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Science and Technology: for or against the people

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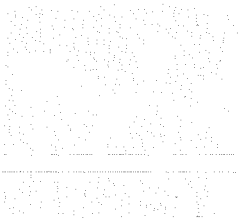

樹欲靜而風不止

Shu yü chin er feng pu tsu

Tree want quiet while wind not stop

wind will not cease even if trees want to rest

Mao Tse-tung, 1966

1. Introduction

In April 1974, at the conclusion of the Sixth Session on Raw Materials, the United National General Assembly (unanimously but without vote) adopted a declaration on the establishment of a new international economic order. This testified to growing pressure for changing the balance of forces in the world. It also reflected the fact that the struggle for modifying the balance of power between Third World countries vis-a-vis First and Second World countries had entered into a new stage. First and Second World countries, pressed by their ruling classes and productive structures, seek to consolidate their hegemoney albeit with modified terms, and to secure the continued expansion and protection of their economies and welfare, supported by the maintenance of asymmetric relations with the Third World countries.

The leaders of the Third World countries, affected by growing pressure of the masses, want to secure national self-reliant development and are at the same time urged to secure a major share in the benefits of resource mobilisation for the old and/or new ruling classes. They therefore seek to modify the terms of these relationships. The First and Second World countries attempt to secure continued subordination and incorporation of Third World countries in a world-wide 'free market' system; at the same time, Third World countries strive to extract themselves from their dependent status. This foments an accumulative movement of contradictions. As the 'Three Worlds' grow together, these contradictions have tended to become deeper.

The search for unity through incorporation and subordination generates a search for independence (experienced as division by the former colonisers); in turn, the search for independence engenders growing pressure for new forms of unity (incorporation into the established framework). On the United Nations forum, the speeches by the representatives of the 'Three Worlds,' which each seek to maintain or modify the balance of power, testify to deep-rooted antagonistic interests. At the same time a strong appeal is made to a common interest, that of mankind. First and Second World representatives tend to stress the dangers of confrontation resulting from the struggle for redistribution of wealth and power, and consider international order and peaceful co-existence as prerequisites (e.g. the speech by the U.S.A. Secretary of State at the Sixth Special Session). The opposite view (e.g. the speeches by the Algerian and Tanzanian representatives at the same session) predicates development and peace upon the establishment of 'A new economic order' which does away with the 'remaining vestiges of alien domination, colonialism and neo-colonialism'; insists that 'there can be no peaceful co-existence between poverty and affluence, development and underdevelopment,' as long as a 'minority of highly developed countries determines at will the allocation of the world's resources,' and protests against a process which 'continually impoverishes the poor and enriches the rich.' The view expressed by the Secretary General of the United Nations, that equity and peace require fundamental changes in the relations between countries, stands in sharp contrast to the opinion of the representative of a major power who, in December 1974, spoke of the 'tyranny of the new majority.'

There is a tendency to reduce the problem of polarised development to that of unequal exchange relations rather than to view these relations as the manifestation of the expanded reproduction of existing productive relations (the combination of internal production relations with production, political and ideological relations on a world scale, which blocks the development of productive forces in the third world countries). Uneven polarised development is acutely expressed in the way in which control is exercised over science and technology. This paper is an attempt to explore some of the interdependencies between science/technology and intra- and inter-society processes.

2. The interdependent development of productive forces, productive relations and ideology

It is generally recognised that the development of science and its application in technology have played a major role in the prodigious development of productive forces during past years, and that it is not an exaggeration to speak of a scientific and technological revolution. The impressive rise in the material standard of living in the rich countries during the last decades is the direct result of the fact that, unlike in the past, science has become a direct part of productive forces and capital. However, the conviction that the development of productive forces could somehow solve the world's problems is now seriously questioned. It is now realised that uncontrolled growth has brought about multiple hazards which, if they do not immediately threaten man's survival, at least compel mankind to look for ways to control the newly unleashed forces so that they can be of benefit. The relentless growth of the productive forces cannot be attributed to the absence of control but, on the contrary, to the predominance of particular forms of control which instrumentalise science and technology for the purpose of maximizing accumulation, growth and profitability. 1) The development of science and technology has always been bound up with the relative advantages which successive dominant classes were able to acquire by using and promoting it.

Simply because of its universality, the class nature of science and technology is so much taken for granted that pointing to it may cause surprise, if not indignation. 2) This reaction is not unusual if it is assumed that science and technology are 'something' in their own right and, therefore, should not be 'mixed up' with economic and political life. This reaction suggests to what extent the view that science and technology are autonomous has become internalised. This internalisation may be considered as only one dimension of the general process of people's adaptation to the requirements of the dominant mode of production which needs to portray itself and its consequences as basically beneficial, inevitable and rational. In particular, it is suggested that its productive relations (not only property relations and the structure of productive organisation, but also the organisation of society and the State in as far as these support dominant productive relations) are identical with, and a natural extension of the development of productive forces. As a consequence, people are expected to perceive their subordination to the requirements of the productive apparatus as natural, that is to say that they cease to perceive it as subordination. 3)

One of the consequences of the adaptation of productive relations to the development of productive forces is that the possible need for transforming these relations is excluded. This inevitably diverts attention from change as a historical process and tends to shroud any perception of historical change, thereby reducing history to what is judged valid, and, therefore, legitimate, in the prevailing dominant values. [4] Another closely connected consequence is that a unilinear vision of development is propagated. In this view it is proposed that all countries and peoples wishing to 'achieve development' must pass through the same process, follow the same procedures and apply the same techniques as have been implemented in the industrially advanced countries. [5] Thus, development is equated with what the dominant classes in the most advanced countries judge as desirable.

In this way the original function of science as a methodological and experimental approach to concrete problems which, in a particular context, require specific solutions, is substituted for the mechanical application of imported formulas which have not been devised to respond to national or local problems. Thus, science loses its original function as the search from within for solutions to be adapted to varying problems. Instead of being an instrument to identify real issues and find alternative approaches, leading to new 'projets de civilisation' implying a more equal sharing of well-being and welfare, it serves to promote private rationality at the expense of global rationality. 6)

3. Some implications of monopolisation and concentration

It is generally recognised that the accelerated use of science in the making of new technology is intimately connected with the concentration and centralisation of capital in increasingly large corporations. These corporations must rely on the continuous development of new products, as well as on the introduction of new (e.g. raw material substitution) production techniques, to ensure future growth and profitability. In as far as profitability is eroded by competition or diminished demand, new techniques and new products must be organised as old ones become and are made obsolete. 7) Such a process may be described as planned obsolescence. Thus, obsolescence producing innovation crucially relies on the expansion of applied science and new technology.

In the industrially advanced countries, the State, as a rule, fulfils a vital role in the expansion of corporations, both by drawing upon and supplying the corporations with scientific and technological inputs. The objectives of the corporations tend to become equated with the requirements of national interest and progress. 8) This unification of public commitment and private interests plays a a major role in the bias of science and technology towards military uses. 9) The recent profitable transfers of nuclear energy for peaceful purposes are only an offshoot of this, and the consequences may not necessarily be peaceful. 10)

Monopolisation of control over the production of science and technology is an essential condition for corporations to minimize operational risks and maximize profitability. It is, therefore, characteristic of multinational corporations to treat host countries as sources of production and profit, while trying to keep research and product development (as well as management policy and output decisions) centralised elsewhere, usually at their headquarters. 11) As a result, while the total stock of science and technology has increased enormously in recent years, it has become highly concentrated in the rich countries. Its growth in volume has been virtually inversely proportional to its relevance for the dependent countries. 12) Even the minimal amount of research carried out in these countries is largely devoted to the problems and methods determined outside rather than by internal requirements. Since multinational corporations, as indicated earlier in this paper, naturally tend to concentrate on the production of goods for the high income groups as this is most profitable, it follows that there has been no incentive for them to develop and disseminate production techniques which can be used by the great masses of people without large and costly inputs of capital. 13)

It has been observed that colonial domination during the past centuries has frequently led to the destruction of existing forms of production. In a number of cases these were, comparatively speaking, characterised by relatively superior forms of technology, 14) while the benefits of the imported technologies turned out to be beneficial only to the dominant classes, both local and foreign. The effect of the development of productive forces was decidedly shaped by the nature of evolving productive relations. The historical effects of dependency have gradually magnified to such a point that at present there are good grounds to posit that the underdevelopment and stagnation of an indigenous science and technology in the dependent countries is rooted in the indiscriminate importation of packages of capital-technology-management and restrictions on the use of transferred knowledge and practices, due to monopolistic conditions under which industrial technology is introduced.

