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DEVELOPMENT, ENVIRONMENT AND TECHNOLOGY

Some non-economic aspects

by

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Note by the UNCTAD secretariat

This study was prepared by Professor Johan Galtung at the request of the UNCTAD secretariat as a contribution to the first phase of a major study now being undertaken by the UNCTAD secretariat [illegible] Joint Project on the Relations between Technological Innovation, Development and Environment.

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PREFACE

The present paper was written at the request of UNCTAD, Division of Transfer of Technology during the winter 1975/76, as a contribution to a major UNCTAD/UNEP Joint Project study undertaken contracts with UNEP on the relation between technological dependence, development and environment. I would like to express my deep gratitude to my friends and colleagues in UNCTAD, in the Geneva-based UN organizations and at the Institut d'études du développement for countless discussion on the themes explored in the present paper - and particularly to Tom Cameron of the Division. Needless to say, the errors are all mine as well as the responsibility for the selection of material and the conclusions drawn.

The study is dedicated to the memory of Professor K. William Kapp, a true poineer in this field - whose decease on 10 April 1976 in Dubrovnik, Yugoslavia, was a heavy loss to all of us.

Geneva, July 1976.

Johan Galtung

Chapter I. CONCEPTUAL FRAMEWORK

1. The purpose of this paper is to explore some non-economic aspects of the relations between "development", "environment" and "technology". In order to do this some clarification of these overused terms is necessary if by no means sufficient; the bulk of the paper will deal with the relations between these phenomena, and in a relatively concrete manner.

2. "Development" will be understood here the way it is conceived of in the Cocoyoc declaration: it stands for the development of human beings, not for the production of things, their distribution within social systems or for the transformation of social structures.[1] The latter may be means towards the end but should not be confused with the end: that of developing the entire human being, and all human beings. The first and serious mistake in development theory and practice enters already at this point: a confusion of means and ends, leading, for instance, to the identification of economic growth or structural transformation with development, without checking whether these (continuous or discontinuous changes) really lead to development of human beings.[2]

3. "Development of human beings" will be identified with satisfaction of human needs, leading to the concept of need-oriented development.[3] It is assumed that for each identifiable human need there are some means that can satisfy the need. When the means are insufficiently available one may talk about "underdevelopment"; when they are abundantly available and consumed to the point that they become counter-productive (e.g. through over-eating or overindulgence in medical care) one may talk about "over-development".[4] Development, hence, is a process making the means of need-satisfaction available to all, above a certain social minimum, or basic level, but also below a certain social maximum or ceiling level. Development shall not be identified with the satisfaction of "minimum needs", however, for what is wanted is more than minimum level of satisfaction - meaning well - distributed poverty.[5] Nor shall it be identified with over-consumptive styles of life as currently found in overdeveloped countries, and in overdeveloped pockets in underdeveloped countries.

Human needs can obviously be divided two ways, into basic and non-basic needs, and into material and immaterial needs. Both divisions are problematic. Work in this field is difficult and controversial to say the least, but for the purposes of this paper an explicit listing of basic material and immaterial needs is sufficient; the philosophical etc. underpinning being of less importance.[1] The focus will be on what in turn are basic needs, of which material needs are those that require some material components for their satisfaction; the immaterial needs can be satisfied without any material component.[2] The needs that will be referred to are as follows; the two lists serve at the same time as our definition of basic material and immaterial needs, mindful of all the variations in space and time:[3]

Table I A checklist of basic needs - material and immaterial

Material needs	Material satisfiers	Immaterial needs
(1) physiological	food, water etc.	(1) creativity, challenge
(2) environmental, individual	clothes	(2) identity
(3) environmental, group/family protection	shelter	(3) autonomy, being subject
(4) health; meaning somatic well-being	preventive and curative medical care	(4) togetherness
(5) education; meaning self-expression/ dialogue	schooling	(5) participation
(6) freedom of expression and impression	means of communication	(6) self-fulfillment
(7) freedom to move and to be visited	means of transportation	(7) a sense of meaning with life

In the middle are the material components that often erroneously appear in lists of needs. They should also be seen as more neutral than in some lists, i.e. they may not be consumed, may be misdirected and may be consumer-productive. Thus, the dilemma here is not whether food is provided, but whether it is received and retained, not whether there is enrolment in schools but whether education takes place.

2. The line to the right, of immaterial needs, follows another logic which will be made clear later. Here there are needs most easily fulfilled for intellectuals (among other reasons because intellectuals have the challenge of working together to fulfill the basic material needs of others), they should not be belittled by them. That is probably the central ideological mistake in development theory and practice: to define immaterial needs as non-basic, this paving the way for a development practice structurally similar to the organization of a zoological garden where most material needs are provided for (except freedom to move, and that education is only

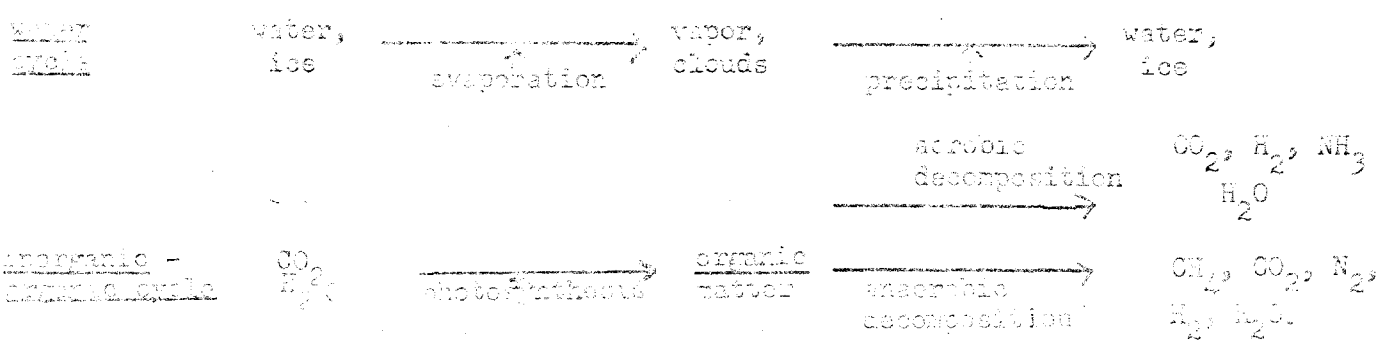
for selected animals).[11] It is also doubtful whether one should accept the idea of first satisfying material needs even at the expense of immaterial needs given the apparent difficulties in changing the structure afterwards so as to give more scope to immaterial needs, except in situations of extreme misery.[12]

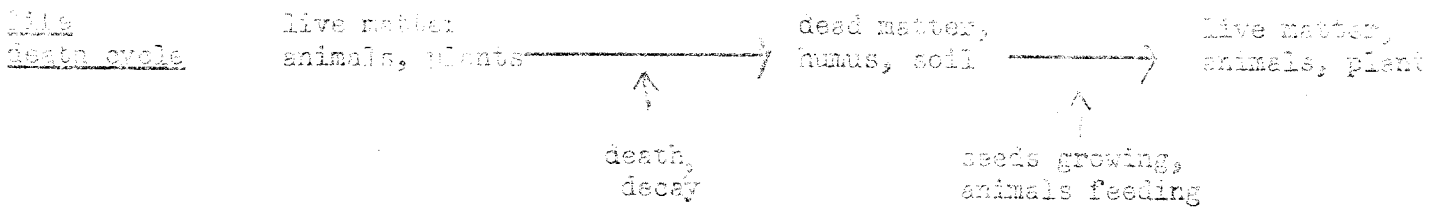
6. The best strategy of development, following the ideas so far presented would be to stimulate those processes that give first priority to the satisfaction of the basic needs of those most in need. This would mean, concretely, to give first priority to the production of food, clothes, housing etc. for the undernourished, the underclad and shelterless; and to give first priority to more opportunities for, say, creative, meaningful work to those who have the most boring, degrading work (not necessarily the same as those who are undernourished). Thus, what is rejected would be the third serious mistake in development theory and practice: the idea that need-satisfaction will best take place, or take place at all, through a trickling down process, starting with providing those already well off materially with more material satisfaction and those well off immaterially (intellectuals, for instance) with more immaterial satisfaction.[13] Needless to say there are important interrelations between the three mistakes in the sense that they are found together in the same socio-economic arrangement, to be described later.[14]

7. By 'environment' we mean the biosphere, or simply nature, admitting an anthropo-centric bias (already evident from the preceding paragraphs) we see human beings as being in a special category.[15] What is important characteristic of harboring a number of ecological cycles whereby matter, organic or inorganic is transformed from one state to the other and/or transported from one place to another, run cyclically, meaning that the basic values are regenerated and that matter appears in the same form again and again at the same places. This rhythm is essential for life, including human life. The alternatives would be a completely static world or a run-away world only replaced with linear processes whereby all matter is transformed and displaced - both of them incompatible with human life as we know it.[16]

8. Some important cycles may be described as follows, again for our purposes:

A. The fine ecological cycle:



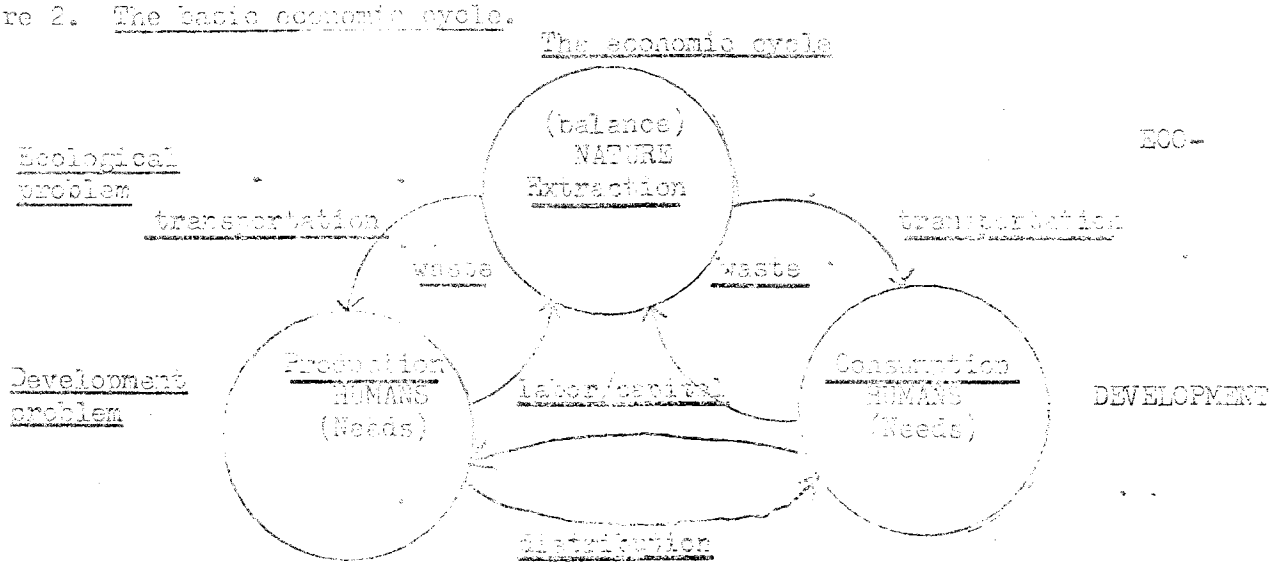


These simple cycles combine into compound cycles: water, organic matter and the inorganic compounds resulting from the decomposition of organic matter may be added to the soil and provide the basis for new life, and so on. But the water may also end up in the ocean, feeding a closed water-vapor-water cycle, all the gases may end up in the atmosphere, the soil may wash away, and so on. Nature indicates possibilities; it should not be assumed that nature is optimal. Nor is nature static: if it were there would have been no changes in the composition of the biosphere, locally or globally, ever since. All cycles - simple or compound - would have been in stable equilibrium. But the daily (the sun), monthly (the moon) and annual movements put into motion wind and water and lead to the transport of matter, sometimes reversibly, often irreversibly (as when matter ends up at the bottom of the sea). Nature also offers non-cyclical processes: the problem being to what extent man increases an unfavorable linear process/cyclical process ratio by destroying cyclical processes too much. [17]

9. Ehrlich says: half animal, half something else. As animals do: he feeds on natural ecological cycles. More precisely this means that he taps nature for air and water and for some organic, live matter. In the simple case all he has to do is to siphon off from the ecological cycle live matter in the short interval between death and decay: fruits and berries that have fallen down or are "ripe", dead animals, dead trees (for fire, maybe shelter) before decay sets in. In short: he [illegible] economic cycle [illegible] ecological cycle. Since man is a part of nature and yields inputs to nature (CO_2, H_2O, excreta, ultimately his decaying corpse) of the same kind as the products he has siphoned off would ultimately have done, man as an animal not only survived but multiplied and fitted into the ecology. All animals have some capacity to push ecological cycles somewhat to their advantage, just as man could pick berries, fruits and other edibles straight from trees and bushes and from the ground, push animals over a precipice or into a trap and store water rather than wait till nature offers all these things from an ecology of abundance. But man's capacity to manipulate the environment went far beyond this. Whereas animals have only one built-in program for fitting into ecological cycles, man was also capable of changing his program - for good and for bad. [18] Thus man's interference with nature was at least potentially deliberate, conscious.

10. Man could construct economic cycles, animals could only create programs for ecological cycles. An economic cycle, like an ecological cycle, starts and ends with nature. But whereas all economic cycles are ecological cycles not all ecological cycles are economic cycles. In an economic cycle there are man-made production and consumption poles and the cycle operates something like this:

Figure 2. The basic economic cycle.



There is Nature with its problem of balance and Humans with their problem of satisfying needs, material and immaterial. Then there is the process of extraction from nature; transportation of what is extracted (raw materials) to sites of production; distribution of what is produced to sites of consumption against some kind of compensation in the form of input of the other two production factors, (labor and/or capital). There is also some direct consumption from nature of the hunter-gatherer type mentioned in the preceding paragraph (e.g. of air and water, berries and fruits in the "season") but as these cycles evolved direct consumption decreases in relative importance and indirect consumption via production increases. Finally and importantly, both from production and from consumption waste products (industrial and domestic) are sent back to nature. Instead of feeding of the waste products back to ecological cycles, man sends back to nature the waste products from his economic cycles, with the hope that nature's ecological cycles can handle them. Nature has been assumed to be capable of absorbing extraction without significant depletion and waste return without significant pollution, and this theory has been protected by the tendency economists have had to focus on the lower part of the cycle only, leaving out nature and the problem of nature budgeting (ecological balance). 20/

11. In the figure the two problems - the ecological and developmental problems - are indicated: is the cycle set up in such a way that nature remains sufficiently balanced and so that human needs are satisfied? To the extent that these two problems were solved one shall talk about eco-development; if not

of some type of maldevelopment.[21] This, then, gives rise to an assumption: there are many ways of organizing economic cycles, and that it is given to man - often through tremendous efforts - not only to become conscious of the program he is enacting in the cycle he is operating, but also to modify the program and - to some extent - to implement that modified program.[22] In other words, it is assumed that man is not, like animals, tied to one program only even when the program is self-destructive (as it has often been for the species on earth that are no longer among us). One condition for this, however, is that one is trained not to see any particular arrangement of the economic cycle as more natural than others to the point of being the way the economy has to be run, and that one is trained not only in critical awareness concerning the dominant cycle, but also in constructive theory and practice in developing alternatives.

