Man, Nature & Technology

Essays on the Role of Ideological Perceptions

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Uno Svedin

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Essays on the Role of Ideological Perceptions

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3 Reinterpreting the Concept of Development from a Science and Technology Perspective

Francisco R. Sagasti

I INTRODUCTION

The major advances in science and technology at the world level over the last thirty years are making it necessary to reinterpret the concept of 'development' and to offer explanatory schemes that incorporate explicitly the process of knowledge generation. However it is surprising how little attention development economists have given to this theme, even though there are a few notable exceptions to this general rule, with some development economists having turned their attention to technological issues in a partial way in recent times.[1]

This essay constitutes a preliminary attempt to incorporate explicitly into the conceptualisation of the development process some issues referring to science and technology. The starting point is a critique of the general model offered by George Basalla to explain the diffusion of Western science. This is followed by a brief description of the components of an alternative conceptual framework, and the outline for an explanatory scheme that would link the various components of the alternative model in an organic fashion. The present essay develops a line of work advanced by the author in other reports, and is part of a larger research project currently under way.[2]

II BASALLA AND THE DIFFUSION OF WESTERN SCIENCE

In a well-known paper George Basalla (1967) proposed a conceptual framework to explain the spread of Western science throughout the world. His model consists of three, partly overlapping, stages: in the

first stage, the non-scientific or pre-scientific society of the developing world constitutes a source of problems for European science; in the second, there is an incipient development of what Basalla calls 'colonial science'; and the third stage is characterised by a struggle to establish an independent scientific tradition.

During the first stage, a few European scientists visit the new lands, explore and collect fauna and flora, study the geographical and physical characteristics of unexplored areas, and then return to their place of origin to complete their scientific work.

A dependent 'colonial science' emerges in the second stage. Natural history continues to be the main focus of interest and attention, but the range of scientific activities and problems studied begins to expand until it almost coincides with that of the colonial power. The colonial scientist is dependent in the sense that the sources of his education and training, the origin of the scientific traditions that he adheres to, the orientation of his activities, and the ways of obtaining recognition for his work are all defined in the metropolitan scientific power, and not in the country or region in which he lives and works.

The transition from the second to the third stage is more complex and difficult to characterise. Basalla suggests that the stage of colonial science contains, in embryonic form, some of the essential aspects of the third phase. During this transition, the colonial scientist – even though he still gets support from outside – begins to create institutions and traditions that eventually will be the base for an independent scientific culture. Thus, in the third stage, the colonial scientist is replaced by a scientist whose main allegiances lie within the frontier of the country in which he works.

Basalla's model has two important limitations: the use of the concept of diffusion or 'dissemination' of 'Western science' as the principal axis, without giving sufficient attention to the processes of 'absorption' and 'internationalisation' of the scientific activities at the local level; and the fact that it centres attention only on the diffusion of Western science, without examining the expansion of the technological base and the internationalisation of productive activities.

To privilege the concept of dissemination or diffusion entails adopting an Europocentric perspective, in which 'Western science', nurtured by different currents of speculative, theoretical and empirical thought that converge upon it, irradiates the whole world until it displaces the local 'pre-scientific' forms of thought. In reality, what happened in different regions of the world, each of them with their

own traditions and culture, was a process of interaction between the imported scientific knowledge and the traditional modes of speculative thought. The permanence of non-scientific forms of speculative thought is a constant in the history of Africa, India, China, Latin America, the Middle East, and even Japan, and the interaction between the occidental view of the world and the traditional perspectives has taken a variety of forms.

For these reasons, rather than speaking of 'diffusion' it would seem to be necessary to refer to the 'diffusion, absorption, and reinterpretation' of modern science, while admitting that this is a process which is still under way, and that in the developing world it is still at an incipient stage. However it is necessary to recognise that this interaction process has been (and is) taking place rather slowly between members of a European elite and their local counterparts; that in regions where local culture did not advance sufficiently it is very weak; and that in many places there has been little interaction, but rather a superimposition of two different and independent forms of speculative thought: the scientific Western view and the traditional autochthonous perspective.

On the other hand, when examining the diffusion of modern science without taking into account the parallel process of dissemination, absorption and adaptation of Western techniques (in which there were complex and rich interactions between the Western and the autochthonous traditions), and without considering the internationalisation of European productive activities (which accompanied the expansion of the capitalist system at the world level), there is the risk of presenting a partial vision, in which the 'diffusion of Western science' is perceived as an independent phenomenon, conditioned only by its own internal logic.