Thus, a definite connection may be observed between the relative decline of local invention and innovation and the growing concentration of research and development in the hands of the multinational corporations. 15) The idea that, in a way, there exists a kind of supermarket where countries can freely shop to select the type of technology appropriate to their needs must be discarded. It has been recognised that the market for proprietary technology is highly imperfect and oligopolistic, 16) and that it entails multiple heavy costs for the countries concerned. If the prevailing trend continues, according to UNCTAD calculations, these costs will increase 20% per year, 17) and will become a major factor in further aggravating the balance of payment position of many countries.

Apart from the direct costs 18) of transferring the commodity of technology in its various forms (e.g., the right to use patents, licences, process know-how, trademarks, and technical services, which studies have shown are usually more profitable to sell than capital investment itself), there are a wide range of other costs.

Among these should be counted the so-called indirect costs (e.g. over-pricing imports of intermediate products and equipment, over-pricing imported technology related to the former, profits on capitalisation of know-how and a portion of repatriated profits of subsidiaries or joint ventures) which may be much more substantial than the direct costs. A third type of cost which is even more difficult to visualise or to calculate, are the real costs or foregone benefits, of the transfer of technology. These result from such limitations as are imposed by transfer arrangements, the transfer of unnecessary or inappropriate technology and the longterm influence of imported technology which deflects national policy from a sound development of national technological capabilities. Such limitations are quite varied and may involve restrictions on resource use, competition, exports, taxes, local innovation, production, marketing, management as well as any other aspects of national and local productive and related activity.

A major restriction to the free use of technology results from monopolistic control by foreign companies in dependent countries over patents of which they own nearly 90%. Rather than encouraging production, these patents are taken out to discourage it. The functions of intellectual property laws do not serve to protect against abuse but serve to promote the owners' interests. 19) Apart from the damaging effects of the transfer of inappropriate technology, the cost of the 'non-transfer' of technology also requires attention. That is, the transfer of technology for the sole or principal purpose of making use of the resource-endowment in a particular country. Among these may be included all those investments which have created in many countries an extractive enclave economy. These have produced mineral and agricultural materials which have served as inputs for the metropolitan economies, with pervasive disarticulating effects on balanced autonomous development. 20)

The purpose of locating the transfer of technology in historical context is not to moralise the issue but to make it intelligible. It may be relatively easy for countries, once the insight has matured, to conclude that it is a question of national survival to take appropriate measures to secure autonomous development. 21) Effective enforcement of such measures depends, however, on a highly complex set of interdependent forces. Among these are the country's economic resources, its international bargaining power, the degree of development of internal pressures for more even development, their effects on the internal political scene, the evolution towards effective solidarity at the regional and continental level, 22) and among producers of particular products, as well as developments between the dominant countries.

4. Some implications of scientific and technological dependence

If technological independence is posited as a necessary condition for balanced national development, this in no way suggests that national autarky is desirable or feasible. It would, however, imply that people acquire substantially increased control over their own society and future. This presupposes the establishment of an effective capacity to adapt external pressures and interests to internal national requirements rather than the reverse.

In this sense, technological independence is inseparable from economic, political, social and cultural independence, all being interdependent. One way in which cultural dependence is revealed is in the uncritical acceptance of the world as it is structured and functions, and in taking the position that answers to the problems confronting the dependent countries can only be found by taking each issue separately.

Technological dependency is not only a problem for people in dependent countries, who need - as a condition for their own emancipation - to develop an image of autonomous development 23) and to realise what action this requires from them, but it should be a basic concern for people in dominant countries. They are confronted with the effects of this dependence by the production and consumption patterns in their own societies and, in fact, substantially benefit from this technological dependence which is only one dimension of the structure of uneven relations between rich and poor countries. If western technology, and its implied economic and social patterns are judged to be superior, and, therefore, western culture is held to be superior, 24) it is posited that such a view is based on the interests and valuations of the dominant class(es). As indicated earlier, they tend to equate economic growth and their consumption patterns, however uneven and discriminating their effects may be on the mass of the population, with national interest and progress.

One consequence of this position has been that training in science and technology has been entirely patterned on western approaches and preferences, while virtually no attention has been paid to the development of indigenous science and technology as part of the search for national and local attempts to answer their problems. Another consequence has been the massive exodus of scientists and professionals to the rich countries where they enjoy higher incomes, more stability and can work in accordance with the professional and cultural values and standards they adopted during their studies which often clash with those in their home environment. In as far as their home countries incur high costs in training professionals and scientists, such an exodus, in effect, constitutes a substantial contribution by poor countries to the functioning of rich countries. To reverse this migratory movement, it is not enough to introduce more adapted and relevant forms of training. Nor can such an exodus only be ascribed to the incorporation into foreign values and life styles. What perhaps plays a more significant role is the overall situation in each country, whether scientists and professionals believe that their own societies have a future and whether conditions permit and stimulate them to serve their community.

The development of such a perspective cannot be dissociated from whether or not there is a movement of society as a whole which encourages scientists and professionals to identify and associate with the lot of the majority of the population. The growth of such a process is, as a rule, closely connected with the growth of a national consciousness which is linked with a wider movement towards a national 'prise de conscience' and defense of national interests, in response to the effects of de-nationalisation of resources.

If there is increasing concern that cultural values are being eroded by the rapid transformation in many countries, and if the preservation of such values is considered vital to people's wellbeing, 25) it needs to be emphasised that culture cannot be understood as a frozen residue carried over from the past, but that culture is always the living expression in people of the contradictions between a dominant and dependent mode of production within a particular social formation (society). If solidarity and sharing, as basic values which are desperately needed in all societies, are increasingly emphasised, to insist on such values without insisting on the need for transformation of the dominant mode of production (rooted in the institutionalisation and promotion of self-interest) leads to moralisation which may confuse the nature of the problem. Such moralisation is likely to reduce the problem to the improvement of individual attitudes and morality.

5. Technological growth: controlled transformation or inevitable compulsion

It, thereby, implicitly bypasses the need for transforming the structure of social relations, as well as the institutions which sustain this structure and in which it is expressed. As has been suggested above, science and technology have become an intrinsic part of the dominant productive forces and, so to say, carry the particular 'code' of the structure of productive relations of each society. 26)

If private property of the resources and instruments of production, and also of the new forms in which it has emerged (e.g., intellectual property such as licenses and patents), is a major factor in the non-diffusion or distorted use of science, technology and traditional forms of capital, then the transformation of this institution must be envisaged as a central task in the creation of new relations between and within societies, as well as in the creation of a new culture based on sharing, mutual exchange and affirmation. The more science becomes the driving force in today's world, the more urgent it becomes to transform the institutions and the culture of private property. It seems, indeed, that solutions to the problems of development, including those generated by the development of science and culture, cannot be found if science remains a private domain instead of becoming the patrimonium of all. 27) In other words, the scientific revolution requires a social revolution, i.e., a transformation of productive relations and of consciousness and culture, so that inequality and uneven development are replaced by equality and an even spread of benefits. 28)

The question arises whether the concentration and centralisation of science and technology, as manifest in the continuous scale enlargement of industrial enterprise, is an inevitable, inherent law of industrialisation required by the very development of productive forces or whether, far from being natural laws and inherent in technological expansion, they are in actual fact social 'laws' deriving from the dominant mode of production in which productive relations have primacy over productive forces. The answer to this question has far reaching implications. If it has to be accepted that concentration and centralisation are inherent natural laws, then the wholesale transfer of technologies from advanced industrialised countries to the dependent countries must be accepted without further question as an inevitable datum. 29) While it may be necessary to minimise or mitigate the possible side effects, the social costs will have to be faced as inevitable.

Among these costs are the previously described costs of centralising the surplus of the majority at the expense of their basic needs, so as to ensure concentrated accumulation, the non-utilisation or under-utilisation of their productive and creative potential, as well as the orientation of all training, education and services in function of such accumulation. It also implies taking for granted the build-up of a pronounced command and hierarchical structure and an excessive specialisation of labour required by such a production structure. Moreover, it assumes that uneven development between city and country, between industry and agriculture - and within these sectors - as well as the environmental damages and hazards involved in such concentration have to be accepted as given.