13. The difference between natural ecological cycles and man-made economic cycles is "technology". In other words: technology implies modification of natural ecological cycles. In saying so it is implied that much of what goes on in an economic cycle are natural cycles, e.g. of the three types mentioned above. When the transition from nomadic hunter-gatherer societies to more sedentary agricultural societies took place soil was tilled so that minerals etc. would be extracted from it. Agricultural production took place where nature was, and consumption very near by. If the water-vapor-water cycle operated right there was no need to modify that part of the ecology. All that was needed were some tools to till the soil and to make use of the natural cycles. If this proved insufficient technology might enter bringing water to the production sites (the fields), in the complex systems of irrigation man developed, and in our time, possible, by seeding clouds, even after first bringing them over the fields. Technology is modification, and from the Figure it follows that one may distinguish between the following kinds of technology:

technology of extraction
technology of transportation/communication
technology of production
technology of consumption
technology of ecological balance

Thus, there are many kinds of technology but they all serve to modify ecological cycles into economic cycles. In addition they satisfy human needs as mentioned, economic cycles, and technology, serve development; but not all economic cycles, or technologies, do; nor do they serve ecological balance. If cycles now could all be classified as "only good" or "only bad" from the point of view of eco-development the task would be easy; unfortunately, most cycles are productive in some ways, counter-productive in others and simply irrelevant in still others.[23]

13. The naive view of technology would be to see it merely as a question of knowledge and tools. These components are important, but they are at the surface of technology, like the visible tip of the iceberg. Technology also includes an organizational structure, even a deep structure.[14] Underlying knowledge is a certain cognitive structure, a mental framework, a social cosmology serving like the fertile soil on which the seeds of a certain type of knowledge may be planted and grow and generate new knowledge. And in order to use the world a certain behavioral structure is needed. Tools do not operate in a vacuum; they are man-made and man-used and require certain social structures to be operational. Even a fully automated production technology implies a cognitive and behavioral structure, viz., one of detachment from the production process. For reasons that will become obvious later there is generally a low level of awareness of these structures associated with technologies. Even in spite of the strong Marxist emphasis on a relation between means and modes of production there is a tendency to reduce technologies to techniques.[15]

14. Thus, it is the basic thesis of this paper that for each technology there is a class of compatible structures (cognitive and behavioral) out of which any structure empirically associated with the technology is one.[16] It may not be the only one, however - hence the concept of compatible structure to make the whole idea less deterministic, more flexible. Correspondingly, there is a class of incompatible structures with which the technology becomes inoperative. To take a simple example of a technology: a game of chess. The associated behavioral structure is a bilateral interaction relation between individuals; the associated cognitive structure is the Man-over-Man idea: the idea of a winner and a loser. But the compatibility class of structures includes such ideas as one group playing against another group, a multilateral relation whereby one player plays more than one game against a number of other players, and a unilateral relation whereby one person plays with himself (some level of "schizophrenia" might be required for this). In the incompatibility class would be a trilateral competition, or the idea of non-competitive games - co-operation towards harmony.[17] Thus, there is usually an associated structure intended or taken for granted through habit; the possibility of exercising other cognitive and/or behavioral interaction, and some limits or constraints on that innovation set by the non-structural parts of the technology. In short, there are compatible and incompatible structures.

15. To discuss social structure in reasonably precise terms we choose as a point of departure the social structure we know best: Western social structure. In spite of large variations in space and time it exhibits some degree of invariance - at least sufficient to make it possible to lay down some characteristics and identify it as a social structure, particularly prominent in dominant sectors of the Western world, and for that reason dominant in the world as a whole.[18] The distribution component above, between the capabilities and of the world or social

cosmology, and the behavioral enactment of the structure, or "social structure" in a more narrow sense will then be made use of, and we shall start with the former.

16. To discuss the cognitive social map of the world some key categories have to be chosen.[24] Thus, some idea has to exist of the structure of social SPACE, of the composition of social TIME, of the nature of social PROCESS, of the relation between MAN and MAN, and the relation between MAN and NATURE. Other key categories exist but if some notion can be developed as to the Western idea of normal space, time, process, man/man and man/nature relations a necessary and sufficient basis for understanding what Western man would see as normal structures, and hence as normal technologies and economic cycles, should be possible.

17. As to SPACE: the conception of social space seems to be highly asymmetric. There is a Center located in the West from which everything radiates, and a Periphery which is the rest of the world. These two parts stand in a clear cause-effect, subject-object, sender-receiver relation to each other. The Center is not unitary, it is pluralistic - sometimes inspired by picking elements from the periphery - and there is a center in the Center moving from place to place through time (once it was Rome, once Germany, once France, once Britain, once US, now it is perhaps bicentral with the US and the USSR as two poles[30] within the Western Center). Nor is the Periphery unitary: it is sometimes divided into an inner Periphery eager to receive the Western message (Christianity, Western science, capitalist organization, technology, development ideas)[31] and an outer Periphery that will not or cannot convert. But basically the whole world is included and seen as potential recipients and converts of and to Western messages and products. The West is seen as a fixed point in the universe. It may grow but not change its basic parameters for Northern society is seen as normal society. Its laws are universal laws; others will develop to the extent they discover/uncover their true underlying nature, meaning their Westernness, get rid of archaic elements.[32] Of course, alternative images exist. There is the possibility that the world might be seen as multicentric, in a symmetric fashion. Or it may be seen as unicentric, but only relative to a pocket of world geography; the rest being inferior ("barbarian") to the point of not being worthy of serious attention,[33] or superior to the point of being feared as something to be closed out - or neither inferior nor superior, simply different, of another kind with which one can interact, but at a distance.[34] It should be noted that to see oneself in the Periphery of a Western Center, as "el último rincón del mundo" indicates internalization of the Western image of space, only seen from the bottom up.[35] Then, there is also the possibility of conceiving of the world in the Western way only with the Center located elsewhere - but no such social cosmology is known to exist at present.

16. As to TIME: the perception of social time also seems to be highly asymmetric, as expressed in the Idea of Progress,[17] (the bad in error), there is a purpose in history, from lower to higher forms. The idea has a continuous, accumulative liberal version and a more sophisticated, discontinuous, marxist version where transitions from lower to higher forms is seen dialectically, as a transition from (accumulation of) quantity (of contradiction) to (a new) quality. In both the idea is enriched through concepts of Paradise Lost (e.g. Utkommunismus, the self-regulated village market), the Fall, Selbstentfremdung, Growth/Development, impending Crisis and (if overcome) Catharsis or Paradise regained. To liberal thinking crisis becomes a problem of management that can be handled by the existing structure, to the marxist the crisis takes the form of a basic contradiction that can no longer be handled by the structure (nor can it be handled conceptually within the paradigm of the thinking generated by the dominant class in that structure) - leading to notions of Aufhebung, transcendence into new types of structures. Seen in historical retrospect evidence seems to be more on the marxist than on the liberal side: there has been accumulation within existing structures, but there has also been relatively discontinuous transitions to other social forms.

Alternative images might see the world as heading neither for the better nor for the worse - at least when essential factors are considered.[27] Time might be equipped with a downward slope, heading consistently for the worse. Paradisiac forms at the beginning and the end of time may be put off. The big Crisis may be seen as something belonging to the past, something might ahead of us or something for the remote, unspecified future. If the crisis is such as impending the burden of History is such as rests on us, here and now - which could lead to a push towards achievement or to some kind of apathy, but in either case to a very demanding relationship to human existence. Most alternative images would be more relaxed. Some dreamers may disdain time package (if this is a valid image) provides for maximum drama, place in time and now at the center of space and time.

17. As to PARADIGM: the typical western approach to problems is highly selective, analytical and non-dialectical. The world is seen as consisting of elements and variables that can be detached from each other. The elements - human beings, societies, lumps of nature - can be subdivided and the good can be sorted from the bad, the bright from the dull, the guilty from the non-guilty, the deviant from the normal, rich from poor, developed from developing into clear-cut categories. Variables can be divided into independent and dependent, into causes and effects. Operational models are typically based on binary causal relations between (a set of) independent and (a set of) dependent variables whereby it is hoped to bring the inferior up along a slope towards perfection, compatible with the idea of progress. Usually, those binary causal relations are chained together into a system of thought with a closer open which would then be the fundamental cause, the nucleus of the causal nexus. Deductive thinking often becomes a guide for a political practice that

points many contributions to flow from a well-directed attack in the correct manner.[39]

Alternative images would be more holistic and more dialectical. They would focus on total configurations,[40] on complex social grammars, not only on some special binary relationship within a totality, a "whole" singled out for attention and blown up disproportionately in the search for one relation that can carry the burden of progress on its shoulders (e.g. the postulated relationship between educational and economic growth). The dialectic emphasis would deny the possibility of sorting the good from the bad but insist that yin and yang go together, that everything is contradictory (that even in the yin, and in the yang, there is yin and yang, and so on, ad infinitum). Hence nothing is perfect, everything will show its cracks sooner or later, it is normal that for instance a technology is contradictory in that it has both positive and negative effects - hence approach it dialectically, do not try to pretend the contradictions but analyze them with a view to overcoming them, and then look at the new contradictions inherent in the new technology. More particularly, there is no such thing as the crisis after which a contradiction-free paradise ushers in (the war to end all wars, the revolution to end all revolutions). History is an endless series of contradictions that build up and lead to some kind of transcendence to new contradictions and so on -- and it is given to man to understand and to steer to some extent, but not to make for a contradiction free world.[41]

20. As to MAN/MAN relations: the typical Western approach is clearly vertical. There are different kinds of human beings according to ascriptive criteria (age, sex, race, birth order etc.) or criteria of achievement (occupation, income level, educational level, place of residence), but the idea has always been that they can serve as criteria for ranking man over man.[42] Moreover, and more specifically, the typical Western approach to conflict seems to be through a competitive, even combative process that defines a winner and a loser (votes, courts, procedures, voting procedures, elections, sports, mathematical computations in general, bullets) rather than through a process that leads towards consensus and some kind of harmony (deliberations and debates until consensus has been arrived at).[43] Conflicts, hence, will lead to the sedimentation of a layer of winners over and above a layer of losers, and society reflects many such layers that are indicative of battles past and present until some kind of uneasy equilibrium is found. The alternative image would be essentially horizontal, but that can better be spelt out when the structural components of verticality have been clarified.

21. As to MAN/NATURE relations: the typical Western approach is that it is vertical, that it is given to man to rule over nature, to be to nature what God

is to man, including creating and destroying nature at will.[42] This is also reflected in natural science which tends to be analytical and non-dialectic, subdividing nature into elements and particles, and variables, looking for sorting mechanisms in an effort to purify (not accepting nature as it is), and for binary causal relations in an effort to modify. Nature is divested of much internal life by being seen in a non-dialectical perspective, as fundamentally different from man. Again some elements and some binary relations are taken out of a context and blown up beyond the proportion found in nature. Natural laws are used, but in non-natural settings. The surprise is great when the result is some kind of breakdown.[43]
Alternative images are provided by today's ecological movements that may be seen as efforts to come to grips with nature in a more holistic and dialectical manner. But there are deep and shallow aspects of this "movement", the latter focussing on problems of depletion and pollution as isolated and isolatable phenomena, calling on special technologies of waste disposal to restore the ecological balance rather than on ways to conceive of the total relationship between nature and human beings in man-generated economic cycles.[45]

22. It is the totality of these five components that, perhaps, may be said to constitute basic aspects of the Western social cosmology, taken one by one they may certainly also be found elsewhere. Together they constitute an image of what would be a *normal social configuration*: a configuration with its center in the west in the sense of networks of transportation, communication and causal dependence with regions, countries, districts and individuals organized vertically along center-periphery gradients,[46] with science trying to come to grips with nature in a highly non-empathic way, at a distance, with scientific insight being converted into technologies that greatly modify ecological cycles but in such a way as to spread the impact through space into the peripheries of the world and through time in steady accumulation, "economic growth". *Normally this basic configuration will appear as normal and less questionable than the opposite.* Thus, peripheries that refuse to be incorporated will be seen as not only counterproductive but as anti-natural; zero or negative economic growth is not only indicative of an economic crisis but of a much deeper challenge; horizontal human relations and *Partnerschaft* rather than *Herrschaft* over nature is seen as archaic, as "dropping out", and so on.[47]

23. In general this may be characterized as an outward-oriented, change-oriented, competitive-oriented, even dominance-oriented culture; the important point being that this is not merely expressed in certain global structures, but already found deep in the social cosmology of the culture itself.[48] However, the structural

expressions in concrete, behavioral terms are important because they are the operational manifestation. More particularly, there are four structural characteristics that all can be seen as variations of one theme, that of verticality, or center-periphery relations. They can be referred to as "exploitation", "dependency/penetration", "fragmentation", and "marginalization" -- these terms being understood as technical terms denoting certain structural arrangements operating at the local, national and international levels, rather than as political-emotive terms. They are seen as the rules of a "social grammar".

2. Exploitation, or vertical division of labor, is the best known expression of verticality or center-periphery relations. Generally speaking it refers to differences in levels of satisfaction of material or immaterial needs insofar as these differences are caused by the interaction relations found in the total structure. There are two kinds of exploitation: [50]

terms of exchange exploitation, meaning that in the exchange between the parties some get (much) more than others.

spin-off exploitation, meaning that the internal changes, the "in-changes" in the parties, caused by the interaction, is much more favorable to some than to others.

The former can be understood by studying what passes between the parties, the latter by studying what goes on inside the parties. Since what passes between them is to a large extent material, it is in this type of exploitation that the direct source of, say, pauperization is found -- viz., because the masses in the periphery are deprived of, for raw materials, use of land (for food production for local, mass consumption), local capital, human labor (both in the form of brain-drain and body-drain) in return for very little or for something that is absorbed by the elites in the periphery countries. [51] The spin-off effects can also be very material, as when the matrix of interlinkages between the various economic sectors in a center country is much more saturated than in a periphery country (the sectors in the latter being linked to the center country rather than to each other); [52] but they are also very often immaterial. Thus, a crucial form of division of labor is between those who solve problems and those who implement solutions; the latter are enriched, expand their personalities, by the challenges derived from the problem, the latter stagnate for lack of challenge, possibly also suffering some kind of personality-contraction through excessively routinised work. [53] As a consequence the former have much more of a chance of imprinting their

work product with their own individuality and hence to become less substitutable; [57] the latter become substitutable because their tasks could just as well be carried out by somebody else with the same transferable qualifications. [58]

23. Dependency/penetration can also be understood in two different ways, one more superficial, the other of a deeper nature. At the more manifest level, and between countries, it primarily appears as a problem of import and export dependence, meaning that the stability of the system would be threatened if production factors or products could not be imported or exported. [59] Thus, some countries may depend on the import of oil or other energy sources, or on grain, other countries may depend on the export of these commodities or on the export of labor - brain or body, in return for remittances [60] export of capital to guarantee an acceptable average profit, e.g. in the form of technology exports. [61] At a deeper level dependency takes the form of a penetration that amounts to a causal relation, in the sense that the causes of what happens in a periphery country are found in the center country. [62] Along such causal chains disparate phenomena like taste formation, images of social reality, inflation, unemployment etc. may pass, often mediated through the elites of the periphery countries. [63]

24. Fragmentation stands for a particular structural arrangement whereby the center is much better integrated than the periphery. At the global level it may take the form of much more interaction between the countries at the top of the structure than those at the bottom. At the domestic level the same may apply to districts; at the local level to individuals. Ultimately fragmentation in the Western sense would end up splitting individuals apart since individual are seen as the "social atoms", the building stones out of which groups and societies are made. [64] In other cultures groups or collectivities (e.g. families) in general may play that role, stopping short of individualistic fragmentation. [65]

25. Marginalization, like fragmentation, is a structural arrangement that separates the center and within the periphery - thus sustaining vertical division of labor and dependency relations. At the global level it takes the form of center countries forming cohesive actors, associations/organizations, excluding periphery countries - and so on at lower levels of social organization. Just like fragmentation it can be counteracted by the periphery countries setting up their own interaction networks and their own organizations - the term "marginalization" stands for an asymmetry in favor of the center in this regard. [66]