III TOWARDS AN ALTERNATE CONCEPTUAL FRAMEWORK

In order to offer an alternative view of the emergence and diffusion of modern science in the developing countries, it is necessary to consider the process of generation, transmission and utilisation of knowledge in an integral way. To this end, it is possible to distinguish a set of elements and components which, together with their interrelations and a certain directionality, form an alternative conceptual framework.

The first component is the *evolution of speculative thought* which seeks to generate knowledge in order to understand natural and social phenomena, to propose explanations that give sense to human existence, and to generate kowledge about the nature of the physical and social world. The second component is the *transformation of the technological base* that provides every human group with a set of organised responses (techniques) to confront the challenges posed by the physical and social environment, and also with the criteria to select from among these responses. The third component is the *modification and expansion of productive activities*, which provide goods and services to satisfy the needs of a community and of the individuals who compose it. These three elements or components, considered in a dynamic fashion as currents in constant transformation, insert themselves into the social, cultural and political context of every human group. What characterises a society at a given time and place is the degree of development of these three currents, the way in which they relate to each other, the form in which they are linked with their homologues in other societies, and the specific nature of the interaction among these three currents and their environment.

Even while it is necessary to reject the Western view as the unique frame of reference for comparing the achievements of different societies, it is impossible to deny that, considering the success in the material and the intellectual spheres and its diffusion on the global scale, the Western vision of 'progress' (which took several centuries to form) dominates the present world and has become an implicit standard. Without going back to the origins of this perspective in the Hellenic world, in the period between the sixteenth and eighteenth centuries, there was a qualitative, radical and unprecedented change that led to a 'Westernisation' of the concept of the natural world and of man's perception of himself. This conception was characterised by an emphasis on instrumental rationality, which subjected all human activities to the criterion of 'efficiency', subordinated human creativity to the process of accumulation, and took away the 'sacred' character of the natural world, thus creating the conditions for Western man to act with impunity over the physical environment. In this way the concern for means or instruments gradually replaced the preoccupation with identifying aims and giving an ultimate sense to the problem of human existence.

We are at present immersed in a world of values, conceptual schemes, artefacts and social entities, constructed by Western man

and his instrumental rationality, to the point that, as Garaudy (1981) says, the West has confiscated the universal. For this reason, and in order to rescue the universal in all its diversity from the predominance of the West, it is necessary to examine and understand the impact that the West has had on the rest of the world. This requires, in the first place, a study of the evolution of the knowledge generation process, of the transformation of the technological base, and of the expansion at the world level of the productive system which characterised Europe and North America. However in this analysis it is necessary to be *en garde* in order to avoid adopting an implicit Europocentric perspective.

The development of different civilisations and societies over the last few centuries should be seen as a complex whole, whose components are in continuous action and transformation, and in which a perspective – the Western one – came to influence all others. But, at the same time, these other cultures preserved their individuality, affected Western culture, and gave rise to new hybrid means of conceiving the world and relating to it (Braudel, 1975). The image of all civilisations and cultures of the world converging to the culmination and greater glory of the Western civilisation, implicit in the metaphor of different cultures as tributary rivers which converge on the sea of Western culture, must be rejected. In this sense, it is convenient here to highlight what Alvarez (1979) has stated:

> Human history may be better described not as a movement of different peoples towards some convergent mythical future (although at different speeds and in distinct groups), but as experience of many discontinuous cultures, each in itself equally important as exhibiting the variability of products of human inventiveness, each crystallizing a system of meanings irreducible to the others. (p. 2).

Ortega y Gasset (1968) has argued along the same lines, with particular reference to techniques, when he opposes:

> [the tendency] as spontaneous as excessive, reigning in our time, to believe that in the last analysis there is truly no more than one technique, which is the actual European–American technique, and that everything else was just clumsy babble towards it.
>
> [It is necessary] to counteract this tendency, and to submerge the technique of the present time as one of the many in a vast and

multiform panorama of human techniques, revaluing in this way the sense and showing how to each project and model of humanity there corresponds a particular technique. (p. 77).