One way of determining if we are faced with a dilemma between possible choices, or whether there is no dilemma at all as there is only one (technological) road to industrial advance and national development, is to examine the nature of development linkages and to find out whether these are technologically determined or whether technological determinations are, in fact, institutionally and culturally defined. It has been alleged that 'all sectors of industry have their fixed recipes, in the main determined by technology, and that these recipes which prescribe the input coefficient matrix derived from the U.S. European input-output table represents a complete cookbook of modern technology which constitutes the structure of a fully developed economy and which all countries will have to follow if they wish to develop. An underdeveloped economy is then, as a consequence, defined as underdeveloped to the extent that it lacks the working part of this system. The process of development consists essentially in the installation and building of an approximation of the system embodied in the advanced countries of the United States and Western Europe, and more recently of the U.S.S.R. - with due allowance for limitations imposed by the local mix of resources and the availability to exploit them. 30)

Such a position excludes any choice or flexibility for dependent countries to pursue a path adapted to their specific needs. Any conception of variance is thus blocked by the rigid determination of technology. All that is left is to adhere to a standard industrial structure and to accept as inescapable the technological prescriptions developed in the industrially advanced countries. Such a view of the role of technology in development completely bypasses the fact that the industrial structures presently characterising the world have, in no way, been ready-made prescriptions handed over from the past to present generations. On the contrary, they are specific results of accumulative transformations of and in the political, social and economic order and, therefore, are not technologically but institutionally 31) and culturally determined. If it is accepted that the main economic parameters for the choice of techniques are the requirements of capital accumulation, the structure and pattern of demand of intermediate and final consumer goods, the real wage rates, the availability and price of investment resources and of raw materials, 32) it must be admitted that these are not simply and purely 'economic' magnitudes. Rather, they are entirely shaped by the particular forms of social organisation, which are the changing outcome of specific historical movements.

Thus the market and distribution mechanisms characterising the various types of social organisation are then principal determinants of the choice of technology which, therefore, cannot be explained in itself. These parameters are thus shaped by particular social forces which bring about specific dominant modes of production, and their transformation. 33)

The assumption that technological choices are strictly pre-determined conceals, therefore, another implicit premise: the invariance and identity of demand structure and patterns in 'developing' countries with those in 'developed' countries. The fact that similar patterns of 'effective demand' evolve in dependent countries does not in any way suggest fixed regularities in human needs. What it does indicate is that the higher income groups actually acquire a pattern of consumption which, in as far as it is conspicuous and pertains to durable consumer goods which are individually accumulated, is identical with that in the industrially advanced countries. 34)

It is obvious that these patterns of effective demand do not respond to any 'innate' or 'natural' needs, but that they are moulded by the desire to imitate the dominant values and life style of the technologically advanced countries. In reality, these patterns are shaped by the productive structure which multiplies the want for a continuously more diversified package of individually acquired goods in order to maximise profits. Rather than assuming consumer sovereignty, there are good grounds to assume producer sovereignty. Under monopolistic conditions, this is founded on instilling in consumers a sense of permanent dissatisfaction. This motive of advertising, in this context, is to convince consumers that there can be no happiness (i.e. the good life), and that they fail to 'progress' and keep pace, unless they satisfy these artificially induced needs. 35) This follows from the inherent dynamics of a polarised, monopolistic market and class society in which 'personal happiness' is equated with individual accumulation and wealth.

There are usually various alternatives open in regard to the input mix for manufacturing products catering to final demand. Thus construction, infra-structure, transportation, automobiles, furniture, clothing and food can be produced with a great variety of input mixes, some of which will require much more capital and technology than others. 36) As has been stressed above, increasingly diversified product development and differentiation, the preference for capital intensive techniques as well as a limited group of high-income clients representing 'effective' demand, both require and rely on a monopolistic market and their mutual reinforcement. As a consequence, what is more profitable is produced, and what is more expensive (fashionable, modern, prestigious) will be sought.

Rather than considering economies of scale as inherent in technology, there is good reason to assume that in many ways they are determined by the profitability which firms pursue. These require particular combinations of technological inputs, given the costs of the development of new technology and products, as well as those of marketing, and the objective of transferring these profits abroad for accumulation or other profitable purposes. 37)

It has been generally taken for granted that in the production of intermediate goods such as steel, cement and chemicals (e.g. fertiliser) there is a relatively high degree of rigidity as to the scale of production and the use of technology, and that this requires a high degree of centralisation and concentration. There is also, however, evidence that what is rational and efficient in this field is not, in the first instance, determined by technological compulsion but by the constraints imposed by the nature and size of the market and the search for minimising costs and maximising profitability. 38) The possibility for a new decentralised small and middle-sized pattern of producing basic inputs and capital goods may be favoured by such factors as the weakness of transportation facilities and the dispersion of mineral and power resources. 39) More decisive, however, appears to be the political and economic organisation which makes it possible to bypass the technological compulsions imposed by the dominant mode of production. 40)

It may well be that governments concentrate capital and technology in basic industries on the premise that these investments will have strong linkage effects, and that the growth of the national economy will in the long run decisively depend on capital formation generated by these investments. While such a view may be valid in abstracto, in practice such investments tend to adapt themselves to the requirements of capital intermediate and consumption goods responding to the demand pattern of the higher income minority. As a result, although such investments may produce rapid growth, their linkage effects are minimal or even negative. 41) Thus, what 'should' be produced from the point of view of national development is not produced, while what is produced 'should' not be produced. This brings us back to the questions of which investment decisions are taken, by whom, for what reasons and what is the resulting pattern of resource utilisation. The answers to these questions are inextricably bound up with the issue of how incomes are generated and distributed and the resulting patterns of effective demand (which are determined by, among other factors, the rate of real wages and the access to investment resources and possibilities).

6. Pressures for technological expansion and the need for planned production

It has been observed above that the State plays a crucial role in promoting technologically intensive patterns of investment in the production of goods which do not respond to majority needs, and that it is the comparatively high profit margins derived from the State's support to monopolistic practices which destroy, or prevent from developing, other investment and production patterns more suited to majority needs (in terms of basic goods and services, work and income). A wide array of devices to cheapen the cost of capital goods, and to facilitate their rapid replacement (e.g. by special depreciation allowances), combine to favour the introduction of unsuitable technology. Capital intensive enterprises permit this reduction of the labour input. Although the smaller but more highly skilled labour

force in such enterprises may receive relatively higher wages than do the workers in the traditional enterprises or those which are kept traditional, the informal sector, and have low productivity, higher wages may well become a reason for the profit seeking entrepreneur to further increase capital intensive technology. 42)

Thus, the pressure of organised labour to ensure a more adequate share of the firm's income may boomerang - their own work in the creation of capital increases their vulnerability. This may trigger demands for increased wages in less productive enterprises, which then may also seek increased mechanisation. Such claims for wage increases by the working population may well be inspired for the very unequal existing income structure (e.g. the relatively high salaries in the bureaucracy inherited from the colonial period), as well as by the government's pressure to diminish this inequality in order to gain political support from part of the working population. 43) At the root of such rounds of wage increases, therefore, are prior unequal income structures. In as far as such equalisation tendencies drive the already established high income groups to assert their privileged position, and to realise it in terms of achieving still higher incomes and expand their conspicuous consumption, this may generate further pressures to further expand technologically intensive industry, at the expense of existing indigenous 'home-born' (medium and small scale) industries. The latter are expected to absorb the rapidly growing labour force which can no longer find employment in the modern sector. At the same time, these industries are lacking the means to grow, often as a result of discriminatory treatment which may be extension of discriminatory laws and practices established before political independence. 44)

It might be argued that surplus maximising types of technology, in spite of being technology intensive and creating little new employment in the short run, ensure a maximum growth of output and are also likely, in the longer run, to permit a steady expansion of employment. Such an argument may be applicable if and when surpluses are fully and systematically re-invested. This presupposes, however, that there is control over surplus and that investment of surplus is subject to planning in the interests of society as a whole. This implies a planned economy either directed by the State and/or based on agreements for planned production between production units controlled by associations of direct producers (the working population). 45) This assumes full reliance on the active cooperation of the population through decentralisation and the creation of a new consciousness and culture which inspire them to carry out their productive activities to benefit the community as a whole. In most dependent countries, due to the dominant mode of production and the social forces which direct it from both outside and within, large portions of the surplus are, as observed earlier, either transferred abroad or unproductively invested or consumed. In such cases, the linkage effects of investments are minimal, and in many ways are negative.

7. The scope and feasibility of intermediate technology

One approach to counteract the negative effects of uneven development and of capital and technology intensive patterns of investment and concentration has been to introduce what has been termed 'intermediate technology'. The original proposal for the spread of intermediate technology is based on several premises, such as:

> 'that work-places have to be created in the areas where the people are living now, and not primarily in metropolitan areas into which they tend to migrate, that these work-places must be, on the average, cheap enough so that they can be created in large numbers without this calling for an unattainable level of savings and imports, that the production methods employed must be relatively simple, so that the demands for high skills are minimised, not only in the production process itself, but also in matters of organisation, raw materials supply, financing, marketing and so forth, and that production should be largely from local materials for local use.'