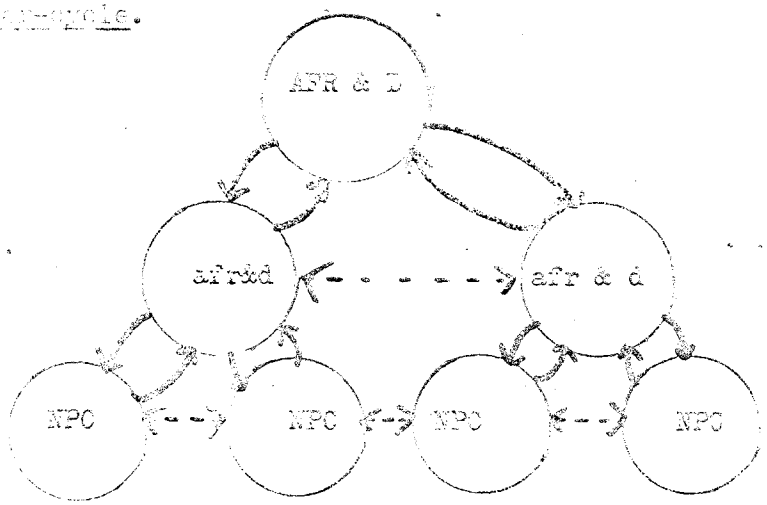
28. Taken together these four make up a total structure that operates much like a system of Chinese boxes. First, there is a global structure where regions and countries are interrelated according to the social grammar constituted by these four components. Second, there is a national structure where the same form is reproduced in relations between districts, productive units and so on. Third, there is a local structure within the district/municipality or productive organization (farm, factory, firm) organized much in the same way; altogether creating considerable vertical distances between the "center of the center of the center" and "the periphery of the periphery of the periphery" because of the chains of exploitation and dependency, supported by fragmentation and marginalization.[66] Only a minor part of this is captured by focussing the attention on terms of exchange and import/export dependencies alone - possibly less than the famous tip of the iceberg. Terms of exchange can be rectified (in the sense that a higher price is exacted for raw materials and a lower price for technology), yet the spin-off exploitation may be the same or even increase, legitimized by the improvement in terms of exchange. Import/export dependencies may also be rectified through more domestic/local production for domestic/local markets, yet the cause-effect dependency may be as operative as ever, among other things determining what to produce and how to produce it. [66]

29. The basic point in this connection, however, is that from the point of view of the dominant system this structure is the normal structure. This does not mean that it is perfect; there is agreement that the conditions along its peripheral edges are miserable. But the point is that efforts to change these conditions to the better will have to be in conformity with this structure to be acceptable (to be "taken seriously"). In other words, there is no need for structural transformation; if there are problems it is because one has not as yet found the right remedy or applied it correctly (including structurally correctly). The alternative structures, based on equity, autonomy, solidarity and participation (to be spelt out in some detail in chapter 4 under the heading of "self-reliance") would be seen not merely as a threat to the existing order but also as somehow unnatural, because they run counter to the social cosmology already described. In that kind of world there would be no clear center; it would be multicentric. Division of labor would be much more horizontal, there would be a higher level of autonomy, more solidarity among the weak, less marginalization into first and second class groupings, viz., a structure "contrary to human nature". [67]

30. All that has been said above has profound impact on the economic cycles and has led to the emergence of economic super-cycles. There are still simple

nature-production-consumption (NPC) cycles, but they become incorporated in a super-cycle that also contains a fourth component where there is neither extraction nor production strictu sensu, nor consumption going on but purely symbolic activity. These are the nodes in the total economic cycle devoted to administration, financing and research and development (AFR & D). These are highly brain-intensive points in the cycle, specializing in tertiary sector activities, leaving the more primary- and secondary-sector type activities to the NPC-parts of the super-cycle. The total configuration may look something like this:

Figure 3. The economic multi-cycle.



Thus, in the super-cycle there is an international control center processing symbols (problems into decisions, raw capital into investment capital, science into technology); there are national sub-centres that carry out similar tasks on a lower level of processing (hence the lower case letters) and they in turn are handling the more or less national economic cycles that enter as constituent molecules in this super-molecule. There may also be some direct links between the lower levels, but by and large the rule is that basic decisions, capital and technologies are handed down through the levels in the super-cycle, and that raw capital, labor (brain- or body-intensive) and some of the products flow upwards for further processing at the center, or simply for consumption. Needless to say the transnational corporation is the clearest embodiment of this general structure, because it is all integrated into one corporate structure. But the structure can also be recognized in the network of bilateral and multilateral arrangements between and within countries, not the least in the intergovernmental organizations, without necessarily being formalized into corporations.[60]

11. The point in this connection, however, is that the super-cycle solves a problem the simple, autonomous, more symmetric basic cycle does not solve:

the super-molecule is a perfect expression of the center-periphery structure mentioned above, which in turn is compatible with the Western social cosmology, because it is

exploitative - both in the "terms of exchange" sense and in the "spin-off" sense - the most challenging, innovative, complex tasks being reserved for the international super-center and the national center;

dependency creating - with the centralization of administrative, r & d and finance inputs the national and local levels cannot survive long without the center (nor can the center without the other levels though - and therein lies their potential strength); [69]

fragmenting - the lower levels are much less integrated than the higher levels, the structure is connected at the top;

marginalizing - there is a clear dividing line between the "first class" members of the total structure, those who handle

administration - the "bureaucrats"
financial matters - the "capitalists"
research & development - the "scientists/technicians"

and all the others in the super-cycle, with workers given routine jobs, children and adolescents stored away in schools, old people pensioned off into old age homes, women working in the families. [70]

12. There is no clear borderline between the three elite groups inside the center of the super-cycle but they tend all to have university degrees and to be "professionals", elites". This being the case one would in general expect these groups to have considerable vested interest in the structure and to defend it against attacks. It should be noted that one way of doing that would be to reproduce the international structure nationally, cutting the ties to the international center (or at least making the ties less vertical), establishing national sub-centers (thus maintaining the total distance between center and periphery within the super-cycle), legitimizing national elite position by a firm stand against incorporation in an international super-cycle. [71] But we are not quite at that point yet; still the global super-cycles dominate and has all the structural characteristics discussed above, and also the compatibility with the

cognitive map (the center is in the West, with Japan operating a system of its own; there is both growth and crisis in the system; the system conceives of itself as a set of detached units and bilateral relations rather than as a total configuration; the system is filled with man-over-man relations and at the very bottom is nature, increasingly depleted and polluted).

33. We shall now refer to a structure of this kind as an alpha structure. Its structural characteristics are as defined above, but it also has some other characteristics. Alpha has no size limitation, all that is needed is to add another level in the pyramid and the super-cycle can attain a "global reach" [72] not only in the sense of being present in most nations, but in the sense of reaching into the most remote villages. Further, alpha is not very dependent on the important discontinuities in nature, since it can move everything around, cancelling out some of the important asymmetries in the world economic geography (e.g. by moving resources into resource-poor areas) and some of the seasonal variations (linking villages to industrial production during the slack seasons in the agricultural annual cycles). [73] Nor is there any doubt, since the proof is all around us to see, that alpha can produce an astounding variety of goods and services of all imaginable, some of them even unimaginable, kinds. This very mastery of nature, however, also has its well-known limitations: man becomes so removed from nature that he no longer sees the impact he has on ecological balances - thus recreating dependencies unheard of before, but of another kind. [74]

34. On the other hand there is what might be referred to as the beta structure, or a class of beta units. [75] One way of defining this structure would be as the negation of all that has been said above: the concrete social structure is equitable/autonomous/solidary and participatory; and the accompanying cognitive map or social cosmology shows a world which is more symmetric/multicentric, less dramatic, less competitive- and dominance-oriented, and more in harmony with nature. It should be emphasized that the beta structure is not only behaviorally different, it also differs in its cultural base- and the latter would be different from dominant aspects of Western culture. [76] A structure of that kind would also have some other characteristics in addition. Beta has size limitations. If people are to have meaningful relations to each other and not be fitted into center-periphery hierarchies, and in addition participate in what happens around them then there is an upper limit to how many can become members of a beta unit. This is one reason why family-run farms and shops, and villages, have the size they have. [77] Moreover, if the beta structure is more inward- oriented, more local and decentralized, the economic cycles (not super-cycles, they belong to the alpha structure) on which it is based materially would

be more exposed to the discontinuities of nature in space and time. Hence, although the structure by definition is less dependent on higher levels, or autonomous relative to them, it may be more dependent on nature. On the other hand, that very dependency may also forge stronger and more harmonious ties between man and nature and these ties may in and by themselves counteract some of the dependency.

35. With the alpa/beta conceptualization the stage is now set for a more detailed discussion of technology where the basic point will be to find out to what extent a given technology has an associated structure that is in the compatibility class of one and the incompatibility class of the other. This will be carried out in the second chapter. In the third chapter some of the eco-developmental impacts of technology, particularly alpha type technology, will be discussed, meaning the impact in terms of human needs satisfaction and in terms of ecological balances. However, the basic position taken will not be that of extolling the virtues of beta over and against alpha ending up with a neat conclusion in terms of "down with alpha up with beta". Rather, the conclusion will be in terms of an alpha/beta dialectic, seeing the two as interrelated, both having advantages and disadvantages. The point will have to be that alpha is by far overstepping its borderlines, pressing beta into a corner - asking for ways of pushing alfa back and changing alfa as well as for ways of creating more beta structures, in other words for a better mix. That mix will be referred to as "self-reliance" (neither local beta "self-sufficiency", nor, indeed, alpha incorporation), a theory of which will be outlined in chapter 4. The question of what technology is compatible with that mix will then be discussed in the final chapter 5. [23]

Chapter 2

TECHNOLOGY AND SOCIAL STRUCTURE: A THEORY AND SOME CASES

36. The general definition used here of technology, as developed in the preceding chapter, is that technology = technique + structure. The technique constitutes the visible tip of the iceberg: the tools and the know-how. The structure is the social relations or "mode of production" within which the tools become operational, and the cognitive structure within which the know-how becomes meaningful. 1/

37. There is a dominant structure in the world tied to Western conceptions of social reality. The structure is vertical, centralizing and is characterized by such features as vertical division of labour, dependency, fragmentation and marginalization. This structure is operating on at least three levels:

- globally: between regions and countries in the Centre and regions and countries in the Periphery;
- nationally: between districts and cities in the centre, particularly the capital, and districts, towns, villages etc., in the periphery,
- locally: in the district or in the farm/factory/firm, between superiors and inferiors, with the former controlling more of the tools and/or the know-how (and means of production) than the latter.

These three levels relate to each other with the centre at a lower level being the representative, contact-point or bridgehead at the higher level. This way a chain of dependency relations is set up from the extreme centre internationally to the extreme periphery locally. 2/ This being the dominant structure, a number of theses follow, to be formulated and explored in this chapter.

38. THESIS 1. The dominant structure will define the techniques rather than vice versa. In other words, those techniques will be selected (defined as "modern") that induce structures similar to the dominant structure. 3/ Concretely, this means that the "ideal" technique has the following characteristics:

- globally: it should originate in the world Centre or at least be developed there. The know-how should be tied to means of knowledge production located there, and some basic tools should be produced there;
- nationally: the national centre, e.g. the capital should be an indispensable transfer point both in the sense of having a monopoly on selection of techniques with some elementary adaptation to national (not necessarily the same as local)

conditions, and in the sense that globally and nationally produced tools are assembled in the national centre;

- locally: the techniques should induce a vertical division of labour between those who have more and those who have less control over tools and/or the know-how.

The economic consequences of these principles are well known and to a large extent well documented: 4/

- through a chain of unequal exchange relations a net transfer of economic surplus from the local periphery through the national centre to the international centre;
- through a chain of vertical division of labour more accumulation of all kinds of spin-off effects in the Centre than in the centre, and more in the centre than in the periphery by virtue of having access to the more challenging parts of the economic (super-) cycles;
- a chain of dependency relations where the lower levels increasingly depend on imports of tools and know-how from the higher levels, so that higher levels may have basic impacts on all or most structural and cultural aspects of lower levels through changes in techniques and know-how;
- a chain of fragmentation relations, the centre being better integrated to the point of oligopolistic/monopolistic control over the production of tools and know-how and the periphery being unable to formulate or produce alternatives;
- a chain of marginalization relations with the centre commanding international organizations, or national organizations, controlling generation and transfer of technologies.

In the following the emphasis will be on the non-economic factors.

39. ImISIB 2: A technique that induces a different structure will tend to be "co-opted" so that a technology at least partially compatible with the dominant structure emerges. Given the economic and other interests in the dominant structure a technique inducing a locally self-reliant, less vertical etc., structure would be subjected to strong forces so as to create a technology more compatible with the dominant structure. 5/

40. By "transfer of technology" we mean a process with two components. The most visible component is the transfer of techniques, meaning some key tools and know-how, globally and/or nationally. Since the technique cannot become operational without some structural context, a transfer of technique also has to be analysed in structural terms. There are several possibilities:

- first, that the techniques are compatible with the social and cognitive structures in the receiving countries, in which case the techniques are easily embedded. Transfer becomes a question of technical competence in mastering tools and acquiring know-how;
- second, the techniques on the one hand and the social and cognitive structures on

the other are incompatible, and in this case we can distinguish between three sub-cases;

- the receiver yields, structure and culture start changing to adapt to the new techniques, a process of "westernization" or "modernization" sets in; [6]
- the techniques are rejected, tools and/or know-how. Very often this will take unarticulated, even unconscious forms and show up as receiver uneasiness, is seen as "irrational", "traditional" or simply "lazy" in some sender's point of view and in some cases even as direct sabotage; [7]
- there is some kind of accommodation: the receiver manages to retain much or most of local structure and culture and to embed the technique within that setting, or to modify the techniques so as to obtain compatibility without making the technique inoperational. [8]

41. THESIS 3: "Transfer of technology" can never be a scientific or politically neutral process, the use of such terms as "traditional/modern" or "developing/developed", giving an impression of a generally accepted or historically inevitable process, notwithstanding. The nature of the transfer of technology process should rather be seen in terms of "Western/non-Western", since this makes the nature of the process more clear. From this it follows that if there is incompatibility between a technology and receiver structure/culture then it should not necessarily be assumed that the latter has to yield or that resistance to change can be stamped out as due to "irrational" or "traditional" culture, or to their structures being "archaic" or "feudal". [9] Correspondingly, nor should it be assumed that compatibility between a technology and a local structure/culture, and easy transfer, can be taken as proof of success, for it may be that the local society has built into it some of the same unfortunate characteristics as a given technology. [10] A fit between two wrongs does not constitute one right. If a Western technology works well in Western society that does not prove that Western society is a "good society" in the sense used in this paper ("capable of fulfilling basic material and non-material needs for all members of society"). It only proves that there is compatibility. Correspondingly, nor does it follow from a case of incompatibility that the technology is necessarily wrong: it could also be that there is something basically wrong from the same point of view with the local recipient society. [11] Only if one assumes that Western structure/culture are somehow normal will compatibility immediately, or after a period of accommodation, be seen as progress. If not it is the structure, not the acceptance of a technique that has to be evaluated.