When discarding the perspective of Western civilisation as the frame of reference, in order to appreciate the march of other cultures, there still remains the problem of imparting a direction for the process of social evolution, which would act as a backdrop for any comparison. For this purpose, it appears adequate to accept the arguments of Wertheim (1974) for whom 'the general tendency of human evolution . . . consists in a growing emancipation from the forces of nature', which is accompanied by 'the emancipation from the domination of privileged individuals or groups'. *Emancipation*, considered as man's capacity to forge his own destiny and to realise fully his own potential, can be considered an end in itself, and the process of *development* as a gradual advancement towards this end.[3]

In order to activate a process of development which would approach emancipation progressively, it is necessary to consider that modern science has been demonstrated to be the most efficient means of generating knowledge for understanding the phenomena that surround man and, as Bronowski (1965) said, paraphrasing Bacon, of dominating not through force but rather through understanding. Moreover the technologies that emerge through systematic reflection (*logos*) about the repertoire of responses and practices that are available to act upon the physical and social world (*techne*), bestow an enormous power of manipulation to confront the challenges posed by the environment. Finally, productive and service activities associated with modern technology have acquired a huge potential to satisfy human needs. In this way, for a particular social group, and for those individuals that conform it, it is impossible to conceive an advance towards emancipation without a minimum level of autonomous capabilities to generate or adapt scientific knowledge, to transform it into technology, and to incorporate this technology, linked to scientific discoveries, into productive and service activities. This capacity has been called an *endogenous scientific and technological* base, and to take it into account becomes an indispensable requisite for the process of development (Sagasti, 1977).

Therefore the elements or components of the proposed conceptual framework can be summarised as follows: three currents of human activities (evolution of speculative thought, transformation of the technological base, and modification of productive and service activities); the social, cultural, and political context in which these three currents unfold; the interactions among these three currents, between them and their context, and between these currents and their counterparts in other societies; a global directionality for the evolution of these currents, contexts and interactions (the concepts of emancipation and development); and an instrumental condition (to take into account an endogenous scientific and technological base).

The unfolding and deployment of these components and the concrete forms they assume over time characterise the historical development of each society, and will also condition their future possibilities and options. An appreciation of the paths that have been covered in the past, conceptualised in terms of the proposed framework, would explain the present situation of backwardness of developing countries and make it possible to design strategies for overcoming it.

IV TOWARDS AN EXPLANATORY SCHEME

The proposed conceptual framework allows the development of an explanatory scheme that can throw light on the nature and present manifestations of the phenomena of development and underdevelopment. It is necessary to begin by recognising that in every society each of the three currents mentioned above, their contexts, and their interactions undergo a series of transformations in time. Nevertheless, considering a long historical period, the main transformations experienced by societies take place when there are major qualitative changes in the nature of speculative thought and in the process of knowledge generation. As a result of these changes the conceptions of man, about himself and about his relation to the physical world, will also evolve and expand progressively to encompass the technological base and the structure of produtive activities. Awarding the character of *primus inter pares* to the changes in the nature of speculative thought implies giving cognitive activities the role of primary ordering element in the explanatory scheme.

The challenge of the West

The evolution of the different societies can be examined in a relatively independent way until the period of the fifteenth to seventeenth centuries, during which the knowledge generation process underwent

a radical transformation. Before this period, it is possible to analyse each society considered as an individual unit. Thus it is possible to examine, within reasonable limits, the European, Andean, Mayan, Aztec, Islamic, Chinese, and other cultures, employing the conceptual framework proposed here to follow the way in which the generation of knowledge, the technological base, and the productive activities evolved through history, and related to each other and to the wider context of social patterns, cultural activities and political processes.

However, the world suffered an irreversible transformation beginning with the scientific, bourgeois and industrial revolutions, which were accompanied by qualitative changes in the technological base and by the expansion of the productive capitalist system of Western Europe on a global scale. After that it is not possible to consider the evolution of societies in an independent way, and their study should take into account the challenges presented by the West to non-European society, as well as the responses that the latter generate. The point of inflection can be identified with the transformation of speculative thought and with the changes that took place in the generation of knowledge as a consequence of the scientific revolution. The transition towards a scientific conception of the world, through which it is possible to link systematically the abstractions and experiments on natural phenomena, to discover laws that rule the physical world, and to derive postulates, norms for action, and prescriptions that increase the domination of man over nature, constitutes an irreversible change in the evolution of humanity.

In parallel with these conceptual changes, and frequently associated with them, there were changes in the technological base, but these transformations were slower and would only accelerate two centuries later, when the number of production techniques based on scientific discoveries increased significantly. Notwithstanding their diffusion throughout all the regions of the world, beginning in the sixteenth century, the transformations in the nature of productive and service activities were even slower, although their pace has accelerated during the last century and a half, as a consequence of the ever closer relationship with technologies based on scientific discoveries.