The types of industry to be tackled immediately would be 'every kind of consumers' goods industry, including building materials, agricultural implements and equipment for intermediate technology' while it is assumed that genuine economic development can only take place in as far as 'people are able to make their own tools and other equipment'. 46)

These premises unquestionably strike the heart of the problem. However, relating the proposals on intermediate technology to the concrete historical setting of the dependent countries would reveal that the very productive activities which intermediate technology wishes to bring about were in the colonial past and are at present challenged by the massive influx of consumer goods from abroad and, at a more recent stage, by the development of import substitution industries. As is known the establishment of import substitution industries, with the help of the State, has been and frequently is at the expense of the informal sector and the development of small and medium scale enterprises. This process has taken place simultaneously with the development of a class and income structure which, as observed above, gears investment and State support into directions preventing the effective activation of the productive and creative capacity of the majority population. Thus, proposals for intermediate technology stand in direct conflict with the allocation of resources and investment patterns responding to the interests of the dominant classes and associated groups. 47) Its realisation would require, among other things, strict control over foreign and associated investments, over patterns of consumption, (in particular, conspicuous consumption) and a re-orientation towards the production of services and goods - capital goods as well as the consumer goods which the mass of the population needs to live reasonably and to become motivated to produce.

There are no a priori reasons to exclude the possibility that governments may develop the political will to re-orient production and consumption patterns in this direction. It is likely, however, that they will be confronted with powerful opposition from vested interests. The vigour of this opposition can be expected to be directly proportional to the determination of a government to carry out such a policy. If such (populist) governments realise that they are challenged, they are faced with a dilemma. They either give in, or create a firmer basis for their policies by attempting to introduce structural reforms such as control over foreign trade, banking and credit, profit and price control, agrarian reform and reform of the market system. The realisation of these reforms will depend on the balance of political forces and whether sufficient, effective, broad-based support is forthcoming or can be mustered.

The implementation of such reforms, however, does not guarantee that the suggested pattern of production and consumption will come about. This will depend on whether the newly emerging groups mobilise sufficient political pressure on the government to re-orient these patterns and whether these groups achieve sufficiently strong direct forms of democratic control and participation. If reforms are intended or lead to politically demobilise the newly emerging groups and do not progressively rely on the mobilisation of political, social and economic power from below and from within (i.e. where people live and work), no significant re-orientation can be expected.

It has been argued that not only in industrial production but also in infra-structure and agricultural production there is a wide range of options in the mix of technology and labour. 48) While inputs and services for the establishment of a social and economic infra-structure in the larger urban centres tend to be capital intensive through the organised capital market, this is less so in the rural areas where self-financing and self-provisioning play a major role. Therefore, by slowing down migration to and population growth in the large urban centres, saving for such investments may be enhanced. 49) This proposition too easily ignores however the concrete social and economic conditions of most of the rural population. Their circumstances are frequently such that they have only limited incentives to work hard and to invest for themselves. Why should they work hard if a substantial share of their social product is taken away from them directly or through unfavourable terms of trade?

In agriculture, husbandry and land use there also appears to be a broad range of options between capital-intensive and other forms of investment. While in the initial stage the 'green revolution' may lead to increased labour inputs, successive rounds of mechanisation due to the impulse of market forces and profit maximisation are likely to be more capital and technology intensive and to reduce the need for labour. The unhesitating application of technological modernisation to agriculture was, until recently, legitimised by the thesis that land-labour ratios were by and large a fixed datum, and that in the more densely populated areas the marginal productivity of labour would approximate zero.

This proposition served to justify equating agricultural modernisation - irrespective of its effects - with development, and wholly bypassed the potential capacity of the rural masses to increase productivity by intensifying their work and expand production by diversifying their activities. 50)

It would require a great deal of imagination to associate the interest of the working population with the need for their labour in terms of marginal returns and profits. Their first interest, surely, would be to have food, enjoy security and the other conditions which make life livable and provide a prospect of a better future. The view of a fixed ratio between land and labour takes the prevailing land tenure system as an inflexible technical datum, disregarding that such a system always expresses the specific nature and structure of social relations concerning the control and the use of land and water as resources, and that it also determines the particular use and combination of technological inputs in the wider context of resource allocation. It is this inevitable bias, which considers labour only an input to be dispensed with if it is no longer 'rational' and 'efficient' from the point of view of the individual enterprise, that leads to favour capital and technologically intensive forms of production. This is facilitated by the cheap availability of capital goods and technological inputs, lobbied for by entrepreneurs and promoted by government.

8. The interrelationship between mode of production and mechanisation

This is not an attempt to argue against mechanisation but to point out that the effects of mechanisation are very different and even opposite, depending on the mode of production in which it is introduced. If and when mechanisation is rapidly introduced and expanded in a market economy with a dense rural population, it tends to lead to expel small holders from the market. It may also lead to the eviction of tenants and the dismissal of labourers, thus increasing the non- or under-utilisation of the rural population. This situation would change radically if people are the joint owners of land and equipment. Instead of being a threat to their survival and security, mechanism then becomes a powerful asset to the development of all, just as any other element of modernisation.

In peak periods, mechanism can help overcome labour shortages and diminish the interruption of other productive activities. It may increase total output, as well as output per worker, by speeding up the process of cultivation and harvesting so that multiple cropping becomes possible thereby creating demand for additional labour. The labour thus saved becomes available for other activities in agriculture, industry, services and a variety of activities in the field of social and economic capital formation. Thus, the negative effects of mechanisation as they are now visible in agricultural modernisation in many dependent countries, point to conditions under which it may become a positive factor. Both the optimisation of opportunities for productive and creative manual work (potential surplus) and the ensuring of benefits of modernisation and mechanisation for the rural working population at large cannot occur without radical transformation

of productive relations. Joint ownership of land and equipment seem an indispensable technical condition.

Mechanisation is a crucial instrument in diminishing the gap between urban and rural life. Apart from its labour saving implications, it is essential to reduce the often back-breaking work on the land. The reduction of such toil to make life in the rural areas more attractive should not be considered merely an incidental by-product, but as worthwhile in itself. Apart from this criterion, mechanisation may be pursued as it makes work more productive and manual work has to be reduced as it becomes too expensive in terms of comparative costs and benefits when the need for new productive activities arises. To prevent the automatic operation of the 'law' that high technology drives out low technology, applicable to situations in which private profitability predominates, it is necessary that the mixing of manual work and mechanisation, as well as the phasing of the mix, be made subject to the conscious and democratic control of the working population. In this way a judicious balance can be achieved between advance in mechanisation and more labour intensive forms of productive activity. The balance between the two is likely to change continuously with the expansion of production and the growth of productivity, as well as with the advance in social development as this creates new needs and modifies priorities.

This control of the balance between technology and physical work applies to all types of activity undertaken by the working population to enhance capital formation. In the initial stages much of the work may have to be done by manual labour with the assistance of available rudimentary equipment. With the increase in accumulation and the development of both industry and agriculture, the labour supply may become less abundant and shortages may even develop. At this stage, more equipment can and has to be used, and more can be achieved in less time. Moreover, as greater yields are achieved on less land, production can be diversified. This description of a possible evolution of productive activity is quite contrary to the generally observed trend as it presupposes the possibility for the working population to rely on internal accumulation so as to both invest and improve its social condition. It cannot take place unless there is a reasonable measure of security for people to dispose of and enjoy the wealth they create.

9. Capital vs. labour intensive production: contradiction or complementarity

The above analysis touches upon the much discussed issue regarding the relationship between capital and labour intensive techniques of production. It is often assumed that in a number of ways their use is mutually exclusive, and that it should be closely tied to a country's particular 'stage' of development. Thus, particular factor endowments would prescribe which alternative should be chosen. The greater the scarcity of capital and the abundance of labour, the more a country should rely on labour intensive techniques, with the primary aim of maximising employment, so the argument goes. The opposite alternative is to concentrate capital and technology in order to ensure high productivity and rapid growth.

The consequence of rigorously applying the first alternative would be for a country to be condemned to low productivity and accumulation, and any long term growth policy would be out of the question. The application of labour intensive low productivity techniques has no merit in itself, although the maximum utilisation of an abundant labour force in a country with scarcity of capital may be a necessary starting point for development, if it wishes to avoid reliance on foreign assistance and thereby increasingly jeopardises its autonomy.