42. THESIS 4: The transfer of technology being a very deep rooted and complex process, discussions of the terms of the transfer should not be limited to the terms of transfer of techniques alone. If a successful transfer implies a successful implantation of one structure/culture on the soil of another society the changes that take place in that society should be included in the analysis of the terms of transfer. [12] Thus, to the sender

a successful transfer in this sense means an expansion, or reproduction, of the structure and culture of the sender's society, even increased legitimacy of that society through the implicit validation of being "accepted" by others. This in itself constitutes a gigantic causal chain with the cause being the sender society and the effect being its reproduction in recipient society - in other words, a major form of dependency. Structural/cultural patterns in one society start becoming the norm for another society. The sender does not have to give anything in return for this, leading to a pattern of highly unequal exchange, for the senders generally do not accept even parts of the receivers' structural culture, the idea being that their own structure/culture is "developed, modern".[13] There is even the circular reasoning that this position is justified by the fact that sender structure/culture is already adapted to the techniques, whereas the receiver structure/culture is not, using the technique as the justification of the technology.[14] Influence tending to be a one-way process as far as technology is concerned a "successful transfer" will be unequal three ways: the individual technology is already asymmetric in the ways indicated, in addition it contributes to general "Westernization" and third; in so doing it paves the way for the easy acceptance of other technologies with the same types of structural implications.[15]

43. THESIS 5: Changes in the world structure will have important effects on the patterns of transfer of technology. It may be fruitful here to distinguish between four, possibly five phases that the technological order of the world has been/is/may be going through. First there is what might be called the "old technological order" where Western technology was transferred on Western terms, the transfer process being protected by colonialism or early post-colonial structures. Second there is what may be called the "new technological order" where the terms of transfer for techniques, tools and know-how, are contested, codes of conduct are worked out etc., so that techniques can be transferred at lower costs for the receivers. The old order is seen as a clear case of technological dependence, it is hoped that the new order, with more reasonable terms of transfer will lessen the burden of technological dependency. In the new order the idea of Third world co-operation both in selecting and generating techniques will play an important role and gradually pave the way for a more active role.[16] However, the structural aspects will not be really considered in this phase, partly because of low level of consciousness about how they operate, partly because of economistic thinking filtering away such considerations, and partly because regional and national elites prefer the Western structures to their own (1) because they agree that the West is "modern" and they are "traditional", (2) because of their vested interest in using those structures to bolster their internal control of their own countries.[17] After some time it is "discovered" that structural dependency is still rampant, and this gives rise to a third and fourth phase that both can be said to belong to the "technology of self-reliance": a third phase where Western-type technology (meaning techniques that give rise to Western structures) is produced regionally,

nationally even locally; and a fourth phase with more consideration given to structural/cultural factors and the impact on man and nature - with new patterns of selection and generation of techniques.[18] In this phase the characteristic feature of self-reliance emerges: walking on two legs, meaning generating both Western and non-Western technology (with the use and further development of traditional technology as a special case of the latter), constituting real independence in the sense that one neither slavishly accepts, nor rejects, Western technology. And finally a fifth phase with "transfer of technology in the opposite direction", meaning a demand in today's sender societies for techniques generated elsewhere, because of increased interest in the associated structures.[19] Needless to say, all of this will be strongly related to world power structure.

44. THESIS 6: Changing structures may substitute new techniques. A country exposed to a new structure in the form of economic boycott will try to adapt by developing new techniques so as not to submit to the international power structure; probably one of the best proven ways of obtaining some measure of national technical independence.[20] The knowledge that one can survive and even do well without technological dependence on the Centre, once gained, is hard to lose even if there is a yearning to return "normal" (meaning dependent) structures. The same applies inside countries: open conflicts with "minority groups", for instance, may bring about increased reliance on local traditions.[21]

45. THESIS 7: Changing techniques may generate new structures. In a sense this is the most interesting thesis, but it is probably only correct to the extent that there is a deliberate search for techniques that do, in fact, generate new structures. For this to happen a clear image of the desired structure is probably indispensable, one cannot rely on the mechanism of technical innovation by chance leading to more desirable structures. In short, what is needed is a more conscious view of the interface between techniques and structure/culture components of technologies.[22]

46. These theses do not constitute a model to be tested in any rigorous way although much of it probably is testable. Rather, they serve as perspectives on the fifteen cases to be discussed below, spanning the range for technologies indicated in 1.12 (extraction, transportation/communication, production, distribution, consumption and ecological balance) and intended to illustrate how the structural components operate through the techniques themselves, and how they can, to some extent, be counteracted through alternative techniques, given the right conditions. In selecting the cases we have not been limited to technologies of production for material needs, basic or not basic, but made use of the broad definition of technology developed in chapter 1 in order to indicate how many-faceted the problem of transfer of technology is once the non-economic aspects are fully taken into consideration.

47. A technology often overlooked because there is no hardware component is the technology that can be referred to as intellectualism. The basic component is, of course, intellectuals of various kinds, particularly those whose task it is to reflect on and enter into the affairs of other human beings. Their (our) major tool is abstraction, and the method is symbolic manipulation; the creation and storage of verbal symbols along a combination of deductive and inductive channels resulting in other verbal symbols that may or may not be translated into some kind of social practice. It should be noted that in doing so other human beings may serve as material for abstraction into symbolic categories that are then counted, classified, analysed in various ways - in short, processed. It should also be noted, that there is a very close correspondence between the phenomenon of intellectualism in human/social affairs and the center periphery structure found in the nation state politically, militarily and culturally, and in the capitalistic arrangement for economic production and social reproduction: the unit handled is so big that it can only be understood in abstracto, not in concreto as is possible when the unit is of the magnitude of 10^2, 10^3 perhaps even 10^4.[23/] The nation state is probably inconceivable without intellectuals and the super nation state (of the magnitude of 10^8) probably inconceivable, at its present level of operation, without the assistance to the central core of intellectuals provided by artificial intelligence in the form of computers etc. Similarly for capitalistic systems: they are based on a high level of mobility of products and factors. This is only possible provided rules are established defining which elements are substituted for each other (which raw materials have the same bio/physical/chemical composition); which amounts of capital are equivalent (this is established by means of arithmetics and forms of mathematics derived from it); which human beings are substitutable for each other (this is established, in "modern" society, in terms of educational criteria) and which finished products are substitutable (according to quality standards laid down by law or by custom, used as a basis for statistical control techniques, for non-tariff barriers etc).[24/] Thus, in the total intellectual package we can recognize the vertical division of labor element between the professionals and their objects, the "population"; the penetration into the popular mind of abstract categories, the fragmentation of the population into counting units, their marginalization as a class under study but not itself studying those who study them, and so on.

48. As a special case of this take the tool of survey research as used by sociologists and many other social scientists.[25/] The population is divided into researchers and researched; the former organize themselves into a team developing

"instruments" (questionnaires, interview guides) to mine the minds of a selected sample from the researched for raw material in the form of answers that can then be processed into some kind of understanding of social reality according to patterns of processing understandable to the researcher alone, and often not even to them when they belong to the un-analysed pre-conditions (one of these pre-conditions being exactly the replication of the alpha structure in the survey research itself). It should be noted that the fragmentation is already built into the method through the devise referred to as "simple random sampling," a devise that effectively detaches each respondent from the next, making it very difficult for the respondents to organize a group before, during or after the survey is carried out, for instance with a view to defending themselves against this type of asymmetric knowledge production about other people. It also goes without saying that marginalization is built into the total system through the way in which the researchers are planning their research alone, and filter down to the researched in a one way communication channel, a "popularized" version of their findings. In short, all the key structural characteristics are a part of the method, one cannot analyse it as a technique alone, it has to be seen as a technology with a built in alpha structure.

49. One might now speculate, in order to see this in a deeper perspective, what the alternative to intellectualism and survey analysis as we know it might look like. One alternative would be to use a beta structure with limited component size; it is assumed that in a unit of the order of magnitude 10^2 a class of intellectuals with highly abstract models of how the system functions and such a socially distant way of getting at the attitudes of other human beings would look somewhat out of place. The social system in general, and the economic system in particular, would be much more obvious to those who participate, more transparent. (a category that should not be confused with horizontal or egalitarian.) Thus intellectuals mean large size structures, just as much as these structures can probably only operate with some intellectuals in their midst. But even in that structure the verticality of intellectualism in general, and survey research in particular, may be counteracted, e.g. through the method known as "counter expertise". The difficulty with that method, however, would be that this can serve to legitimize another elite, perhaps less establishmentarian in its orientation, but nevertheless an elite. Hence the idea of making all intellectual tools available to the population, and/or the idea of simplifying all these things, even demystifying them by expressing them in more ordinary language, demathematizing them etc. . In survey research there is the additional possibility of establishing a horizontal relation between the scientist and the citizen, of exploring problems together in a dialogical fashion, of shared publication patterns avoiding any kind of secrecy or multitier publication system (popular version for general consumption ; a technical version to the organizations

paying for the services of the social scientists). This should not be confused with the participatory field methods used by social anthropologists. Their methods are also based on vertical division of labor, penetration etc. only that the techniques are more artisanal, not so industrialized as the survey research methods, supported by computers and other gadgets, indulged in by sociologists.[26] The parallel is most clearly seen the moment one imagines a politically fully conscious population sample, or village that instead of letting themselves be observed and interviewed call in the visiting social scientists to ask him a couple of questions and observe his reactions. In short, the social sciences also have their "associated structures", with compatibility and incompatibility classes. And this also applies at the micro level as seen when a psycologist finds it entirely proper to observe children secretely through a one way mirror or the social psycologist administers experiments leading the object completely astray as to the purpose.[27]

50. Let us move from these two examples to something more easily recognized by everybody as a technology; the car, both as a production technology and as something that induces a certain technology of consumption. That the production technology is of the usual kind illustrated in 1.30 and in THESIS 1 in 2.38 is in need of no further elaboration; but more interesting is the consumer technology. For the car carries a certain social/cultural message. Thus, its size is geared to the nuclear family, to the couple with 2/3 children. The correspondence is not only numerical, there is also a structural isomorphism: with parents in front, the children behind, the father operating the technology, the mother commenting and handling some of the interior relations in the car - family structure even being reflected in the possibility of the boy sitting behind the father absorbing his role, the girl sitting behind the mother doing likewise.

51. Thus, the message is not one of individualism as it is on the producers' side in a noisy assembly line factory, but one of nuclear familism. The car defines the family as the natural group, thus propagating the idea of birth control, and a two children family (excluding the grandparent generation since bigger cars cost too much) more effectively than most other forms of propaganda. Within that nuclear family the car permits a unique form of collectivism, an undisturbed collective consumerism of togetherness, landscapes, speed, power, conquest of space and status. Thus, there is fragmentation in the sense that one car spins a cocoon around one group to the exclusion of others - not only while en route but also because it induces thinking in terms of family excursions rather than group excursions. And the car marginalizes, it draws a line

very clearly felt in the less developed countries, between car owners as first class citizens and the rest as not - because of the artifacts of "modern" societies that are prepared for car owners, e.g. highways, filling stations, motels . And the cultural message is also clear , expansion in space is made possible on an individual basis from a centre (home) to which one returns with souvenirs, goods, photos, impressions and experience; everybody practicing his own centre-periphery relations. There is the idea of "man competing with man; of competition regulated by traffic rules; and indeed the idea of "man over nature", leaving exhaust gases behind, institutionalizing the escape from one's own acts of pollution in the very mechanics of the car. In short: the car stands out as a supreme vehicle (no pun intended) of the western social/. cultural message.

52. To gain in perspective some words on the two obvious alternative technologies: collective means of transportation and bicycles. Whereas no decentralized production technology compatible with the beta structure. developed in chapter I seem to be known for buses, trams and trains; it should be possible to develop them for bicycles. Bicycles do not seem to have undergone much change, if any, during this century but even in their present form production on a more local, even artisanal basis should not be impossible.[28] Their availability to practically speaking everyone, even in very poor societies makes them a tool of participation rather than marginalization, but one objection may still be that they fragment individuals away from each other. If one takes seriously a desire for togetherness, the car is superior to four bicycles on a trip to work or a Sunday outing; unless one practices some of the techniques developed by the Vietnamese during the war of linking bicycles together in parrallel and in series by means of rods (that can be easily unstitched again so that the bicycles can be operated individually). In countries with an unfavourable climate to bicycling there should be room for the innovation of suitable protection against wind and rain. In countries with many hills one might even argue in favour of devises similar to ski-lifts by the road side so as to pull the less energetic over the crest, provided the device can stand an energy calculation . (These things are mentioned only semi-facetiously; they serve as examples of what follows the moment one starts reasoning from structural and cultural values in developing techniques and not vice-versa.) As to cultural values: bicycles coupled in parrallel or in series will offer beautiful examples of technically induced structures of co-operation (and this is probably the reason why we do not see this very often, individualist competition being more of a norm). Moreover, the bicycle has a reasonable relation to nature - it does not pollute and does not deplete too much, provided the cyclist derives his calories from energy extensive rather than energy intensive sources.[29]

33. As to collective means of transportation they neither marginalize nor fragment the population. They have a tendency to alienate, however, reducing people to clients (referred to as "passengers"), leaving very little initiative and creativity after the itineraries have been set up and become a routine. For that reason the possibility of more flexibly operated collective transportation systems might be more compatible with alternative social structures, e.g."dial-a-bus"systems. The environmental impacts, however, are still negative but the argument will usually be that they are less negative per passenger.[32] This argument does not help nature very much, however, if the total number of passengers increases more than the saving of pollution per passenger. In general terms the argument would nevertheless be that the combination of bicycles with collective transportation, provided both of them are inexpensive enough to be available to everybody,would offer a package highly compatible with a society with the beta structure strong and the alpha structure relatively weak. And this becomes even more the case if one posits improved sailing ships that take into account the findings of modern aero dynamics against highly inequitable jet, even supersonic transport systems in the atmosphere.[33]

34. Let us turn from this example, transportation,to a case of communication: radio or television. Not elaborating the obvious technology of production for senders and receivers in hardware terms, we are thinking of the whole social structure induced by these modern systems of mass communication between the people who produce the programmes,and the listeners/viewers. Few places is the centre periphery structure so clearly seen. There is literally speaking a centre in the capital and/or other big cities from which mensages are radiated. There is a clear division of labour between those who have the challenge of producing programmes and those whose task it is to provide the former with listeners and viewers. There is a clear asymmetry in the relation of influence with the senders exercising considerably more impact on the receivers than vice versa. There is the fragmentation of the population into individuals (or at most very small groups) listening and/or viewing separately, in parallel forms of consumption rather than in co-operation. And,there is a clear double-marginalization at work between those who appear in the programmes and those who form the public on the one hand, and between those who possess the means of reception (the radio, T.V set) and those who do not(the latter type of marginalization may slowly disappear as the transistor radios become cheaper and cheaper, but will remain for some time for T.V. sets). Needless to say, this alpha-structure is aggravated further through the importation of programmes developed in even more central places, through satellite communication systems. etc.

55. Again, it is useful to consider what the alternative technology might be. The argument would not be against the views of electro-magnetic waves, but would have as a point of departure the desirability of more horizontal communication structures. The walkie-talkie is an example; cable T.V. with sets that permit two way communication (e.g. like video-phones) may also serve as an illustration. The basic point would be the possibility of a more horizontal dialogue, diminishing, even washing out the asymmetry between sender and receiver. Ideal would be a form that could bring groups into a dialogue with each other, and this is feasible with the present techniques, making use of audiences in two, three or more different studios communicating with each other, be that with radio or television as means of communication.[12] As the examples indicate, the usual difference between alpha and beta structures shows up: with conventional structures radio/T.V. technology can reach any number of people; with horizontal structures the techniques can only include a more limited number. There is an interesting parallel here to the Chinese wall posters with small characters, generated locally and presumably spontaneously: they involve people horizontally, much as in a dialogue, with several groups producing different wall posters, a much higher number than can be easily included in verbal conversations, but much less than can be reached by means of a newspaper with nation wide circulation (or a big character poster originating from some central point).