The evolution of speculative thought

Examining briefly the evolution of speculative thought, it is clear that every culture presents its own way of generating and acquiring knowledge, but in general a transition can be observed from the

contemplation and passive acceptance of nature towards a greater interaction between man and the phenomena that surround him. Whatever the scheme employed to explain this process – for example, Frazer's ideas (1964) on the transition from magic to religion and to science, or the alternative view provided by Malinowski (1974) – it is possible to perceive a progression towards the use of reason as the principal means to structure the human vision of the physical, social, intellectual, and even spiritual world.

However, to accept this progression and to recognise that the emergence of modern science was a point of inflection, does not necessarily imply the establishment of a great 'divide' between traditional pre-scientific knowledge and modern scientific knowledge. The wide spectrum of forms of knowledge generation must be considered as a continuum, without postulating a radical division between Western scientific thought and non-Western modes of thought. Elkana (1977) has examined this theme in detail.

> The tendency to link observed events by referring to theoretical entities, i.e., to make causal explanations, is a universal feature of human thought. Western science is distinctive, however, in creating deliberately new experiences by inventing theoretical entities in advance of common-sense observations – for example, non-Euclidean geometries (p. 160).
>
> There is in short no 'great divide' between Western science and traditional thought. There are no fundamental characteristics of the one which are totally absent in the other, no sources of knowledge unknown to either, no aims of knowledge acceptable to one of them only. (p. 161).

In this way, the changes in speculative thought and in the way of generating knowledge in different socieites present certain commonalities, although there are great variations in approach, rate of advance, and emphasis (for example, relative weight of abstract theories versus empirical aspects). This leads to a revaluation of the 'traditional' ways of generating knowledge that should be seen from a wider perspective, and not simply in comparison with the rigid and Europocentric pattern of Western science.

Furthermore the limits of Western science have begun to be emphasised recently and there have been suggestions that Western science is likely to suffer radical transformations in the near future.

Thompson (1978) argues that the descriptive ideal and concern of science will lead inexorably to a new type of mysticism and that physics has already been transformed from a materialistic science towards the processing of cognitive models. Thompson visualises a process of 'remythologization' and 'resacralization' in the field of human thought through science, art and religion that will converge in new modes of knowledge generation. Berman (1981) argues that it is necessary to develop a new 'enchanted' vision of the world that would incorporate the achievements of modern science, but that would also give man a sense of continuity in human experience and physical integrity, along with a sense of actively belonging in a cosmic scheme. De Riencourt (1981) proposes a synthesis of oriental mysticism and Western science, a theme treated earlier by Siu (1957) in his essay on Western knowledge and oriental wisdom. Snyder (1978) considers that the different cultural perspectives will enrich modern science, contributing to its future development. In any case, it is beyond doubt that the revaluation of non-Western forms of thought would contribute significantly to a better understanding of the transformations in speculative thought and more appropriate attitudes to the world that is emerging at present.

Changes in the technological base

When examining the evolution of the technological base in different societies, it is possible to appreciate that each of them has its own set of responses (techniques) to relate with the physical environment, and that this set will evolve gradually over time. In general, it is possible to postulate the transition from 'technical' stages towards more 'technological' stages. It could be said that, initially, a social group has at its disposal a set of 'techniques without technology' which encompasses a layer of passive empirical knowledge that only offers responses to specific challenges and situations; later it acquires a base of empirical knowledge that begins to detect variations and to register them through trial and error; and finally it develops a base of active empirical knowledge in which there is the beginning of systematic experimentation, but without theoretical constructs to orient the experiments. When advancing in this process of transition towards more complex and rich sets of techniques, the variety of available responses increases continuously until it constitutes a vast 'genetic reservoir' of techniques.

A subsequent stage is characterised by the evolution of technical

responses as a function of theoretical constructions, thus moving from 'technique' to 'technology'. Initially the theoretical abstractions and reflections that support the advance of techniques are rudimentary and their impact is not very different from that of an active and systematised base of empirical knowledge. At this juncture it would be possible to speak about a 'incipient technology' or about a 'technological common sense'. Beyond this stage there emerge conceptions that explain the techniques and anticipate them, strengthening this transition towards technology. Pacey (1976) has characterised this transition as the move from the artisan to the technologist:

> The great strength of the technologist's discipline as compared with the craftman's art is that it allows him to design things by drawing and calculation which are outside the range of previous experience; it allows him to explore possibilities which are far beyond the point where the intuition of a practical man can offer any guidance. (p. 19)

Finally, and especially in the Western world, we arrive at the conception in which theory dominates technique, first through engineering and its professionalisation, and later through the almost direct incorporation of scientific discoveries into the development of new technologies. The triumph of 'technology' over 'technique' is now complete.