The scope for capital formation by relying on intensive labour utilisation for a wide variety of productive projects has long been recognised. 51) What has not been admitted, however, is that optimum rates of accumulation are in no way identical to maximum rates of accumulation, and that people's creative and productive power can only be fully mobilised if they acquire, as insisted upon earlier, their proportional share in both accumulation and productive consumption. This implies the reduction of unproductive investment and consumption or, in other words, a transformation of social relations between the working population and those who control their work and the fruits thereof. Uneven development, through the use of technologically intensive procedures, is the unavoidable consequence of bypassing the immense reservoir of under-utilised labour. If the bulk of the population, in the dominant view, is considered useless at the moment that more profitable ways of surplus creation become available to entrepreneurs, 'entrepreneurial initiative' and reliance on such methods are proposed as 'the only way'.

If all-out priority is given to the application of capital intensive techniques in the dynamic sector, namely industry, then it is unavoidable that this will lead to the creation or intensification of imbalances between the rural areas and agriculture on the one hand and the urban centres and industry on the other hand. In actual practice, the choice between capital and labour intensive forms of production does not exist in an economy based on commodity exchange. The increasing call for the use of labour intensive techniques manifests a belated concern with the marginalising consequences of the lopsided development of the modern industrial sector as well as the marginalising effects of recent agricultural growth policies. It is frequently not so much inspired by an authentic concern for the wellbeing and welfare of the masses as well by the awareness that it can serve to stave off pressures for the overturn of prevailing productive relations and to secure a measure of stability.

If a plea is now made to concentrate on labour intensive techniques, it is rarely accompanied by the recognition that the marginalisation and stagnation provoking the proposals for labour intensive techniques is rooted in the uncontrolled, unplanned growth of the modern sector. Instead of supporting the development of the 'traditional' agricultural sector by raising its productive capacity so as to augment the surplus for re-investment, this growth blocks its expansion, while frequently extracting, and making use of the surplus generated by it. It is, therefore, suggested that no meaningful discussion of the desirability and usefulness of capital intensive versus labour intensive techniques

can be carried out without investigating the concrete terms of the relationship between the modern and the traditional sector as well as the nature of each of these with regard to the rules governing the distribution of the social product between accumulation/investment and consumption.

It is proposed that neither a one-sided reliance on labour intensive nor on capital intensive techniques is a promising way to achieve autonomous dynamic development. What is called for is a combination of the two, taking into account the factor endowment of the country at its particular stage of development, as well as the need for increasing productivity and laying the foundation for long term growth. A widely spread increase in productivity must be simultaneously promoted with the creation of work and of a reasonable income for the whole population. 52) Traditional techniques and skills may well have to serve as a point of departure for raising productivity, and every effort must be made to modernise the available skills and technology. This does not preclude the organisation of a modern, significantly more productive sector. On the contrary, the build-up of such a sector to produce basic inputs, capital and consumer goods is indispensable to activate the traditional sector in its attempt to advance and raise productivity. However, this would be conditioned by the dynamic advance of this traditional sector which provides the basis for its own accumulation.

Thus, the correct approach may be to combine the existing fund of science, technology and skills with innovative modern approaches, and generalise the application of more advanced science and technology so that the level and quality of overall productive activity is continuously raised. This presupposes, once again, a radical transformation of productive relations which would permit the widespread, active involvement of the entire population in learning and experimentation. It has been observed that the most fruitful periods of scientific advance were those in which the class barrier was at least partially broken down and a close relationship developed between practical activity and theoretical analysis. 53) Thus, it seems that only when a scientific revolution is combined with social transformation does the possibility arise that fundamental and applied scientific research are oriented towards the real problems of a country.

At present, this implies a consciously planned state policy regarding the choice and use of techniques and technology. 54) But such a policy only bears fruit if there is a 'structure de reception' for it. This not only requires preventing or abolishing the monopolisation of resources and their mobilisation, as well as new practices of democratised surplus appropriation and control, but also the organisation of the population in a way which enhances its motivation. The optimum involvement of the population in seeking imaginative answers to local problems, and the possibility of developing indigenous abilities and creative capacity, is unavoidably linked to the de-monopolisation of the control and use of science. 55)

10. Science and technology: instruments of subordination or of development

The development of science implies its institutionalisation. If this institutionalisation leads to the acquired fund of insight and knowledge being mechanistically transmitted and applied, it follows that it cannot bring about human development, as this requires the creative assimilation of existing knowledge and know-how, as well as the discovery of new knowledge and practical ways of responding to concrete challenges. A linear vision of progress necessarily entails the imposition of established procedures. While these may be effective in certain contexts, they may not be relevant in other contexts. Such an imposition of particular forms of technology and applied science precludes the development of scientific attitudes and methods among those who are the recipients of ready made formulas. Thus, the basic function of science (a growing process, instead of a fixed thing), 56) as a method of constantly questioning the fund of existing knowledge and practices, and of searching for new ideas and practices more adequately responding to people's needs and aspirations, may be jeopardised. 57)

In this context, for people of a nation or of a community, development may mean, above all, the capacity to identify their true problems and to formulate methods of solving them. 58) It is useful to remember that in the initial stages of the industrial revolution in the West the multiple, small-scale technical innovations were not the determinant of economic development but, on the contrary, it was the bottlenecks caused by the rise in demand which made a break through in productive forces necessary, thus favouring the search for practical answers. It was only at a much later stage that science and the development of techniques became major determinants of economic development. 59)

With the present concentration of science and technology in the world, the challenge for the dependent countries is to create the conditions under which they will be able to develop their own science and technology in response to their national requirements, and to use the fund of established science and technology in a selective and creative way so that, rather than being a liability - blocking autonomous, balanced development - they promote it. There is undoubtedly a close link between the ways in which accumulation takes place and is promoted in a country, and the possibilities for people to be encouraged to acquire scientific attitudes and to learn by doing (making a virtue of necessity). If and when accumulation is primarily viewed as the concentration of capital and technology in a few production centres, then involvement in science and technology necessarily becomes the privilege of specialised elites.

If, on the contrary, reliance is placed on the widest possible multiplication of initiatives, this would also entail alternative patterns of accumulation and of the development of science and technology. New perceptions regarding accumulation, and how it can take place, require new approaches to linking productive activities and sectors.

Attempts are therefore required to analyse alternative approaches, and to develop through practice proposals regarding how productive activities and linkages can be organised in view of both accumulation and social development so that the effects will be unifying rather than dividing. A basic premise is that a country will mainly rely for its development on its own resources and mobilising capacity, and that planned use will be made of the surplus which is generated, in response to the needs of the majority population.

11. Final Observations

One effect of incorporating the 'modernised' parts of dependent societies into the capitalist mode of production on a world scale is the intensification of uneven development between and within the industrial and agricultural sectors and the weakening of the prospects for development of cooperation and complementarities between societies, which for most of them is a requirement for autonomous development. 60) The search for joint action and the defense of common interests by the Third World countries is promoted by the attempts to prevent them and to break up efforts in that direction. Measures such as the American International Trade Bill of January 1975 designed to protect the internal market, are basically intended to maintain the status quo and to prevent the Third World countries from bringing about a change in the balance of power. Rather than leading to stability, such measures are likely to intensify contradictions and to press Third World countries to seek ways to overcome the atomising and fragmenting effects of a divide et impera policy. Inasfar as ruling classes in Third World countries accept the continued dependent incorporation into the 'free' world market system, implying increasing marginalisation of the masses as a result of intensified uneven development (which is a major cause of famine or threat of famine in several countries), or these classes reserve for themselves a major share of the benefits resulting from successful pressure to modify the balance of power, they prepare the ground for their own overthrow and the development of a social revolution which will be pressed by the masses out of sheer practical necessity and the need of which has long been recognised. 61) Profound transformation of social and productive relations becomes ever more urgent and is enhanced by the pursuit in all countries of a mutually reinforcing process of accelerated capital accumulation and conspicuous consumption. 62) Thus, the ideal of a more human society, rooted in mutual support, equality and solidarity, will be realised as it comes to respond to the necessity for human survival and secure conditions for self-realisation by people and peoples.

Notes

1. 'The large corporations today seek to optimise their profitability not their profits.... For these bodies the objective of profit accumulation is not important. Instead their interest and the aim of their professional management become maximising the profitability of the enterprise in terms of how efficiently capital is used and increases itself. This transforms capital from a means for maximising production to the end goal of corporate policy. The relationship between capital and production is thereby inverted: instead of capital being a factor of production, production has become a factor of Capital', Charles Levinson, Capital Inflation and the Multinationals, George Allen and Unwin, 1971.