56. As a next example, again concentrating on technologies of consumption and on the everyday existence of people in general, let us take the key element in the human micro-habitat, the house. It provides at the same time protection against the hazards of nature (together with clothing, the human compensation for lack of fur), privacy for the family (extended or nuclear), and is a unit that can be arranged together with other units of roughly the same size and shape into larger units. The predominant unit of micro-habitat in the world is the one family, one(perhaps two) storey house; but the apartment is rapidly rivaling in significance. The former are usually put together in such macro-habitats as villages and suburbs; the latter in apartment houses (a form frequently found in the Nordic countries with one family houses scattered even miles apart constitutes an exception.) Evidently, the "modern" technology here is the apartment house, particularly the really tall high rise buildings, the "living machines". They can house the same order of magnitude of people (10^2, even 10^3) as a typical village, yet offer a very different way of organising things. Thus, the typical western apartment house not only presupposes one apartment per family but also one room per family member, with the possible exception of a couple. Apartments are also

usually small, again carrying a message of two-three children families as optimum with an implicit message of family planning and non-extended families. Like cars the fragmentation by apartment houses is in family rather than in individual units, for provisions for communal living exist in the family - the living room/dining room idea of the typical middle-class apartment - but the apartment house usually has no collective togetherness facility for all inhabitants. If there is a courtyard it is likely to be on the dark side of the building, the kitchen side, the place where children might play and garbage accumulate; not a place for serious and/or entertaining encounters among adults. At the same time the verticality is literally speaking built into the building, social status being correlated with elevation above the noise of the street level, culminating in the top floors commanding the better views (at higher prices), and the penthouse. In this the "man over man" idea is given a very concrete expression, just as the defiance of laws of gravity in the high rise building is reproduction of the "man over nature" idea - very different from, say, the way in which for instance Berber villages fit into the surrounding nature. [31]

57. One contrasting macro-habitat would be provided by some African villages or by the Chinese courtyard system where the houses are next to each other, enclosing a courtyard which serves as a center for joint activity, for discussions and talks, washing clothes together, all of it much beyond hurried encounters outside elevators in modern apartment buildings, reducing time and experience shared with neighbours to a minimum, even to zero. The courtyard function, however, can also be obtained in the high-rise buildings provided one floor or something similar is set aside as a meeting room, a place for creative togetherness, a communal kitchen and eating place, etc. But from the production point of view it is probably more difficult to conceive of a participatory way of producing vertical macro-habitats than horizontal ones, given the physical constraints (the stronger the steel beams, the more centralized the technology of production). In this sense modern house production is dependency forming: a person's habitat is shaped by such professionals as city planners, architects and engineers, and usually in a highly non-participatory manner. The amount of leeway left to the inhabitants is insignificant relative to the conditions already built into the plans. The solidity needed for vertical macro-habitats usually impedes individual creativity once the building has been raised; contrasting unfavourably with the ease with which horizontal macro-habitats, where the individual houses are made from local materials, can be changed. [32] Needless to say conditions in the temperate or cold

could serve as a constraint on the choice of material, but the purpose here is to indicate how the technology of building and living in apartment houses when other forms are possible has deep structural and cultural implications.

58. It should also be pointed out that what has been said above is replicated at a higher level of habitat organization. Whereas the inward looking village, collectively organized, also may have been to some extent isolated from the rest of the world (roads leading to and from being very poor or non-existent and communication within being direct, eye-to-eye, face-to-face) a modern city consisting of apartment buildings gives the opposite picture. Not only do the apartments face outwards, the ideal being that each family should have a view unimpeded by the view of neighbours. The city also faces outwards, highways leading in and out usually facilitating rapid mobility much better than the congested intra-city system. The city is centrifugal, the village being more centripetal. This, however, is not the same as saying that "centrifugal is bad, centripetal is good", for just as there may be a loss of identity and a dilution of participation in a centrifugal system the centripetal system may lead to excessive inwardness, lack of stimulation and stagnant waters. The point is only that techniques induce structures, as always, and the need for a certain level of consciousness about these structures.[35] Nor is the point that all technologies associated with modern living necessarily lead to alpha type systems. A telephone system, provided everybody could have about equal access to it, is a beautiful example of symmetric bilateralism. It does not operate by some central person calling all telephones at the same time with everybody picking up the receiver, receiving the message and being unable to talk back or initiate a call; in other words similar to what happens in a radio/T.V. structure, as mentioned above. It should be noted that the bugging capacity is highly asymmetrically distributed however.

59. Let us move from such typical consumption technologies to some medical technologies, that perhaps also can be seen as consumption in addition to being intended for the production of health. Thus, look at medicine in the form of pills; any type of pills. Characteristic of a pill is that it is consumed by one individual, and, consequently, is compatible with the view of disease as something above all located within the individual - the individual being the place where the disease finds its major expression, has to be alleviated and can be eliminated.[36] The pill focuses the attention away from the group as the source both of ill-health and health; it tends to make the individual lonely with his or her disease since there is no need for any communication with others or any help beyond instructions handed down to the recipient along the company/physician/pharmacist chain of command. For that reason this technology of medical treatment also has vertical division of labour built into it

with the individual decision making reduced to compliance with prescriptions and the patient being an object of bio-chemical reaction rather than a subject of individual or collective action. Since tranquillizers constitute a major fraction of prescriptions for medical treatment in this form the contrasting example is clear: some type of social therapy where the individual confronts his or her problems together with "significant others" rather than submitting to excessive individualisation induced by the pill technology. A similar argument can be raised in connection with the contraceptive pill: it is compatible with individualized decision making by the woman rather than contraceptive practices that would require joint decisions or at least joint awareness, thereby introducing important asymmetries. [38]

60. Sticking to the technology of contraception the international structures of population planning is a clear example of the international alpha-structure at work. The well-known techniques, of a mechanical or bio-chemical nature, originate in the centre and are transferred to the periphery. [39] Accompanying the techniques is not only an international division of labour where level of expertise is concerned, but also such phenomena as the centre testing contraceptive techniques on the periphery population rather than on its own people, and the idea that development is better served by reducing the population growth rate among the poor in the world periphery than among the rich in the world centre who consume much more and consequently deplete and pollute much more per capita, not to mention by putting a ceiling on their consumption styles. [40] Thus, one should see the ideology as to the target of population planning as highly compatible with centre-periphery ideas; it is "we controlling them rather than they controlling us". This is most clearly seen if one imagines, for pedagogical purposes, a new contraceptive developed by researchers in the Third World, tested on West Europeans and North Americans, distributed to them either at a profit or free of charge, and accompanied by Third World social scientists studying how to overcome irrational resistance in those quarters of the world against zero or negative population growth.

61. There is a parallel between this and the structure of malaria eradication. Again, it is "we spraying them, not them spraying us". The point is not whether the campaign was successful or not but that the total technology has been acceptable because it was compatible with the general centre-periphery structure of the world. If somebody invented a technique to counteract Western nervousness (or whatever it is that tranquillizing pills are supposed to be a cure of) that would imply the spraying of bedrooms and living rooms all over the Western world

by means of some kind of herbicide only available in some Third World countries that would have a world monopoly on its production(but might be willing to use local representatives for the spraying operation,)the approach would hardly be called"scientific." All kinds of forces would be mobilized either to debunk the technique or to develop alternatives or both because the accompanying structure would so clearly be antithetical to the dominant world structure. We mention this to indicate how structures may dominate a selection of techniques in addition to the point made very often already, that techniques may change structures. 41/

62. One of the best examples in this field, however, would be the difference between Western type of anaesthesia and Chinese acupuncture. In discussing them it should be noticed that both are capable of development provided a sufficiently clear image of the desirable social structure induced by the techniques is present. This structure can be discussed at the usual three levels: in the physician/patient micro-setting, in the national social structure,and internationally. If what is wanted is a structure that makes it possible for the patients to retain and even develop a maximallyactive role as a subject, not only an object,of his or her own disease, medical treatment should be combined with patient consciousness. To reduce the patient to pure soma under general anaesthesia is clearly undesirable, but there is also the possibility of local Western type anaesthesia . Acupuncture as a technique is compatible with a structure of involvement, even participation to the pint of helping in the performance of the operation on the part of the patient. For this compatibility to be utilized preparations in the form of reading about the disease, discussing the operation beforehand with the physician, reporting any feelings in connection with the acupuncture and the operation itself will constitute important elements. But in addition to all of this, which perhaps could also be obtained in conjunction with local anaesthesia as a technique, acupuncture (both for diagnostic, anaesthetic and curative purposes) seems to be relatively easy to administer at least at the more elementary levels, contributing to a softening of the Western discontinuity between the patient and physician when it comes to handling tools and acquiring know-how, even to some extent to the demystification of the physician. The tools, like herbs and medicinal plans in general, are relatively easily produced or available locally, and the know-how can to some extent be acquired even in hobby groups in middle-schools, 42/ thus lessening considerably the dependency on national and international centres for the production of tools, biochemicals and know-how.

63. Let us then turn to technologies more commonly associated with strategies of development, such as technologies for increasing the yield from agriculture by means of fertilizers and tubewells , and the yield from fisheries through improved preservation techniques for the fish caught. The three cases are actually quite similar and there is a general logic to them that has already played a considerable role in development theory and practice.

64. To start with the fertilizer plant: the technology compatible with the dominant structure would be based on synthetic production from oil or coal, whereas the alternative technology would be a village scale bio-gas fertilizer plant. One Western type plant is sufficient to produce 230,000 tons of nitrogen per year, whereas one biogas plant typically would produce 8.8 tons; meaning that 26,150 biogas plants will give the same yield as 1 large scale fertilizer plant.[43] Given that the capital costs are about the same for the two types of development (Rs. 12 00 million for the former, Rs. 10 70 million for the latter at the cost of Rs. 41,000 per plant, meaning a saving of Rs. 130 millions; but the order of magnitude is roughly the same), the difference along a centralization-decentralization axis is obvious. In addition to this the former requires foreign exchange, the latter can be made from national, even local material and components; the former employs only 1,000 persons, the latter more than 130,000 (5 per plant)[44] and whereas the former consumes energy the latter - through the process of anaerobic microbial fermentation of sewage and cattle wastes - generates energy in the form of methane (and other gases). Thus, everything should count in favor of the biogas plants although there is the difficulty that it may only be operational at the village level, not at the family level (the family not generating enough waste), and the village level may be difficult for structural and cultural reasons (insufficient ability to co-operate at the village level, no tradition for collection of waste on a communal basis).[45] Thus, the biogas technique may also generate a structure that is incompatible with some local societies (India?) but not with others (China).[46] But the technique is also incompatible with the dominant structure of the world since it presupposes in general, no more administrative skills, capital investment or research and development than can be generated locally; thus obviating the dependency on national and international centres. If the biogas technology fails to generate sufficient need for bureaucrats, investors and scientists/technicians, one would therefore assume that efforts to change the technique (searching for more efficient, standardized, mass produced plants) will soon be forthcoming.

65. A corresponding logic will apply to the bamboo tubewell, indeed a low cost device for exploiting ground water. Assuming that metal or plastic pipes require more geographical centralization and more capital intensive methods

of production than the bamboo, the former will be more compatible with the economic super-cycle than the latter. In order to recuperate structural positions lost the obvious technocratic strategy would be to argue in favour of "Institutes for bamboo tube well research", including efforts via genetical research to produce optimum bamboo for this particular purpose of carrying water. Like for the corresponding efforts in the biogas field [47] this may produce more efficient tools, but at the cost of inducing a highly asymmetric structure of know-how production. To steer the development in such fields towards local rather than national/international tools and know-how production much higher priority has to be given to decentralized, horizontal production structures. If this is not done deliberately the dominant structure will operate on a given technique so as to make it compatible, using efficiency ideology as legitimation. [48]

66. The same applies to preservation methods for fish caught in great quantities through modern fisheries methods. One typical Western method would include deep-freezing and storage at very low temperatures, transportation in insulated cooling vans and ships specially made for the purpose, ending in the freezer of the local grocers and the local consumer. [49] The total investment in the freezing capacity along the entire economic cycle, beginning and ending in nature is high; ultimately to be borne by the consumer. If the consumer is a rich person in a rich country this may cause no difficulty; if he is a poor person in a poor country the net increase in the unit price, even with considerable increase in the catch, may price the fish out of reach for mass consumption. In addition, the techniques used are centralizing and dependency-creating, which together with the price will tend to force the economic cycle outwards into a super-cycle where only extraction and initial processing take place locally, and consumption takes place in national and international centres that also would direct administrative, financial and research aspects of the cycle in addition to channelling most of the proceeds in their direction. What is a highly profitable cycle from the point of view of national economics, earning foreign currency for the country and giving national elites A, F and R & D experience may be very negative in its implications from the local point of view, both increasing dependency on higher levels, and decreasing mass consumption. [50] The alternatives, e.g. various drying and smoking methods are easily given up if local climatic conditions or sources of smoke are problematic instead of becoming the subject of local creativity; the "modern" method being seen as unproblematic. Needless to say, a very conscious perspective favouring horizontal structures would be needed to try to overcome the problems of alternative technologies, and to see more clearly the problems inherent in Western technologies. But even if this consciousness results in new techniques the danger of co-optation through subtle changes so as to make them more compatible with a dominant structure would continue to exist.

67. This can, of course, be seen as a special case of a more general phenomenon relating to food production and consumption in general. Take the case of milk to infants, directly from the mother (a pure case of a direct nature-consumption cycle) as opposed to the idea of having cows produce the milk, converting it into milk powder and let is pass through ever quite encompassing and complicated cycles before it is fed to the infants. Leaving aside the question of whether this is more or less dangerous to infant health given hygienic standards and practices, and whether information to that effect should be given together with the milk powder, the structural implications are numerous.[51] First of all, one of the most natural ties in the world, mother's breast to infant's mouth and thereby mother to offspring, in close physical touch is broken; in its place is put a mechanical relation mother-bottle and bottle-infant. Second, a part of the self-reliance among women, exchanging information and experience about breast-feeding is now directed outwards, towards the milk producers and the infant milk professionals, thereby weakening the mother-mother relations.[52] Third, by this method the economic super-cycle manages to penetrate one more field that was kept within family bonds, thereby strengthening macro- (and alpha) structures at the expense of micro- (and beta) structures. Evidently, the "alternative technology" would consist in exploring and satisfying the conditions under which mother's milk would be abundantly available - and rediscovering breast feeding.[53]

68. Then, there is the general field of ecological balance technology where the contrast would be between various ways of disposing of, or recycling pollutants on the one hand and production without waste on the other. As an example may serve two different ways of handling the problem of fertilization of fields: through artificial fertilizers, and through organic manure mixed with finely chopped crop residues. The former produces a pollution problem that has to be handled, e.g. through research in order to develop something else that can neutralize the detrimental effects of artificial fertilizers; the latter may be nothing but a purified version of a natural ecological cycle. The former calls for the economic super-cycle as form of organization to cope with the problems; the latter may be highly compatible with a cycle of very limited extension. And this points to the two major approaches to the environmental problem today: the organization of additional alpha structures, parallel to the depleting and polluting ones, engaged in cleaning up technology and recycling exercises and on the other hand a reorganization of some/all or production life into beta structure based on the principle of "production without waste". Which again leads in the same direction as the conclusion of the preceding chapter: how does one combine the two approaches, if they are combinable at all? International organizations, and even more so intergovernmental organizations, themselves large-scale alpha structures would tend to favor alpha solutions, and those who favor beta type solutions will tend to distrust alpha structures.[54]

69. To complete the picture, but in a sense outside our terms of reference, a brief look at military technology may be useful. Since the application of means of destruction (rather than of extraction, production, consumption etc.) are involved the reference is to some kind of economic dys-cycle rather than cycle, essentially producing waste. Arms are produced like any other commodity, but the "consumers" are destroyed, and returned to nature. This can be done according to the rules of the alpha structure, which is exactly what one finds in the modern army: centralized, highly vertical, with very pronounced division of labor between brain-intensive and body-intensive tasks, one way channels of command, fragmentation of the bottom level into small units (troops, platoons etc), and the total marginalization of the civilians, not to mention the enemy; all of this encompassing very high numbers of people, to the order of magnitude of 10^6, even 10^7. Contrast this with guerrilla warfare which may have a central command yet much more decentralized planning and execution (one reason being that it is less dependent logistically on the center), a much more horizontal and participatory command structure, fragmentation into small units but no marginalization of civilians, even less marginalization of the enemy (who is seen as convertible); of course operating in much smaller units, being a beta structure. As a matter of fact this is probably the clearest structural contrast one can find although it bears much similarity to the communication and health examples mentioned above. [55]