In this movement towards the predominance of the '*logos*' over '*techne*', the variety of technical responses increases noticeably, but it acquires a potential rather than concrete character. That is to say, a large number of possible technological responses do not become a reality due, among other factors, to the fact that the conceptual schemes and theories that lead to their generation also contain criteria such as 'efficiency', 'reliability', 'simplicity' and other similar concepts that act as 'variety attenuators', limiting the process of transition from what is imagined theoretically to what is realised in practice. This leads to the apparent paradox of a greater variety or heterogeneity of effective technical responses in societies that have not been completely 'technologised', in comparison with those highly 'technologised' societies which present a relative homogeneity in their observable technical responses.

The challenges posed by the physical environment to a society, and the forms of organisation adopted to confront them, condition the demand for technical responses and the transformation of its

technical base into a technological one, a process that also requires the development of a certain level of knowledge generation capabilities. As Needham (1977), Bernal (1971) and Alvarez (1979) indicate in their analysis of the technological achievements of non-Western cultures and societies, these acquired a set of technical and technological responses of their own, appropriate to their context, and processed by the forms of social organisation prevailing at the time. Therefore, now that the predominant forms of Western technological responses are being questioned,[4] it becomes important to study the alternative configurations of the technological base in societies that have not as yet been completely westernised.

Transformations in productive and service activities

The evolution of productive and service activities has as its principal motive the satisfaction of needs of the members of a social group, and is intimately related to the evolution of the processes of accumulation and the way in which the economic surplus is appropriated, distributed and allocated. However, the definition of 'needs' varies with time, with the degree of material development of a society and its income distribution patterns, and at present a large number of needs are generated artificially by the logic of the accumulation process itself, particularly in highly industrialised market-oriented economies.

An important turning-point in the evolution of productive activities is the new character that the process of accumulation assumed in the industrial civilisation of the West beginning with the bourgeois revolution. As Furtado (1979) has indicated, the reorientation of the process of accumulation towards the productive system, in such a way that surpluses are invested in the expansion of productive activities with the purpose of generating more surplus, conditions the evolution of the productive system and influences the transformation of the technological base. According to Furtado:

> In contrast with what takes place in traditional accumulation (in defence walls, in temples, in palaces. . .) that which is made in the productive forces seeks to obtain a surplus. This may come from the opening of new commercial routes, from the discovery of new natural resources, or from increases in the physical productivity of labour. This last case reflects the introduction of more efficient methods which, in turn, are linked to a better division of labour or the use of better instruments. (p. 53).

These changes in the social organisation of production, which are a consequence of the way the surplus is used and the direction of the accumulation process, interact mutually with the transformations of the technological base and the evolution of speculative thought. The expanded repertoire of technological responses presents the productive system with a range of possibilities for increasing the generation of surplus, while the greater surplus available constitutes a challenge to human inventiveness and stimulates the development of new technologies. On the other hand, the emergence of the secular concept of reason, the desacralisation of nature, and the rational conception of the world that finds its expression in thinkers like Descartes and Bacon, gave ideological support to the organisation of production in accordance with the demands of the process of accumulation, and also with the appropriation of the surplus associated with the emergence of capitalism. At the same time, the diffusion of capitalist production, characteristic of the industrial civilisation of the West, contributed to the predominance of the secularised and instrumentalist vision of 'rationality' which expanded its scope progressively, even reaching the very conception of human relations (Barret, 1979; Berger *et al.*, 1974).

A constant in the process of evolution of productive activities, particularly during the last four centuries, with the diffusion of capitalism and the industrial civilisation of the West, has been the enlargement of their geographical scope. From their organisation at the local level, production and service activities extended at regional and continental levels, and at present encompass the whole planet. This internationalisation process has been accompanied by the emergence of a global consumer elite with relatively uniform consumption patterns, superimposed upon a variety of local forms of consumption – corresponding to much lower levels of income and resource use – in the underdeveloped societies.