2. J.D. Bernal, Science in History, The Emergence of Science, Penguin Books, 1965. Vol. I, p.50.

3. Theodor W. Adorno, 'Spätkapitalismus oder Industriegesellschaft': Verhandlungen des 16 Deutschen Soziologentags, Stuttgart, 1969.

4. 'La technocratie, aujourd'hui, a besoin d'une idéologie qui la justifie et permette l'integration à la societé qu'elle veut constituer. Or la mondialisation de la technique et de la conception technocratique présuppose une réduction et même une liquidation de l'histoire (consideré comme poids mort, résidu, encore plus gênant que pittoresque). Par contre, la pensée historique affirme qui les contenus out autant et plus d'importance et d'intéret que les formes. Elle dit que formes et structures se font et se défont, se dissolvent ou éclatent. Elle met sur le même plan, dans le temps, la formation des structures (structuration) et leur disparition (destructuration).....

   L'irrational apparent réclame son intégration, non pas à une conception de l'homme tout entier. Faute de quoi il se révolte. La theorie de l'alienation dénonce les fétichismes, les scissions, les mutilations de l'être human total. Elle dénonce en particulier l'alienation technique, technologique, technocratique, récemment promue on rang de grande alienation humaine'. Henri Levebvre, 'Reflexion sur le Structuralisme et l'Histoire', Au-de-là du Structuralisme, Paris, 1971.

5. This observation was made by Bernard Laponche, member of the Pugwash Group, physicist of the Saclay Nuclear Study Centre, at a Colloquium on Private Enterprise and International Development Action, Maison (Unesco, Paris, 4-5 April, 1973, Recordings of the Colloquium, ed. by Le Fédération pour le Respect de l'Homme et de l'Humanité), Paris, 1973.

6. Ignacy Sachs in one of his interventions at the same Symposium.

7. Joan Robinson and John Eatwell, An Introduction to Modern Economics, Mc Graw-Hill, England, 1973, p.132. John Kenneth Galbraith, Economics and the Public Purpose, André Deutsch, London, 1974, p.152.

8. J.K. Galbraith, op. cit..

9. J.D. Bernal, The Social Sciences: Conclusion, op. cit., Vol. IV, p.1254.

10. J.D. Bernal, The Natural Sciences in our Time, op. cit., Vol. III, pp. 704-706.

11. Hans Singer, 'The Foreign Company as an exporter of Technology', Bulletin of the Institute of Development Studies, University of Sussex, October, 1970, Vol. III, No.1.

12. Hans Singer,'Dualism Revisited', Communications Series No. 41, Institute of Development Studies, Sussex, October, 1969.

13. Report of the Group of Eminent Persons to study the Impact of Multinational Corporations on Development and International Relations , see the chapter on Technology. United Nations Economic and Social Council (document E/5500/Add.1).

14. Solon Barraclough and Jacobo Schatan, 'Politica Technologica y Desarrollo Agricola', Cuadernos de la Realidad Nacional, Universidad Catolica de Chile, Santiago, September, 1970, No.5. Helen Lamb of MIT, see chapter 4, section 'Special Features of Capitalist Development in Western Europe', on the comparatively advanced stage in pre-industrial development in India vis-à-vis England and Europe, Economic Growth in Brazil, India and Japan, Duke University Press, quoted in Ernest Mandel Marxist Economic Theory, p.442, Merlin Press, London, 1971.

15. Miguel Wionczek, 'Where patents go through customs', Ceres, FAO Review, Special Edition on the Cost of Science and Technology, March-April, 1973, Vol. VI, No.2. Wionczek is the principal adviser of the Mexican Government on Scientific and Technological Policy.

16. Report of the Group of Eminent Persons , p.51.

17. Report of the Group of Eminent Persons , p.56.

18. Surendra J. Patel, 'The Cost of Technological Dependence', Ceres, FAO Review, same edition. Surendra Patel is chief of the Transfer of Technology Branch of UNCTAD.

19. Report of the Group of Eminent Persons , p.68. See also the study by the UNCTAD Secretariat Restrictive Business Practices, Interim Report, United Nations, New York, 1971.

20. See Paul Baran, Political Economy of Growth, Pelican Books, 1973. Samir Amin, Le développement inegal, Editions Minuit, Paris, 1973. Tamas Szentes, The Political Economy of Underdevelopment, Akademia Kiado, Budapest, 1973.

21. Miguel Wionczek, see his analysis of the Mexican situation, op. cit..

22. United Nations Report on a Unified Approach to Development Analysis and Planning, preliminary report of the Secretary General, p.14, New York, October, 1972. 'The capacity to choose an autonomous style of development (by a society) conditions the possibility of making choices in all the other areas. If a national society simply accepts its place in existing international order, it may, under favourable circumstances, experience a kind of dependent 'development' over an extended period, but decisions on the main lines of production and consumption will be out of its hands, and it will be unable to tolerate forms of participation that might threaten the distribution patterns associated with these lines of production and consumption'.

23. In the study Social Change and Social Development Policy in Latin America, ECLA/United Nations, New York 1970, the need for the development of authentic societal images is emphasised as a requisite for national autonomous development. In the same study the structure of dependence and of internal colonialism are analysed in relationship to the capacity for autonomous development. Perhaps insufficient attention is given in this study to examine in a more systematic way the dialectical relationships between the relative absence or default of authentic images of the own future society (in view of the internalisation of dominant values and ideology) and the structural conditions of dependence and internal colonialism. It may be posited that both shape and support each other.

24. A. Boudhiba, 'Pays Recepteurs de Science Moderne', La Science et la Diversité des Cultures, UNESCO, Paris, 1974.

25. This has been recently stressed by UNESCO. It would seem that man's dignity and also his capacity to adapt without harm to a process of rapid transformation of his society and community can only be promoted in as far as he is permitted and given a chance to associate himself consciously and voluntarily with the process of transformation and as Paulo Freire has stressed can 'make his own history'. Radical democratic practices (which are prevented and at the same time urged by the ongoing and intensifying processes of monopolisation and concentration of power, opportunities and income) are a crucial condition for such a process towards self-creation and self-development to take place.

26. The expression is used by J.E. Stepanek in his study Selection, Development and Application of Technologies Appropriate for Social Equity and Economic Growth, prepared at the request of the Government of India, Draft, UNIDO, Vienna, January 1974.

27. A. Boudhiba, op. cit..

28. Report of the Group of Eminent Persons , p.12.

29. Charles Bettelheim, Calcul économique et Formes de Propriété, Maspero, Paris, 1971, p.74. Bettelheim discusses the implications of the acceptance of the growth of the organic composition of capital and the apparent necessity of the ever increasing growth of the size of production units on the Third World countries and proposes that such a transfer of the structure of production and of production techniques with its inherent tendency to concentration and centralisation inevitably leads to processes of accumulation which cannot take place without the squeeze out of a major part of the population. He goes on to posit that the transfer of productive relations, characteristic of the industrialised countries of the West, may become an obstacle for the all round development of productive forces and may lead to large-scale waste and underutilisation of productive potential.

30. Wassily Leontieff, Input-Output Economics, Oxford University Press, 1966, pp. 44-51. Quoted by K.N. Raj, see next footnote.

31. K.N. Raj, 'Linkages in Industrialisation', paper prepared for the Working Group on Industrialisation and Development of the United Nations Committee for Development Planning, United Nations Industrial Development Organisation, Vienna, February 4-8, 1974.

32. Charles Cooper, 'Choice of Techniques and Technological Change as Problems of Political Economy', International Social Science Journal, 1973, Vol. III, No.3. Charles Cooper is a former member of the Directorate for Scientific Affairs of the OECD and is a senior research fellow at the Science Policy Research Unit of the Institute of Development Studies of the University of Sussex since 1969.

33. See for a synthesis of an historical approach to the process of transformation of modes of production in the context of the transformation of social formations. Karl Marx Precapitalist Economic Formations, with an introduction by Eric Hobsbawm, Lawrence and Wishart, London, 1969. Samir Amin Le Développement Inegal.

34. Giovanni Arrighi and John S. Saul, 'Nationalism and Revolution in Sub-Saharan Africa', The Socialist Register 1969 (ed. by Ralph Milliband), Merlin Press, London. The authors stress the growing polarisation in income and wealth differentials and the development of a pattern of 'perverse growth' which strengthens the external linkages at the expense of internal linkages. This both foments the exclusion and need for authoritarian control of the marginalised peasantry and those strata not integrated in the wage economy vs. those who become partners, albeit junior partners of the ruling classes.