70. If one now looks through the totality of the examples given, the logic behind the examples will, perhaps, be more clear. In a sense it is a way of spelling out the daily existence of people in rich, Western countries: being planned by intellectuals of various kinds, analyzed by social scientists; having cars, radio/TV/newspapers and living in apartment buildings in towns and cities; being medicated through individualizing pills and clientelizing programmes of various kinds, including being made passive in various ways; having big, central factories for such things as fertilizer, pipes, deep freezing equipment; in general having an increasing number of links interspersed between nature and consumption of any kind of food, including mother's milk; ultimately having the balance of the environment and the security of the country taken care of the same way - meaning with the same consistent alpha structure. Add to this the more detailed picture of all the alpha type production technologies, with international, national and local division of labor, making most people do

routinized, uncreative work because the total mass of creativity is spread so unevely along the economic cycle that it becomes the monopoly of very few people. Contrast all of this with the corresponding beta structure: decentralized planning by people themselves, decreasing the proportion and power of social scientists and other centralizing intellectuals; moving around with bicycles and collective means of transportation; having more direct and locally generated forms of communication including the living habitat itself; basing medical treatment more on people and nature; making production for essentials more decentralized and direct with better use of nature's own ecological cycles and building defense capacities around each beta unit rather than from the center down. The contrast should give rise to two reflections out of which the first is as follows: regardless of what one prefers, alpha or beta as here defined and described, it cannot be denied that the implications of Western techniques of various kinds are deep and affect not only the social structure of human relations, but also the whole manner of thinking, the cognitive structure, the whole culture for that matter. All the four structural and the five cultural aspects are reinforced every day through the interaction of human beings with their own tools and know-how. Consequently a reasonable conclusion would be that after political colonialism has been eradicated, even after economic neo-colonialism has been uprooted the Western structural/cultural invasion of most of the rest of the world will survive in the tools and the know-how simply because of their deep impacts on the organization of human existence. In short, because the technology carries the code of society. 56/

71. The second reflection has to do with the simply put (but not easily answerable) question: is this good or bad? Looking through the cases used above as illustration the conclusion should be both-and, good and bad, mixed, dialectic, yin/yang, as was the conclusion in the first chapter. After all, intellectuals are useful for something, cars that are a pest inside cities may be more legitimate between cities, bamboo does not grow everywhere, Western medicine and particularly hygienic practices have alleviated much suffering, there may be a need for some supplement to mother's milk and so on. Others may have other reflections on the list of examples. Again the problem of a "mix" rather than a clear choice in favor of alpha or beta arises, to be developed in chapters 4 and 5. 57/

Chapter 3: TECHNOLOGY AND ECO-DEVELOPMENT

72. Time has now come to link the structural aspect of technologies, as developed in chapter 2, to the ideas about eco-development presented in chapter 1. The basic idea in eco-development is its double goal, as put in UNEP parlance: satisfy the "inner limits" of man without transgressing the "outer limits". Or, as it is put here: satisfying the basic material and immaterial needs of human beings while at the same time not destroying, perhaps even improving the ecological balances in nature. That Western type techniques have been counterproductive in both regards in vast regions of the world is today hardly even disputed; the question is how, how much and how it can be reversed.

73. The intervening link between technologies on the one hand and ecological imbalances and non-satisfaction of needs on the other lies in the way ecological cycles have been modified into economic cycles, and later into super-cycles; and in the way the structures associated with the techniques modify human relations at the local, national and international levels.[1] We shall start with the more ecological aspects and then proceed to the human relations, keeping in mind, however, that man is a part of nature so that any clear line drawn between non-human and human environment may introduce a distorted perspective. More particularly, the question of health vs. ill-health of human beings can also be seen, to a large extent, as a question of maintaining cycles with reasonable stable, dynamic equilibrium (such as the temperature, acidity and sugar content of the blood; the various nutrition cycles and, certainly less well understood, the mental balances). Consequently the "ecological impact of technology" also includes reflections on the impact on human beings, on their somatic and mental health, but we shall start with the conventional way of distinguishing between "eco-" and "development", meaning "nature" and "man".

74. There seem to be two ways in which Western type technology has changed the ecological cycles so as to produce very harmful effects on the ecological balances: by <u>modifying the ecological cycles</u> because man has been an effective agent of change in nature, and through the process of ever <u>expanding economic cycles</u>. The two processes reinforce each other in the sense that the former leads to depletion and pollution, the latter destroys some of the most effective mechanisms to counteract environmental deterioration.

75. <u>The modification of ecological cycles</u> through technology has <u>dislocated the balance between cyclical and linear processes in the ecology in favour of the latter</u>. In a linear

process the original forms of matter are not reconstituted, or at least not at the same place. Waste products may decompose or in general undergo chemical and physical transformations of various kinds, but no longer back to the point of departure. Moreover, some of the processes will be so slow that for all practical purposes a steady state emerges quickly. [2] Among the causes behind this change towards linear processes one might mention more utilization of minerals and metals or aborganic compounds in general for which nature does not offer the same rich variety of decomposition processes with return to the point of departure, and, indeed, the rapidly increasing transportation capacity - particularly during the last centuries - bringing in foreign materials alien to the natural habitats. The consequences are clear: a linear process is one that by definition has a depletion effect in one end and a pollution effect in the other, although not necessarily poisonous.

76. The expansion of economic cycles into complicated super-cycles leads to a decrease in visibility and in intellectual transparence of what happens. In an economy where extraction, production and consumption take place very near to each other, even within the confines of a typical farm, any tendency towards linear processes will be detected. The impact of depletion and waste accumulation, poisonous or not, will make itself felt because of the visibility of at least some aspects of the process. The mechanisms may not be properly understood and the deleterious processes may not be counteracted - as when farmers overutilize the soil in years of distress: but the effects are not hidden away in remote corners of the world creating the illusion of a nature without constraints. As a consequence of the transition towards ever expanding economic cycles a number of automatically functioning micro level detection and protection mechanisms have been destroyed, thus aggravating the situation further. [3]

77. The problem is now to understand how the alpha structure in general, and the economic super-cycle (1.30) in particular will react to the problems of the environment. One way of analysing this would be in terms of the logic of the super-cycle inself. Its basic goal is not development in the sense of satisfying human needs, but circulation, meaning simply that matter is extracted, transported, processed, distributed, consumed in return for something needed to keep the cycle going, with all the waste products returned to nature. The cycle becomes a goal in its own right and its expansion, both in the geographical sense of encompassing larger parts of the world and in the economic sense of handling more value becomes synonymous with development. An expanding cycle, however, will usually exhibit some bottlenecks such as transportation shortcomings, low processing capacity, poor marketing procedures, low level of consumption, etc. For all of this there are well-known remedies (such as investment in transportation infrastructure and productive machinery, financed through expanded markets, fashions, planned obsolescence, trade etc.). What is new is that nature is also seen as a bottleneck for the double reason of depletion of non-renewable resources and destruction of the mechanisms servicing the renewable ones),

and pollution including poisoning, one way or the other, human or non-human nature. Hence the logic of the alpha system demands that nature be restored so that the bottleneck is removed. The colonial and neo-colonial methods of extracting raw materials from the periphery will also be coming to an end for the Centre countries - through increasing practise of New International Economic Order principles,[12] thereby speeding up environmental concerns in the Centre countries and soon adding them to the agenda of the centres in the periphery countries, since they cannot so easily export the problems to the world periphery.[9]

78. The general thesis is that the "problem of the environment" will tend to stimulate the creation of new alpha structures and thereby the dominant structure in general. There is one geographical and one structural reason for this to be developed below. Thus, there is no argument that the alpha structure is not motivated to and capable of doing something with the problem of ecological balance; but the question is not only how well it will be done but also how it will be done. Given the circumstance that modern industry to such a large extent works on anorganic (even radioactive) matter, turning out material products as well as waste that is much less degradable into acceptable components than what traditional agriculture produced, it is hard to see how the structure is capable of counteracting depletion/pollution. Increasing the cost of the product so much that it will have a negative impact on the consumption and thereby on the production will not do because it will slow down the economic cycles. Introducing new forms of depletion (e.g. of valuable sources of energy) or new forms of pollution (e.g. thermic pollution) in order to "solve" the problem will only give new forms to the old problem. Moreover, even if the problem can be solved without a chain of new depletion-pollution processes, and without the cycle coming to a halt somewhere in the centre, there are still problems.

79. The geographical argument would run as follows. If all causes and consequences are taken into account every ecological and economic cycle is world-encompassing, but analytically it is possible to divide the world into two parts and say that for all practical purposes the cycle is contained within one of the parts.[7] If we now take a unit such as a farm, village, commune, district, province, country, sub-region or region and look at the total ecology and the total economy of that unit it makes some sense to ask: what is the area enclosed by its ecology, what is the area enclosed by its economy, what is the relation between the two? For simplicity let us distinguish between three cases:

the ecology and the economy are both within the unit. In this case, an ideal one which almost presupposes that the unit is on an island or at the bottom of an extinct volcano, the consequences of any economic activity are felt in the unit itself and only there: there are no inter-unit implications.

the economy is within the unit, but the ecology is larger. In this case wind and water carry effluents etc. to other units and an inter-unit problem arises through the export of pollution. The more pollution there is of other units the higher the pressure

for some change, which may be in the direction of balanced pollution, both ways, or some kind of inter-unit co-operation.[10] In either case it is the centralizing alpha structure that will tend to be strengthened, not the beta structure. Given the international structure ecological problems between two municipalities on either side of a border will end up in the two capitals and in an intergovernmental body, rather than being handled directly.[11]

The ecology and the economy are both larger than the unit. In this case the economy adds transportation to wind and water and adds depletion to pollution, not mentioning the non-environmental economic and psycho-social effects. The pressures generated would now be stronger, but the important thing is - once more-that to articulate those pressures and put some power behind them some type of alpha structure is needed; as seen clearly in the Third World defenses against the harmful impact the world Centre has had on their environment.[12] Thus, once more the alpha structure is reinforced by the impact of alpha type technology on the environment.

80. The structural argument would run as follows. If techniques are developed centrally for the problem of the environment, the environmental technology will in and by itself be a reinforcement of the total alpha structure. But with expansion of the economic cycles the techniques will have to be of the centralized bureaucracy-, capital-and research-intensive varieties, with administrative centres at the governmental and inter-governmental levels devising recycling, waste disposal etc., technologies to be used in economic cycles at all levels. Rather than making use of local forces that can come into play immediately when there are some signs in the direction of local eco-catastrophy the tendency will be to rely more on centrally generated techniques than on locally generated measures, in order to have something universally applicable.[13] Although the tendency will be to do both, the tendency will be in the direction of creating new groups of professionals, including academic institutes for training and research on environmental problems and ministries and intergovernmental agencies for the administration of environmental aspects of super-cycles - with subsequent clientelization of the rest of the population. Thus, even if the results should be positive at a technical level, those solutions will be preferred that are not only compatible, but even strengthen the alpha structure.

81. At this point it may be argued that the alpha structure is in itself anti-ecological, for ecology is more than merely a question of avoiding depletion and pollution so that the expansion of the economic cycle can continue unabated. It is also a question of creating a certain invulnerability to the hazards of the environment, and this invulnerability (meaning a relatively stable dynamic equilibrium) is probably best promoted through such[14] measures as decentralization and variety, adding up to a more complex structure than provided by the centralizing and homogenizing, unifomity-creating alpha structure. Thus, what happens when all environmental policies have been co-ordinated and standardized all over the world and it is, ultimately, discovered that they all incorporate the same mistakes

Complexity rather than complication seems to contain a basic key to ecological understanding, and to the problem of counteracting the destruction of natural balances.

82. Added to this comes the argument that the present structure underutilizes the possibilities of the ecological cycles already present in nature. Thus, every morning all over the world water in various forms evaporates and ascends - an enormous display of energy that man, perhaps, one day will build into some of his economic activities. Decomposition often releases underutilized heat energy and so on. It is difficult to argue whether alpha or beta structures are better at generating the type of creativity needed to invent new ways of utilizing better ecological cycles, syphoning off products that can be used to satisfy human material needs without dislocating, even destroying the cycles. The alpha structure generates scientific and technical insight, the beta structure generates the type of insight that derives from being closer to nature and from releasing more creativity of people in general. Obviously some type of combination might produce an optimum of ecological insight, provided alpha specialists do not demobilize beta laymen into apathy and clientelism, and beta laymen do not reject a priori anything produced by the alpha structure. In this traditional agriculture should not be glorified; it included slash-and-burn techniques to mention only one example and large-scale erosion is eloquent testimony to its inadequacy - to give two arguments for an alpha/beta mix.

83. The general conclusion would be that in efforts to study the inter-relation between development, environment and technology studies limited to the technical adequacy of environmental technology may be highly misleading, for at least three reasons. Two of them have been mentioned above: to what extent are other techniques brought in than in and by themselves have similar effects, only less visible for the time being - in other words to what extent are the problems swept under the carpet - and to what extent are the technique reinforcing structures than in and by themselves are a part of the development problematique. Thus, if a country manages to become independent in production technology dependency may reappear in the need to buy expensive environment technology from Centre countries; and in the master-disciple pattern found in the numerous international seminars around the world where key polluters and depleters - governmental and non-governmental-manag to convert their experience into a new field for transfer of technology.[14] Behind this, however, there is also a third factor: the tendency to use the environment problem as a form of understanding that sees "limits to growth" in terms of the limitations of nature (limits as to resources and capacity to absorb pollution) rather than in terms of the crises in the world-encompassing cycles and super-cycles, meaning that the circulation stagnates, even decreases. To blame it on a limited nature rather than on human and social factors (such as decreased propensity to consume, barriers to free trade, meaning limited access to raw materials and markets) diverts attention away from the latter and towards cooperation to overcome natural obstacles rather than needed structural confrontation - with continued "economic growth" as the consequence, and [illegible].[15]

84. Turning now to the development aspect of the eco-development formula the argument of the present paper is that Western technology has to be evaluated in terms of its ability to satisfy human needs, material and immaterial. This splits into two: does the technology, in fact, make the "material satisfyers" (food and water, clothes, shelter, medical care, schooling, means of communication and transportation) mentioned in 1.4 as the conditions for the satisfaction of basic material needs available to those most in need, above a certain floor or minimum level; and how is the relation to the satisfaction of basic immaterial needs?

85. As to the basic material needs: by and large the geography of poverty tends to show a distribution with peaks in the peripheries of countries highly penetrated by Western technology, as evidenced by the statistical information provided by the UN agencies in the fields of food, of health and of education (unfortunately statistical estimates for the other basic needs are not equally well disseminated, probably due to the absence of specialized agencies in the fields of clothing and housing).[16] However, even if one agrees as to the nature of the geography of poverty it does not follow that there is any agreement as to the role of Western technology. The poverty distribution might be like that under any technological order, or, if the technology were different and the poverty disappeared it might be for other reasons, etc..

86. More convincing, consequently, are the comparisons often carried out between developing countries that have taken different roads towards development; e.g. between China and India, between North and South Korea, between North and (formerly) South Vietnam, between Cuba and Venezuela, and so on, with a view to assessing the basic needs situation of those most in need. There would probably be relatively widespread agreement today that the comparison where the bottom 20%, 25% or even 30% are concerned would be in favor of the socialist countries.[17] Many of the techniques used to achieve such results, however, are Western or Western type. The difference would be in the accompanying structure, possibly engendering less verticality and more participation by people in general.[18] In many cases the difference would be in the technique, too, or perhaps rather in the mix between alpha and beta type techniques - a theme to be developed further in chapter 5.