A central issue in the discussion of the development problematique refers to the paths that countries of the Third World, which lack the capacity for accumulation of the Western industrialised nations, should follow in order to expand their productive and service activities and satisfy the needs of the population. While it is clear that the process of development, whatever its conception, entails the satisfaction of material needs at a level compatible with human

dignity, the evolution of productive and service activities need not necessarily follow the same path as that followed by the highly industrialised nations, particularly with regard to the volume and diversification of goods. Concepts such as 'another development' (see, for example, the Dag Hammarskjold Report, 1975) question this premise and seek to propose different options that would involve a redefinition of needs, and even the revaluation of productive and service activities of societies outside the European–American sphere.

Interactions among the three currents

The interactions among the different stages in the evolution of the three currents, visualised against the background of the social, political and cultural organisation, would characterise the degree of development of a given society. For example, in the West the evolution of speculative thought led to science as the key method for generating knowledge, which accelerated the transformation of the technological base and helped in the transition from 'technique' to 'technology' while receiving at the same time the support of many technological advances which contributed to the scientific enterprise. Productive and service activities found increasing support in the new technologies related to science, to the extent that at present productive activities which employ technologies of scientific origin are clearly superior and dominate the scene. All of this takes place simultaneously with the acceleration and reorientation of the process of accumulation and with the emergence and expansion of capitalism as the dominant mode of production, a process which feeds on the technological and scientific advances and which, in turn, gives the stimulus and the material resources to support them. This process has been called the rise of an *endogenous scientific and technological base* in the highly industrialised countries.

The emergence of an endogenous scientific and technological base is accompanied by changes in values, with a new vision of the physical, social and intellectual world, and with a series of changes related to the diffusion of the by-products of the scientific activities. All of this gives its specificity to Western culture. In parallel, other cultures and societies have developed their own ways of linking the three currents and of relating them to the social, political and cultural context. For example, China displayed great achievements in the evolution of speculative thought about nature, as well as in logic and mathematics; she was able to generate technologies based on abstract and systematic

conceptions, and developed an efficient social organisation of production. As Needham has pointed out (1977, p. 194), the philosophical and intellectual tradition of China at the time of the Renaissance was 'much more congruent with modern science than the Christian conception of the world.'

However, a variety of social, economic, and political factors – which emerged as a response to the specific environment of Chinese culture – did not conduce to modern science and to an endogenous scientific and technological base. Similar considerations can be applied to India, the Islamic world, and to cultures of other regions. By examining their transformation it would be possible to identify the variants or the different 'models' of societal development, without falling into a spurious comparison with the achievements of Western civilisation taken as a frame of reference. In this way it would be possible to develop a proper perspective for examining the achievements of the West, for understanding its limitations and the nature of its present crisis, and for exploring new roads to the progressive acquisition of an endogenous scientific and technological base in Third World countries.

Towards a new cultural context

Seen in this light, the progressive establishment of an endogenous scientific and technological base in the non-Western countries requires a new cultural context, different from the one that characterised the emergence of industrial civilisation. For this it would be necessary to transcend the narrow or rationalistic vision characteristic of that civilisation, avoiding the almost complete subordination of creativity and of knowledge generation to the logic of the productive process. The new cultural context must leave ample room for the idea of emancipation as the directionality for the evolution of human groups, should accommodate the diversity of the products of social inventiveness, and should also restructure the pattern of values of industrial civilisation which privileges the means, and embraces instrumental rationality (emphasis on 'how'), rather than the ends, and the conception of a human destiny (emphasis on 'why'). The idea is to overcome the situation that Furtado has described in the following terms:

> The most fundamental impulses of man, generated by the need for self-identification and for defining his place in the universe –

> impulses that constitute the matrix of creative activities: philosophical reflexion, mystical meditation, artistic invention, and basic scientific research – were subordinated, in one way or another, to the process of transformation of the physical world required by the drive towards accumulation. This led to the atrophy of the linkages between creativity and human life conceived as an end in itself, and to the hypertrophia of the links between creativity and the instruments used by man to transform the world. (Furtado, 1979, p. 100).