    Celso Furtado analyses for Brazil the crucial role of the State in contributing directly to a more unbalanced income structure and the partnership which it offers to the new higher income group in the privileges of the ruling classes so as to expand the opportunities of the monopolistic productive structure, 'The Brazilian Model', Social and Economic Studies, Vol. 22, 451 March, 1973.

A similar process is analysed by Ranjit Say for India who shows the trend in the Indian economy towards the gradual incorporation of the middle classes in the benefits of the ruling classes and the concomitant deepening of the inequality between an expanded privileged minority and an impoverishing mass of workers and peasants. (Ranjit Saul, 'India Economic Growth, Constraints, Prospects,' Economic and Political Weekly, Vol. 7, No. 5-7, Annual Number, 1972.

35. Marcos Kaplan, 'Hacia un modelo mundial alternativo, La Critica del Mundo Actual', Comercio Exterior, Revista del banco de comercio Exterior, Mexico, D.F. Febrero, 1974.

36. K.N. Raj., op. cit. Esther Boserup, 'The Forgotten Majority', Ceres, FAO Review Nov-Dec. 1973.

37. On the pressures for optimising profitability in order to ensure accelerated capital accumulation, Charles Levinson, Capital Inflation and the Multinationals. A recent study by UNCTAD, Major issues arising from the transfer of technology to developing countries , Geneva, April, 1974 (TD.B.AC. 11/10/Rev.1), prepared for a session of the intergovernmental group on transfer of technology, concludes among others (p.67), 'The various provisions regarding special facilities for foreign investment in such fields as taxation, tariffs and exchange control, result in a state of affairs in which the benefits, accruing from foreign capital and technology go mainly to the foreign suppliers'.

38. The thesis of Leontieff is amply disproved by developments in China, see Shigeru Ishikawa, 'A note on the choice of Technology in China', Journal of Development Studies, Oct. 1972. It is also disproven by an analysis of the history of industrialisation in the West itself. See the analysis by Paul Bairoch on the structural factors which favoured the diffusion of production technology and the crucial role played in it by the relatively small size of production units, the relative simplicity of production techniques and the opportunities this offered for creative involvement. He emphasises the process towards concentration as a result of the pressure to maximise accumulation through profit maximisation (Paul Bairoch, Le Tiers Monde dans l'Impasse, Paris, 1971, pp.81-91).

39. It must be stressed that the adequate identification of a society's resources is closely related to its effective capacity for autonomous self-reliant development and that this is rooted in the emergence of a new consciousness, fruit of enhanced capacity for control over the potential use and mobilisation of own resources. The example of China is illustrative in this respect (Coal, Iron, Oil). Note the emphasis Paul Bairoch gives to the relation between the multiplicity of local initiatives in capital formation and innovation in the History of European Industrialisation and the prohibitively high costs of transport which acted in the first stages of industrialisation as a natural barrier against concentration. Minimisation of transport costs is one of the arguments in Chinese Political Economy. To stress the rationality

of promoting decentralised industrialisation along with other considerations such as the optimum mobilisation of local resources, organisation of production in function of and sensitive to local (changing) needs, giving full play to local initiative and creativity, facilitating and promoting control by people over themselves, their environment and their productive activity, in short the development of democratic self-management in the framework of central planning.

40. K.N. Raj., op. cit..

41. Thus the link between investment and development is lost and the process takes place which might be qualified as growth without development. This leads to a radical questioning of dominant growth pole theory as developed on basis of the process of industrialisation as it took place in the West. See the excellent synthesis of Western Growth Pole theory by Tormod Hermansen, 'Development Poles and Growth Centres in Regional Planning', Growth Poles and Growth Centres in Regional Planning, (ed. by Anthoni Kuklinsky, The Hague, 1972. See in the same study the analysis by R.P. Misra 'Growth Poles and growth centres in the context of India's urban and regional development problems'. Both analysts recognise the difficulty of transferring Western inspired regional growth models to underdeveloped societies. They do however not accept the consequences. As a result their propositions are couched in terms which somehow suggest universal validity, as if it would be possible to prescribe a hierarchy and formation of centres and an organisation of structures of communication and diffusion of innovation in dissociation from the dynamics of the specific historically shaped and continuously changing social and class structures of each society. See the critique by Myrdal in Asian Drama (p. 1197) on the mechanistic assumptions underlying much thinking on multiplier effects of industrialisation on his warning that industrialisation as planned in India will 'perpetuate the colonial pattern of society'. Also A.N. Bose, 'The Basic Problem of the Indian Metropolis, its continuing semi-colonial character', The Indian Journal of Regional Science, 1971, No.1.

42. Charles Cooper, op. cit.

43. Giovanni Arrighi and John S. Saul, 'Socialism and Economic Development in Tropical Africa', op. cit.

44. Colin Leys, 'Interpreting African Development', African Affairs, Journal of the Royal African Society, October, 1973.

45. The basic assumption in the study by A.K. Sen, Choice of Techniques, 3rd edition, Oxford, Blackwell, 1968.

46. E.F. Schumacher, 'Industrialisation through Intermediate Technology', Developing the Third World (ed. by Ronald Robinson, London, 1971)

47. Charles Cooper, op. cit.

48. Esther Boserup. 'The forgotten majority'.

49. Esther Boserup takes abstraction in her analysis from the class structure and assumes too easily the feasibility of both savings for such investments and the slowing down of migration and population growth without deepgoing social transformation.

50. See both Gunnar Myrdal's (Asian Drama) and Erich Jacoby's (Man and Land, the Fundamental Relationship) critique on the static conception of 'employment' linked to this interpretation and their emphasis on a dynamic conception of labour utilisation.

51. A major break with the one-sided emphasis on growth through capital came in the beginning of the fifties from Ragnard Nurkse in his Problems of Capital Formation in Underdeveloped Countries, Blackwell, Oxford, 1953. Nurkse failed however to recognise the interdependence (and relative identity) of production and consumption and to perceive increased consumption (by the masses in reward and in exchange for their work) as an essential condition to increased production and productivity. As Mandel argues in his Marxist Economic Theory, p.620,'Mobilisation of millions of peasants for regular work which upsets their ancestral customs demands the presence of a political and/or social force able to mobilise them, which is capable of obtaining this effort from the peasants willingly'.

He rightly points to the ineffectiveness and wastefulness of harnessing potential capital formation by means of force. Not only overt but even more so indirect concealed forms of forced labour need be stressed if attention is drawn to the failure of increasing productivity and of creating an environment in which commitment, interest and creativity can flourish.

See also Gunnar Myrdal. His approach to the question of discipline appears essentially moralistic as he emphasises the need for discipline 'in all strata' and even the villages without perceiving the rationality of the privileged group of supporting a 'soft' State which protects and promotes its position and on the other hand the rationality of silent protest by the poor villagers manifest in their lack of commitment and cooperation in Government projects of which the benefits are likely to favour the privileged groups. Asian Drama, the chapter on Concepts and Practice of Democratic Planning, Vol. II.

Myrdal does not establish a direct link between the possiblity to develop discipline (as an expression of commitment and interest) and the prevalence of asymmetric antagonistic relationships which he emphasises as a major feature of the rural structure and the stagnation resulting from it. Such a link between the contribution by public work projects and structural transformation and reform is clearly formulated by Erich Jacoby, op. cit., p.59. After having pointed to the relative failure of public works programmes through popular participation, Jacoby observes: 'There is no doubt that idle agricultural labour in the underdeveloped countries could be utilised effectively through public works, provided, however, that structural and institutional reforms have fostered a positive attitude at all levels of rural society'.

52. Tran Ngoc Bich, 'Strategie du Développement et Evolution de cadre socio-économique au Nord Vietnam', Civilisations, No.11, 1972. The policy to combine old and new, the traditional and the modern, the less and more advanced, high productivity and low productivity techniques is characteristic of the North Vietnamese development strategy.

Apart from the need to turn necessity into virtue and make an optimal use of the latent potentialities in creative and productive capacities in people which can be organised and step by step raised thanks to the identification of people with the overall orientation promoted by the leadership and State (a process which is not even but characterised by continuous and inevitable contradictions), there are however also 'technical' arguments for paying full attention to and draw upon the mobilisation of the small scale, less advanced units and forms of production. Maurice Dobb has formulated two theoretical criteria under which the choice of lower capital intensity would not be prejudicial to the objective of maximum growth (assuming that maximum growth for countries with a low level of development of productive forces and low levels of welfare is a legitimate and necessary objective):

1. Where a lower capital intensity, when combined with a smaller scale, leads to a shorter gestation period for investment and, hence, makes it possible to reinvest surplus accruing from the investment earlier (a 'compound' effect). The amount of surplus per unit of capital investment may be smaller but the compound effect could lead to a higher rate of growth.
2. Where additional employment of labour force does not involve any additional claim upon the investment funds of the economy.