87. What can be said with certainty at the present stage would be that the introduction of Western technology is neither a necessary, nor a sufficient condition for satisfying basic material needs. If it had been necessary the

socialist developing countries relying extensively on non-Western technology (such as China) would not have been able to achieve what they did achieve; had it been sufficient the others would have come much further along the road of development by now having been exposed to so much of it during both colonial and post-colonial phases of their recent history. The argument would also be that some of the technologies might have been counterproductive because of a net deterioration in the material basis, partly because of the depletion of raw materials (including soil) for conversion into goods consumed in the developed countries, or for non-basic material consumption in the developed countries, or because of the pollution of the environment. To the extent that is the case it is built into the total technological structure, whether the ultimate wasteful consumption is in the international or national centers. 19/

88. As to the basic immaterial needs: due to the predominance of economism as a form of understanding for the entire development problematique they have received very scant attention. First, they tend not to be included in any definition of development except in some kind of passing reference to "the human factor". Second, very little if any information is available about the degree of satisfaction, and probably not only because of measurement difficulties, but also because of the suspicion that this approach may throw too much doubt on the entire Western model, and also on the entire developed/developing distinction.[20] However, the little information that can be obtained is difficult to interpret but tends to point to some kind of correlation, even causal relation, between what is here called the alpha technology and the lack of satisfaction of such needs - referring to the definitions of them in Chapter I (1.33 and 1.4).

89. Off hand it should be strange if this were not the case. For if the techniques induce structures replete with vertical division of labor, penetration, fragmentation and marginalization one would expect that to have impact on the satisfaction of immaterial needs. More precisely, vertical division of labor would not only tend to siphon material resources upwards, nationally and globally (thus leading to the deterioration in the material basis mentioned, and ultimately to extreme poverty), but also turn creativity and challenge into a monopoly of the higher echelons and to threaten, even eliminate the sense of identity through alienating production processes, routinized to the point that one's work could just as well have been carried out by someone else. Further, the high level of dependency on others erodes any autonomy or feeling of being master of one's own situation, and the splitting off of individuals from each other by individualistic production and consumption processes and against each other in the competition for higher positions in the

hierarchy make a mockery of "togetherness" just as much as the way elites talk about or to, but rarely with and without listening to people in general makes a mockery of participation.[21] Somehow this must also relate to the last two on the list - admittedly put together without much of a theoretical rationale - from 1.4: "self-fulfillment" and "a sense of meaning with life".

90. If we now add to the structural characteristics so far made use of (a loss of identity because of work processes that make people substitutable; a high level of dependence on others; individual isolation; a sense of being second class) three more that come into play the moment one considers multiple, not only simple social structures (see Appendix for elaboration of this) - segmentation, rank disequilibrium and incongruence, and structural dissimilarity - the pressure on the individual (and not only at the bottom) living in structures that form parts of Western technologies should be considerable. The total picture would be that of individuals detached from each other, alienated from themselves and their work product, perhaps also from what they consume, having their social existence divided into relatively watertight, unintegrated compartments, being embedded in structures that sometimes place them high, sometimes low, sometimes above another person, sometimes below; living in a multiplicity of mutually contradictory structures, and in addition detached from nature, compelled to achieve, living under the pressure of individual and collective crises, all of this should work like ice-breakers on the human psyche; possibly also having some effect on the human soma. In other words, the idea would be that the alpha structure carries in it a highly pathogenic potential, perhaps under the condition that there is not a protective cocoon in the form of some type of beta structure spun around the individual, shielding it from the impact.

91. Without in any way claiming that there is general agreement about the issue, some recent studies seem to indicate a relatively close connection between the alpha structure and the incidence of mental diseases. It should be noted that this is actually beyond the problem posed. If it is correct western technology might not only lead to non-satisfaction of immaterial needs, but even to the deterioration of the immaterial basis for their satisfaction, the human mind itself; just as the claim was made above that it had a similar impact on the material basis; the natural environment, and the human body.

92. One of the most interesting studies in this field, the International Pilot Study of Schizophrenia,[22] shows that patients with symptoms of schizophrenia

in non-Western cultures tend to recover clinically and socially better and quicker than comparable patients with similar symptoms in Western cultures. There are several interpretations of this. Thus, there is the biomedical interpretation that a greater proportion of the "Western" patients had "process" schizophrenia , i.e. a disorder involving deeper neurobiological disfunctions whereas a greater proportion of the "non-Western" patients had"reactive" schizophrenia which comes as a response to stress,but the patient recovers soon because the homeostatic mechanisms of the individual are intact. Then there is the microsocietal interpretation that patients in Western type societies have less support and from fewer "key persons" (in the family, circle of friends, etc) at the same time as the substitute for primary group support is an institution such as the hospital, or other components of the health services. There are reasons to believe that this social situation of the schizophrenic patient maintains and even generates his symptoms. Such constellations of factors (strong alpha structure and weak beta structure in our terms) occur less frequently in non-Western societies, making the "natural history" of the illness carry patients more easily towards recovery.

93. The socio-cultural interpretation: in individualistic, competitive cultures where the ethic of individual responsibility and accountability is the regulating norm, one is not supposed to indulge in and disseminate "false beliefs"(delusions). If the person is aware that his statements are false it is even punishable; he is only excused if his statements result from an acceptable,medically defined,illness. He may thus be exposed to treatment and a test of his recovery would be his acquisition of "insight" into the morbid nature of his experience - explaining them away as the result of "enemy action" - the enemy being within himself in the form of "bad"organisms, molecules or faulty habits acquired in childhood. If he fails to improve he can no longer be punished for any delusions but will be segregated as a "chronic" case either physically in an institution or merely by being put on social welfare and denied participation in a range of social interactions. He may or may not continue to blame himself. 28/

94. In other cultures where responsibility lies more with the group and less with the individual there is less pressure on the individual patient to gain "insight" . The symptoms may be seen as the result of "enemy action" but the enemy is no longer located within the affected person. The "enemy" is outside, some kind of outside threat which means that protection of the affected individual becomes a form of self protection of the group. The borderline between health and ill-health of the individual is less dramatic

for group action may compensate for individual shortcomings. The individual does not have to pass from the test of his ability for social integration; it is the group that has to function adequately, inward toward its own members and outward in the general social setting. Needless to say, the general impact of Western technologies is destructive of group formation both on the production and consumption sides of the economic cycle.

95. Schizophrenia is only mentioned here as an example, however. If one extends the vision to other types of mental disorder the general tendency of the data point in the same direction. Thus, this seems to be the case for depression, with for instance, over 20 per cent of the urban population in New York being placed in the group with depressive symptoms; whereas the Nova Scotia population exhibit the same symptoms three times less frequently. [24] Related to this comes the variation in the rates of suicide in different cultures; being 14 per 100,000 in London as against 1 per 100,000 for Western Nigeria - but being 25 and 43 per 100,000 respectively for Afghanistan and South India - indicating that there may be many factors at work. [25] Patterns of drug and alcohol usage also seem to exhibit geographical variations with an over representation in the West. [26]

96. Human beings to a large extent being integrated, not neatly divided into a somatic and a mental part, one would also expect some correlation with somatic diseases. And the evidence seems to suggest that populations of the same ethnic and presumably also genetic stock "can exhibit very different morbidity patterns if exposed to different cultural influences. Thus compared with the general population in Japan, the Japanese living in the United States of America have an excessive death rate from cardiovascular and cerebrovascular diseases, but, as noted in a WHO expert committee report, lower death rate from gastric cancer." [27] There is, however, some evidence to indicate that the incidence of cancer may also be related to Western technological influence, [28] and not only in the trivial sense of correlation with smoking habits. As for schizophrenia the hypothesis may be formulated that cancer plays a more important role in the general picture of human pathology after than before the industrial revolution. [29] Whether the mechanism is via environmental pollution or "stress" built into the structure/culture content or both we can only speculate about. But in either case such findings are obviously relevant for any consideration of relations between technology and eco-development, the human population being part of nature. The case should therefore be made for the evaluation of the short run and long run impact of mental and somatic health as a standard part of any program evaluating the impact of technology on the environment.

97. At this point one remark about cognitive filters in understanding the impact of technology. Imagine that we conceive of a production function with four production factors:

$$P = P\,(C,L,W,T)$$

where
P = production output
C = capital input (capital, capital goods)
L = land input (soil, raw materials)
W = work input (unskilled, skilled labor)
T = technology input (techniques, structures)

Since techniques = tools + know-how, with the former built into the capital goods and the latter into skilled labor (including professionals), and technology = techniques + structure the fourth production factor is essentially structure or, differently put: organization. The point to be made can now be formulated as follows: production is always under constraint. Not only are C,L,W and T only available in limited quantities, the mix also has to be right within a certain range and: P has to be fed into an economic cycle that generates enough C,L, W and T that can be used as inputs to keep the system going. In capitalist production processes the emphasis is, as the word implies, on capital: an economic cycle is inadequate if it operates at a loss in capital terms (unless the loss can be compensated for over time or absorbed by a more inclusive cycle). No similar requirements have been put on L, W and T, although they could easily be formulated. If the focus were on nature the production process would be organized in such a way that it left human beings, the producers, better off in terms of material and immaterial needs than before production started. And if the focus were on technology the production process would be organized in such a way that the structure, the organization would develop and improve (evolving, for instance, becoming more horizontal) as production proceeds. Most societies, however, seem only lately to have developed concerns for nature and seem to be particularly unconcerned with the impact a production process has on the human beings who operate it, or on the organization needed for C, L and W to be brought together and result in a product at all (characteristically it is not even included among the classical production factors, and impact on land is often handled as "externalities"). The focus has been, essentially, on the (P,C) cycle - how production generates capital and capital generates production by being converted into L and W - the rest being treated as residual factors.

98. This being the case (or so we assume) one would also assume considerable resistance to changes in the prevailing pattern of thinking. It is not easy

to see human beings as the pivot element in the production process. In economic thinking the image of the human being is that of "work", man-hours, at various skill levels - which is a very abstract and selective approach to human beings indeed.[30] Qualitative aspects of human beings cannot easily be fitted into the quantitative approaches used to handle (P,C) cycles. The same applies to organization, but less to nature since natural sciences are formulated in the same language. This is worth emphasizing because it is probably one of the reasons for the resistance against a more human and structural, or psychosocial, approach in the analysis of the total impact of technology on eco-development: it cannot be fitted into the paradigms that have developed during the last generations whereas the impact on nature to some extent can be handled. Hence one would envisage all kinds of strategies to reject hypotheses about the human and social factors, including the idea that they are "vague", "general" and not substantiated by rigorous empirical tests. Characteristically the burden of proof will be on he who suggests a negative impact, e.g. in the form of cancer or schizophrenia, deriving from or related to western technology. It will not be on the adherents of western technology to be prove that there is no such impact - although a broadening of the technological assessment movement may change that relatively quickly.[31]

99. The major reason for the resistance is, however, of a more political nature. Imagine that what has been said here is more or less correct: the technology in question

(1) has proven capable of satisfying not only basic, but also non-basic needs of those least in need;

(2) has so far proven incapable of satisfying the basic needs for those most in need;

(3) as a result of (1) and(2) has led to ever increasing inequalities within and between countries;

(4) has led to a deterioration of the environment both in the sense of depletion/pollution and in the sense of destroying natural and man-made homeostatic mechanisms;

(5) is a pathogenic factor within a range of mental diseases;

(6) is a pathogenic factor within a range of somatic diseases.

Then, how explain that a technology with such impacts has had such a success in the sense of spreading all over the world? The answer can only be that for those

in power the first positive factor outweighs the combined effect of the other five. Since they themselves benefit from the technologies, both in terms of material impact, immaterial impact and the structural position they can derive from them, they have a vested interest in arriving at that conclusion. Moreover, since western type technology has been developing and spreading for a long time they must have drawn that conclusion for a long time, which makes it unlikely that they will suddenly come to other conclusions in the serious sense of acting upon them. The only exception might be action to restore ecological balances so as to keep the cycles operating, and so that structural positions are not threatened, perhaps even reinforced. In short, the best way of explaining the diffusion of western type of technology is that it is in the interest of international and national elites - and some others. [32]

100. The conclusion to be derived from this, in turn, is relatively clear: it is hardly from national or global power elites that the basic trust for a change in the prevailing pattern is going to come. Even with the best of will elites are likely to introduce the type of measures that will strengthen their position, and they will be in the alpha structure direction as indicated many times above. For that reason some other type of thinking about development, "another development" so to speak, is needed: not necessarily totally antithetical to the alpha structure, but with other elements built into it, one of which would definitely be a more people generated approach. One formulation that carries in it perspectives of that kind is self-reliance - a term in search of practice at the same time as it also serves as a pointer towards some of the more overtly political aspects of the relationship between technology and eco-development.

Chapter I

ON THE TECHNOLOGY OF SELF-RELIANCE

127. There is much talk to the effect that "human beings should be the masters, not the slaves of technology" and that "technology should be in harmony with nature". A recent UNEP study [1] claims that all the criticisms levelled against Western technology [2] can be divided into three parts: ecological, economic and social considerations. The position that will be taken here is that such divisions, much too similar to the way universities are divided into faculties and departments, may impede progress in the field and that it may be better to proceed directly from considerations about the human beings the technology is supposed to help. The result is relatively similar, for our thinking is conditioned by such formulas anyhow - but the underlying focus will guide our thinking in more human, less academic ways:

Table 1. The demands on technology

The purpose of technology is to:

Satisfy basic human needs:		
material	(food, clothes, shelter, medical care, schooling, means of transportation/communication)	economic
non-material	(creativity, identity, autonomy, togetherness, participation, self-fulfillment, meaning)	social
There are necessary conditions:		
structural	(equity, autonomy, solidarity, participation, integration)	social
environmental	(ecological balance)	environmental

128. No good theory or practice in the field of development, environment and technology will ever emerge if these demands are divided between those advocated by different pressure groups or satisfied by different techniques: only an

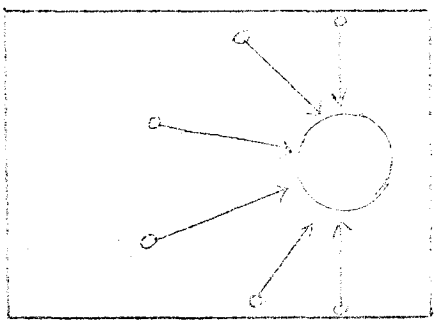
integrated approach will do. The alternative to the present dominant technology that mainly satisfies basic and non-basic material needs for world elites, and fails to satisfy basic material and non-material needs for most of humankind in addition to inducing structures that are exploitative, dependency-creating, fragmenting, marginalizing and segmenting, not to mention environmentally disastrous; is not to argue narrowly for a technology that satisfies all basic material needs but nothing else; a technology that gives much identity to its users but nothing else; a technology that is structurally perfect but fails to produce anything; or a technology that is so soft that it leaves the environment absolutely intact - including starving human beings that are properly recycled.

