to the sphere of technical know-how, which can be acquired. Insofar as the techniques are "ideologized" and integrated into the system of religious imagery, this is a different form of dispossession of the world, of alienation. But this is religious alienation, reflecting the inadequate mastery of nature, and not commodity alienation which is closely related to the fragmentation of jobs.

In order to conduct simultaneously the three revolutions needed: that of the relations of production which determines the others, that of techniques which enables the first one to develop, and that of ideology and culture which ensures that it develops in the correct direction, it is essential to have confidence in the masses. Political, economic and social democracy at the grass roots, and real self-management, are the necessary conditions for this re-appropriation of the world. To control the productive process is also to keep for one's community the gains obtained by technical progress. Otherwise "participation" becomes a farce and, as in Yugoslavia, the worker is indifferent to his "rights". Here science must come to the aid of the producers. Making science serve the producers means to effect radical change in education (its form and its content), and to link theory to practice at all levels. It also means guiding the productive apparatus in a direction which will enable it specifically to meet the problems posed by the improvement of productivity and of the level of living of the vast majority - for example, making industry serve agriculture in a first long phase of transition.

Immense progress can already be made at this stage. That is how the Chinese commune managed to feed, keep healthy, clothe and house decently hundreds of millions of people while elsewhere the "green revolution" and western-type industry is avoiding neither hunger, nor shantytowns, nor epidemics. That is how Viet-nam succeeded, in wartime, by artisan methods, in meeting adequately 60% of its non-food consumption needs and 40% of its capital equipment needs.

Naturally, we must see beyond these advances. But their extension to millions of producers, and the effective participation of these producers in the improvement of their lot, are the best guarantee of a subsequent creative ability which can then progress very quickly. At that stage, borrowing (with reservations and criticism) may find a place in the speeding-up of history. Borrowing a technology from the capitalist world is never "innocent", because this technology underpins class relations or production. But it is an acceptable compromise when the forces of socialism dominate the situation and are aware of the contradiction between this borrowing and the general policy of socialist development. On the other hand, in other circumstances (for example those of the countries dominated by imperialism, or those countries which, like the Soviet Union, believed in the "neutrality" of technology) borrowing becomes unacceptable because it objectively strengthens the powers of domination of the bourgeoisie and the techno-bureaucrats.

It is understandable that backward countries which are freeing themselves from capitalism and imperialism are forced to adopt, at least in some sectors, the modern techniques that are the only ones at present known, while launching a specific criticism of that technology. China imports machinery. But the "modern" machinery is taken to pieces in front of all the workers, who are thus invited not only to learn in a practical way how it functions, but also to re-assemble the machinery in their own way and to organize their work as they like. Japan and Russia also imported machines, and also dismantled them, but only for the benefit of skilled engineers who were required to reproduce the machinery and if possible to improve it according to their own logic. What China is doing is different: it has set itself the goal of accomplishing the industrial revolution, but an industrial revolution different from that of the West, an industrial revolution which opens the way to the development of techniques which carry with them socialist relations of production.