These criteria formulated by Dobb in An essay on Economic Growth and Planning, (Routledge and Kegan Paul, London, 1960), are cited by Shigerua Ishikawa in his Note on the Choice of Technology in China', op.cit.

Both the Chinese and Vietnamese strategy of walking on two legs need therefore not only be interpreted in terms of making a virtue out of necessity. They have advantages in a more restricted sense. The debate about choice of techniques and comparative advantages and merits of the various avenues of action in order to be fruitful and meaningful cannot be carried on in dissociation from the specific concrete dynamics and context of each society and the specific resources and potentialities of it. There are considerations of a political nature (need for autonomous independent self-reliant development) as well as those concerning the nature of the new society to be created which are in no way touched in the above considerations and of which the overall effects by far exceed the technical considerations with regard to the 'compound' effects in a more restricted technical sense.

53. J.D. Bernal, op. cit., Vol. I, p.50.

54. Ignacy Sachs, La Découverte du Tiers Monde, Flammarion, Paris, 1971, p.244. After having stressed the necessity for the countries of the Third World to protect the development of science and industry in function of their own requirements, Sachs goes on to say: 'Non certes que nous croyions à une sorte de rédemption par la science, ou à la possibilité de remplacer la transformation sociale par la révolution scientifique, Repétons-le, il ne peut s'agir que de complémentarités. Et encore faut-il l'économie utilise à plein les

possibilités ouvertes par la science. Cela implique une orientation de la recherche fondamentale a appliquée, vers les problèmes réels du pays et la promotion de choix des techniques au rang d'une véritable politique d'Etat'.

55. See Ivan Illich, Tools for Conviviality, Calder and Boyars, London, 1973. The approach of Illich is a highly idealistic one. While he acknowledges that planning for a convivial society is a political process, his approach remains one-sidedly normative in that he implicitly assumes that somehow the rationality of his proposals will be recognised in view of the increasing need for self-preservation by the human species. It would seem that he underestimates the organic link between the requirements of the productive structure, as driven by the inherent pressures for accumulation in the capitalist mode of production, and the defense of rationality of the evolving 'order', propelled by these forces. The result is that he devotes minor attention to the nature of the underlying contradictions which become manifest in the conflict which he describes as man's alienation and subordination to the tools of his society. Thus he devotes hardly any attention to the organic relation between the structure of productive relations and the development of productive forces and its manifestation in the dynamics of the social and class structure as well as in conflicts between dominant and competing values.

This is not to distract from the great merit of Illich's work or to contest the thesis he presents in an original and creative way: that man's tools reach a point beyond which he loses control over them and they start to take hold of him. Also, if it is recognised that man's alienation is shaped in a class-structured society by the absence of social control over work and the conditions of work, and the negation of the dialectical relationship between the development of productive relations and productive forces (primacy being given to the latter of which the former is supposed to be the one-sided expression and automatic result), this does not diminish the urgent task of investigating the nature of alienating labour and its degrading consequences for human self-development and self-realisation. Both in practice of the capitalist mode of production and in the practice of bureaucratic state capitalism in which profitability and economic growth have been overriding 'natural' assumptions, one-sided concern with the expansion of productive forces (with as an implicit consequence the pursuit of centralised accumulation, concentration and economies of scale) have led to the ideology of the 'inevitability' of Technological 'Progress' the concomitant socialisation into the acceptance of inherent technological compulsions, and the subordination of people to the requirements of the economic system concealed beneath. This has been the ideology of capital as a thing and not as a social relationship and the negation of people as the source of all creativity and productivity (see 'On the pseudo-theory of the primacy of productive forces', Peking Review, 10 September 1971).

The economic philosphy of the Bolsjevik Party, reflected in Stalin's relentless pursuit of maximising growth (the search for equality was to him a petit bourgeois concern) can be traced to the acceptance of the dominant views in the German Social Democratic Party, the distorted undialectical 'Marxist' economic conceptions of Kautsky and his Harmony Model, which implied the subordination of the working population to the 'objective' requirements of capital. The Soviet Thesis that class contradictions have been overcome, as the state on behalf of the working people has taken control of the means of production, bypassed the reality that State and Government Party are themselves always expressions of contradictions in society.

Changes in the legal form of property are substituted for the (process towards) real and direct appropriation by the working people of the fruits of their own work and control over their environment (see Charles Bettelheim, La Lutte De Classes Dans Le URSS, 1919-1923, Maspers, Paris, 1974). The thesis on convergence of the Soviet and Capitalist modes of production, welcomed by some reputed western economists, seems to bypass the fact that the disintegration of a socialist mode of production in the Soviet Union and the development of a ruling class and of bureaucratic state capitalism are not a new phenomenon but have deep historical roots. On the other hand they tend to equate the continuous expansion of the welfare function of the State and the growth of centralised bureaucratic power at the expense of local initiative and responsibility with 'socialist' advance in the 'free' market countries, bypassing the fact that the control and intervention by the State becomes increasingly urgent in order to secure stability and project the 'free enterprise' system against the destabilising effects of the very contradictions which it creates and intensifies. Undoubtedly the development of the class and economic structure of the Soviet Union of today have been profoundly shaped by the linear mechanistic 'Marxist' conception, predominant in the Bolsjevik Party, in which it was posited that no society could arrive at socialism without going first through the capitalist stage (see Rudi Dutschke, Versuch Lenin Auf Die Füsse Zu Stellen, über die halb-aziatische und Europäische Produktionsweise, Wagenbach, 1974). Lenin's view that a socialist society could be organised by combining the transformation of productive relations with the wholesale introduction of western technology (manifest in his great admiration for Taylor's 'Scientific' management and his interest to rely on American Engineers) reveals a mechanistic undialectical conception regarding the relation between productive relations and productive forces. The Chinese insistence on both class struggle and self-reliance in production and scientific experiment reveals more confidence in the possibility that, if and when people are properly motivated and their creative potential is released through the transformation of social and productive relations and the search for appropriate forms of (self) management, innovation is a major source of capital creation and the expansion of productive forces (see John Sigurdson, 'Rural Industry, A Traveller's View', China Quarterly, April-June 1972, Roland Berger, 'Profile of a Chinese County', Geography April, 1972 and Charles Bettelheim, Revolution Culturelle Organisation Industrielle En Chine, Masper , Paris, 1973).

56. J.D. Bernal, (The methods of Science), op. cit., Vol.I, p.35.

57. Bernard Laponche, Paris Colloquium, Unesco House, Paris, 1973.

58. Ignacy Sachs, same colloquium.

59. Paul Bairoch, Révolution Industrielle et Sous-Développement, Sedes, Paris, 1963, pp. 200/201.

60. Tamas Szentes, 'The environmental problem and the industrial investment patterns of multinational companies in the Third World', paper of the expert group meeting on alternative patterns of development, United Nations, Geneva, 13-18 May, 1974.

61. Measures for Economic Development of Underdeveloped Countries, United Nations Report of a group of experts, New York, May, 1951. This report says (pp.15-16):'In our judgement, there are a number of countries where the concentration of economic and political power in the hands of a small class whose main interest is the preservation of its own wealth and privileges, rules out the prospect of much economic progress until a social revolution has effected a shift in the distribution of income and power'.

62. It must be pointed out that the roots of the economic crisis which threatens the Western World are not located in the rise in prices of raw materials, particularly oil (the OPEC countries receive only a minor share of this price rise; during the last few decades, oil has been a major factor in the rapid industrial expansion of the West in view of its very low cost), but that this crisis has endogenous roots and is the consequence of the inherent dynamics of the capitalist mode of production with its unceasing drive to maximise accumulation and the inherent necessity to raise and expand consumption in function of the process of accumulation.

It would be contradictory if the germs of the disease were located within the nature of the societal system of the capitalist mode of production itself, since this would point to the necessity to seek and invite support for an alternative mode of production. To discharge the responsibility for the prevailing and developing crisis of the capitalist mode of production on the oil producing countries (and other Third World countries which are seeking to secure fair terms of trade - most raw material prices have actually declined recently) is indispensible if the real interest and ideological values underlying the implicit acceptance of the productive relations in which these interests express themselves are to be safeguarded.

For an analysis of the roots of the present crisis, see Geoffrey Barraclough, 'The Great World Crisis', The New York Review of Books, January 23, 1975.