The new cultural context required for the establishment of an endogenous scientific and technological base in the Third World would seek to rescue creativity from its subordination to the productive process, to diminish the importance of instrumental rationality, and to counteract the homogenising tendencies associated with industrial civilisation. In this way, taking into account the reassertion of a diversity of finalities, which is the counterpart of these changes, there will be room for a greater variety of ways of articulating speculative thought with regard to the technological base and productive activities. This perspective has been highlighted by Ladriere (1977):

> The type of culture that appears to announce itself through the interactions between the technical and scientific systems, and the different cultural subsystems, is a culture crossed by multiple tensions, which suggest diverse modes of articulation among its own components, and also between the other systems and itself, which proposes a variety of schemes for action and is flexible in its own structure, compatible with multiple forms of equilibrium. . . . . In that culture there is not, properly speaking, a unique center that integrates everything, but multiple centers. A relative dispersion substitutes unity. (p. 193).

In another essay I have speculated about the future of present day societies, postulating that we are witnessing the appearance of two 'civilisations'. The first civilisation corresponds to the highly industrialised countries that have an endogenous scientific and technological base, and the second civilisation to those Third World countries that lack it. To combat the threat posed by a growing division of the human race into two distinct and antagonistic camps, it will be necessary to advance towards a 'third civilisation' in which the

achievements of modern science could be integrated in a harmonious fashion with the cultural heritage of non-Western societies. This search for a third civilisation, which must be considered as a general frame of reference within each society could explore its own paths, requires many conceptual changes and a refocussing of our perception of Western culture:

> Despite its unquestionable achievements, the Western scientific–technological culture of the first civilization should not be considered as the universal model to be imitated by the countries of the second civilization; it should rather be viewed as one of the many phases of a global and historial process of material and intellectual evolution. There is a need to discard the implicit arrogance of Western culture which makes the first civilization consider itself as the model to be followed by the developing world. A more ecumenical perception of the processes of development and progress is required, in which the potentialities of the many cultures that are part of the second civilization would be revalued and appreciated, particularly if we have the foresight to visualize what could be achieved if a harmonious integration of their cultural heritage with modern science were possible. (Sagasti, 1980, p. 132).

Notes

1. For a review of development theory see Björn Hettne, *Development Theory and the Third World*, Stockholm, SAREC Report 22: 1982; the treatment of technology in several theories is discussed in my monograph, *A Review of Schools of Thought on Science, Technology, Development and Technical Change* (STPI Module 1), Ottawa, International Development Research Centre, 1980.
2. The project ' A Scientific and Technological Reinterpretation of Development' is being carried out at the Group of Analysis for Development (GRADE). It received support from the Swedish Agency for Research Co-operation with Developing Countries (SAREC) during its first stage.
3. I am conscious that this involves bringing an exogenous, pre-defined, concept into the model, that of 'emancipation', but short of falling into an absolute cultural relativism, or giving a particular culture the status of a frame of reference, I see no other way of providing a framework of comparison.
4. See, among others, the works of Ellul (1980), Winner (1977), Schwartz (1971) and Schumacher (1973).

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4 Socially Viable Ideas of Nature: a Cultural Hypothesis

Michael Thompson

I CONTRADICTORY CERTAINTIES AND THE DISCERNING SPECTATOR

What is a resource? I was once fortunate enough to be spectator to an exchange of views on this question between a distinguished ecologist and a Nobel Prize-winning physicist. The ecologist let drop something about 'natural resources' and the physicist was down on him like a ton of bricks. 'You cannot talk about *natural resources*,' he cried, 'there are only *raw materials*', and he went on to explain how a raw material only becomes a resource when human ingenuity, skill and enterprise are successfully focussed upon it. This is a profound and insoluble disagreement. For our ecologist riches are given to us by nature; for our physicist[1] they are given to us by our social inheritance – by that complex whole that gets transferred from one generation to the next by mechanisms that are not genetic; a whole that includes the whole of language, the whole of knowledge, the whole of technology, and a great deal more besides.

Clearly our ecologist and our physicist locate resources very differently. Their premises, in other words, are different and, as a result, so are the sorts of policies that they see as desirable (or even feasible). Our ecologist has an *idea of nature* as something stern and unforgiving – as supplying him with a strictly *accountable* inventory of resources. Our physicist, on the other hand, sees these limitations as being of little consequence because they are capable of modification, exploitation and multiplication through the application of skills that are socially acquired and transmitted. In this way he is led to the idea of nature as essentially *cornucopian*. So here is a fundamental cleavage. Our physicist's world is a world of *resource abundance*; our ecologist's one of *resource depletion*.

When people argue from different premises they will, in all probability, fail to agree. At best, they may agree to differ. This is