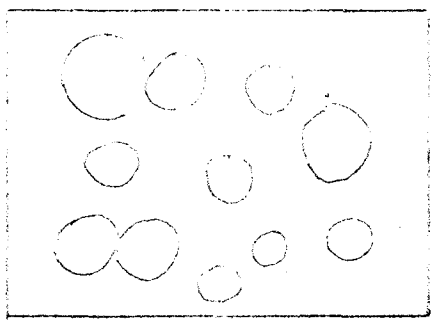
129. What we should demand of technology is this: that it produces for the satisfaction of basic material needs-for all, preserving essential ecological balances, and that it has built into it structures that also are compatible with the satisfaction of basic non-material needs - for all. In order to meet this heavy bill one must not reason from the techniques - one has to reason from the purpose and more or less derive the techniques. Since this is not the way it has been done in the past it looks as if the demands will make the system overdetermined: how can we get technology that meets the material needs and also the non-material ones and at the same time is compatible with a horizontal, simple structure and ecological balance? The answer is probably (1) the apparent overdetermination stems from the analytical approach, from splitting up the demands on technology in many factors rather than adopting a more holistic approach that makes us "see" solutions more intuitively and (2) it is probably impossible to satisfy all demands perfectly - nor is it necessary. We do not ask for anything perfect; only goals are perfect. Reality can be short of the goals - the question is only whether it is dangerously distant, and whether the reality has

built into it sufficient contradiction to be dynamic in a self-reinforcing manner. And this is where the alpha/beta mix comes in, not only as a way of trying to walk on two legs, getting the best of both worlds [3] - but as a way of ensuring that the result will not be a structure that stagnates (although it may have local points in stable equilibrium) but is contradictory in a way that makes it progressively dynamic. Needless to say, the Chinese are the masters in this field - so far. [4]

130. In the following analysis the point of departure will be structural because we assume that structures, in spite of all the evidence indicating that they are hard to change, are nevertheless more flexible than human needs or the laws of nature. Further, we want to capture the most essential features in the structural analysis by postulating two ideal types:

	ALPHA	BETA	
Vertical	unequal exchange	equal exchange	Horizontal
	vertical division of labour	horizontal division of labour	
	penetration/dependency	autonomy	
	fragmentation	solidarity	
Complicated	marginalization	participation	Simple
	segmentation	integration	





The former is clearly the organization of the modern state exemplified by the airline network emanating from the capital city; the latter is a structure that consists of many smaller units, less related or even unrelated. The former

is, to take an example, the structure with which the country would officially meet an attack from the outside, with a vertically organized army; the latter is what may turn out (e.g. after occupation) to be the real structure of resistance, in many small groups. In fact, it is unnecessary to go into too much detail about these structures for they are relatively well known to everybody living in modern society. 2/ The state organizations, modern corporations under private or state capitalism, most large-scale organizations, the international structure etc. are all built according to this pattern. Examples of the latter are harder to find but they would beat the social micro-level, and often at the "unofficial" level: not the family as such but maybe some families, or couples, or groups of siblings (most families being by far too vertical), groups of friends, groups of colleagues, many associations. One basic reason why the examples of the beta structures look so "unofficial" is precisely that they are not structured by techniques but constitute more pure forms of human relations; to a large extent carried by the more human half of humanity - the women. However, this does not mean that one should assume human relations, when left to themselves, necessarily to turn out to be horizontal and simple: there is no scarcity of societies without Western techniques and quite simple, yet very vertical.

151. The major arguments against the alpha structure, are readily seen from the definition and they are implicitly the arguments in favor of the beta structure. Alpha stands no chance of fulfilling non-material needs. Vertical division of labor with all its alienation distributes creativity extremely unevenly; the pattern of penetration and dependency-creation will counteract identity and autonomy; a fragmented structure makes togetherness impossible; a marginalizing structure rules out participation; and a segmented structure is incompatible both with self-fulfillment and the search for meaning with life. In addition to that, but these are more empirical propositions: material needs-satisfaction is counteracted in the periphery, and ecological balances in the whole Man-Nature system, upset and even destroyed. Life in synchronic solidarity

with human beings everywhere and in diachronic solidarity with future generations [6] becomes impossible because the structure is not only centralizing in <u>space</u> (in favor of the Western center at the expense of the periphery), but also centralizing in <u>time</u> (in favor of the present generation, at the expense of future generations).

132. The major arguments against the beta structure would be that its limited size (if the conditions in the definition are to be taken seriously) makes it difficult to even out the imbalances in space and time found in nature. <u>The alpha structure has a potential as equalizer</u> because it has the capacity to take resources from places of abundance to places of scarcity, evening out some of the asymmetries in the economic geography of the world, the natural catastrophes, and the seasonal variations. [7] More particularly, the alpha structure is probably better at meeting natural catastrophes, and because of its size and fluidity and all the exchange that goes on, there is less of the atmosphere of stagnant water that may develop in the small parts of which a beta structure is composed, and also less control over the single individual. The borderline between strict control and loss of identity because nobody cares to control is a thin one, however, as is the borderline between the freedom of anonymity and the alienation of loneliness.

133. The general formula for an adequate mix between alpha and beta structures, and compatible with the definition of self-reliance as being the negation of dependency (meaning that it will cultivate both independent and interdependent structures) would be <u>to embed simple beta communities in an alpha structure, making both of them as horizontal and simple as possible</u>. In so doing, the beta units to be modified or created would be the unit of local self-reliance whether in the countryside (a federation of villages) or in the towns (a federation of blocks, wards); and the alpha structures to be modified would

be at the levels where national and regional self-reliance are built. 8/ Thus, regional self-reliance, being part of a policy that also includes national and local self-reliance, would not be built according to the alpha structure as it is defined above; that would destroy the basis for national and local self-reliance (and correspondingly for national self-reliance relative to local self-reliance, not to mention local self-reliance relative to the self-reliance of families or groups wanting to live on relatively isolated farms, or individuals opting for the extreme of self-reliance - a hermit type existence.)

134. In practice this means that the struggle for self-reliance splits into two:

- to create and strengthen beta communities that probably should be self-sufficient in food and self-reliant in everything else pertaining to basic needs;
- to modify and weaken the alpha structures at whatever level they are found, local, national, international.

The relative significance, not to mention the concrete meaning, of these two points will vary considerably from place to place in the world geography and history. Thus, for countries in the first (capitalist) world the basic task would be to strengthen and recreate new patterns of local communities, among other reasons to prepare for the day when national and international structures are modified in such a way that there will be much less privilege accruing to the centers. For countries in the second (socialist) world (with the exception of China and some of the countries in former Indochina) the task would be the same but with the important difference that it is the gradient inside the country, not the one tying the country to the international system, that would have to undergo most changes under a consistent search for self-reliance. And in the Third World it is probably the task of modifying more than that of strengthening local communities that will dominate the political picture - for many of those local communities are still alive. However, to develop further, against a horizon of rising expectations, these local communities also have to be strengthened, if not exactly to be (re) created.

135. At this point technology enters as a key intervening factor. The problem is evidently how to select an adequate mix of alpha and beta type technologies that are capable of delivering the goods. Table 2 gives some views on this problem, suggestive of a type of thinking, nothing more. It should be pointed out that the beta community is seen as the basic social unit and the alpha structure as some type of supporting infrastructure. Nevertheless, the alpha structure will inevitably have some kind of center, only much less prominent than found in the more extreme alpha structures of today. It should be pointed out that in this approach there is no need to think of some techniques as modern and some as traditional or some as Western and some as non-Western - they could all combine into a totality that might serve human needs well. That some components are of one kind or another does not necessarily make the total structure one of that kind - unless, that is, the structure itself is already tilted so much in that direction that <u>any</u> technique introduced into it will be modified so as to comply with the structure. By and large the picture given by the Table is simply this: strengthen the local basis of the beta unit by reviving old techniques and introducing new ones, compatible with the beta structure; weaken the alpha structure above all by decentralizing it and distribute the sites of production and consumption more equitably in society - not recentralizing but multicentralizing society.

136. Looking at the two columns in Table 2 there is a certain logic to each column. The alpha column might, perhaps, best be identified with some Northern European welfare state society, high on division of labor between the producers and consumers of goods and services, but also relatively high on equitable distribution of these goods and services in geographical and social space. It may be referred to as a <u>modified</u> alpha structure, often containing some strong unmodified technologies (e.g. centralization of intellectual expertise, energy-production, military command) that dominate the picture so much that one loses sight

Table 2 - Some suggestions for alpha/beta mix of technologies

	ALPHA TECHNOLOGIES	BETA TECHNOLOGIES [9]
Food [10]	build down trade in food, drop cash crop practices; build down agri-business	try to restore the old system that the food is grown within the horizon - local autarchy; also patterns of local food preservation and storage; collectivize ground that can be used for food.
Clothes [11]	build down international textile business	try to restore patterns of local handicraft for better quality and lasting clothes: symbiosis with food production.
Shelter [12]	build down housing business	try to restore local house building patterns of local materials [14]
	make houses and habitats less center-periphery dominated; transfer more work to homes [13]	collectivize ground that can be used for housing.
Medical care [15]	better distribution of centers for negative health care, rural clinics; Sanitation standards, control of drugs, control of epidemics.	emphasis on life in the beta community as positive health care participation, less distinction [16] between healthy and ill.
Schooling [17]	better distribution of centers for schooling, "escuelas rurales", etc.	emphasis on the beta community as education, integrating school, work, leisure.
Transportation/ communication [18]	less centralized, two-ways patterns; collective means of transport, care for long distance only	try to restore patterns of walking, talking - bicycles, wall posters; cars banned inside units, cable TV, local papers
Energy	better distribution of centers for large-scale energy production	solar/wind/wave/biogas networks [19]
Defense	democratized armies, better distribution of commanding positions	local defense patterns, military (guerrilla groups) non-military (satyagraha)
Environment [20]	recycling cleaning up technology	local control and dependence on smaller economic cycles
Comprehension	Maximum transparency through citizen participation and reporting	Small size units (10^{0-2} and 10^{3-5} for micro and macro units respectively), comprehensible to anybody

of the modified components. [21] Then, the beta column is no doubt inspired by the Chinese people's commune; but similar patterns are found in almost all designs for local communities on a self-reliant basis. [22] Much more could be filled into either column ; the alpha column would still look like a soft version of modern/Western technology, and the beta column like a hard version of traditional/radical technology. The hard version of modern/Western technology is discarded for the reasons mentioned - it is assumed that it is on its way out because of its anti-human implications; and the softer versions of the traditional/radical technology are not mentioned either since it is assumed that they will not produce enough and will be incompatible with the life-styles desired by most of those people whose technological innocence got lost somewhere in this process.

137. The question is how these two styles can be integrated. That question presupposes a need for integration which many would deny. Others would maintain that the two are incompatible with each other, for instance because alpha is based on production for <u>exchange</u> and beta on production for <u>use</u> and the two have different, even contrary social logic. The first objection is relatively easily met: any integration formula should permit some pure alpha and some pure beta units - where circumstances permit - so that those who prefer could opt for these more pure lifestyles. In general, however, it is assumed that both the critique of alpha and the critique of beta are valid; hence that purity, even in the modified forms, may be counter-productive from the point of view of human needs-satisfaction. As to the second objection: this is precisely the contradiction that no doubt will keep the society dynamic. If a more static society is needed one would have to opt for the more pure forms. But the basic point we are trying to make here is that there is no need to think in absolutes: one could imagine a spectrum containing all possible alpha/beta mixes from 100%/0% to 0%/100%, including the extremes. In general, however, it is definitely the assumption that the mix in

most parts of the world has to be pushed, even quickly, towards the beta end of the spectrum, or as a very minimum that the present tendencies towards the alpha end have to be counteracted.

138. Concretely there are at least three ways in which the alpha and beta systems can be integrated: functionally, in space and over time. One could also easily imagine a fourth form which would combine all three and that is the form the present analysis leads up to - because it is sufficiently rich to accommodate most of the problematique delved into in the preceding pages.

139. By functional alpha/beta integration we would simply mean that a society decide to use alpha technology for some problems and beta technology for others. Thus, it may decide to satisfy the needs for food, clothes and shelter locally, in beta communities much like the need for procreation is relegated to the family, and the rest by means of alpha structures. Any other mix could be imagined, depending on the distribution of resources and the political will to go in one direction or the other. There is, however, a very serious objection to this kind of integration: it is incompatible with local self-reliance. If local self-reliance implies local self-sufficiency in times of crises (and in some fields also in normal times), then there has to be experience with the total spectrum of human needs-satisfaction at the local level. Hence this pattern should not be seen in terms of either-or, but would perhaps be more meaningful if one talked in terms of some function being carried out more at the local level, others more at the national level, and so on rather than an allocation in more absolute terms.

140. By alpha/beta integration in space we mean a pattern that would divide the territory of the country relatively clearly into alpha and beta regions. The meshes could be very crude, with one part of the country modern/westernized and the other traditional/radical: or they could be so fine as to cut through cities, wards, even through houses. Thus, a family might have a little vegetable garden and some chicken in the basement, let out into the garden so as to enter an eco-cycle with the things that grow and the things that move (and some an-organic matter); at the same time they could have a very modern set of electronic gadgetry, a car and so on. The finer the meshes, the more equitable the arrangement - crude divisions would almost inevitably lead to cases of exploitation.

141. By alpha/beta integration in time we mean a pattern that would operate at the individual level and permit those individuals who want it to oscillate at the rhythm of their choice between alpha and beta life styles. The pattern is known in many countries today as the oscillation between urban lifestyles for work and more rural life-styles for leisure and vacation, [23] the argument being that the change in style in itself seems to satisfy some human need for challenge, new experience, variation. The integration over time, hence, does not necessarily mean that the society as such has to change over time in the sense of oscillating between alpha and beta phases, but that individuals should be permitted to do something like that. Incidentally, in so doing individuals might also be able to construct more individualized life-styles than seems to be the case today, for instance, in the People's Republic of China. [24]

142. Combining these three formulas, then, should yield a highly flexible reservoir of possibilities from which to work. By and large, as can be seen from Table 2, the idea would be that many of the answers to the problems of today are already embedded in the beta structure as such. In other words, in the beta case the structure is the technology. There is so much evidence to the effect that living in a community that is both horizontal and simple/integrated, [25] catering to all or almost all of the needs of human beings, is in itself an educational and healthy experience, obviating the need for much of the schooling and medical care of alpha-dominated societies. It is only in such societies that techniques constitute the structures. On the other hand, human beings are also robust, they survive a lot which is one reason why some optimism in connection with this more eclectic approach should be permissible.

143. More concretely, then, one might imagine federations of villages or blocks in cities that would constitute typical units, and cater to all the basic needs in such a way that he or she who wants it could live entirely within such

units, on a production for use basis. There should be strong measures against penetration from the outside; norms of structural privacy should emerge (e.g. forbidding people to make propaganda for products that would destroy the mother-child link known as breast-feeding). The potential of the local community for production for use only, not for exchange, could be utilized fully. (In Southern Europe this would probably be more village-based, in Northern Europe the federations may be of farms rather than villages and there is, of course, a long tradition to draw upon in the co-operative movements). But this would only be the beta part of the society, saturated, integrated units, full of life, but unrelated to each other, or almost so, which in some phase may be a condition for being able to keep the surplus. It would be as if the People's Republic of China consisted of only the 70.000 people's communes, nothing more. China, like any other country, also has an alpha structure, also in need of modification so as to become more horizontal. There are many rationales for this structure:

- to create a pattern for exchange and co-operation between the beta units - by making road and rail networks, and tele-communication, of the non-centralizing, self-reliant kind connecting the former periphery points with each other rather than connecting the capital with province capitals and the latter with towns that in turn are connected with the villages;

- to complement local production, particularly with the production of labor-saving devices so as to avoid unnecessarily hard and degrading work. [26] There is also the case for automation of some work, supplying some goods and some services by means of natural (although man-made) systems, practically speaking eliminating human labor; [27]

- to even out inequalities (inequities having already been eliminated through the introduction of self-reliant local units) by having reserves for natural and social catastrophes, to compensate for seasonal variations

and to some extent also to distribute surplus from the more to the less fortunate (production for reserves and the storage can to a large extent be done locally).

- to provide the society with protection against military, political, economic and cultural aggression from the outside, which does not mean closing the country for economic and cultural exchanges but to engage in them only to the extent that they can take place in a steadily horizontalizing international structure.

144. To pick up one of the other key themes of this paper, what would happen to the "eco" part of the eco-development formula? If the problem of the environment is taken in the narrow sense of depletion/pollution in the natural environment, then an integrated alpha/beta mix would use a combination of two strategies. The beta communities would carry the main burden of constituting a defense against depletion/pollution simply because the principle of limited, transparent economic cycles would make those who destroy ecological balances suffer from their own action. The alpha structure would add to this recycling and cleaning up technologies, partly to compensate for their own destabilizing influences, partly to complement beta level activities. For a deliberate, well co-ordinated combination of such approaches there seems to be no theory available at present; experience has to be gained from a deliberate effort to practice this kind of mix.

145. At a deeper level of ecological reasoning not only would "environment" be interpreted more broadly so as to include the human environment, but attention would be given to deeper phenomena than depletion/pollution only. Thus, one basic point would be to recreate some of the old ability to make use of ecological cycles, working with the nature rather than against it; this must have been some of the explanation why humankind managed to survive for such a long time. [28] No doubt, some of the scientific and technical insight gained in alpha structures

can be put to use in beta communities. [29] Thus, very much that passes under the name "electronics" can be low-energy devices both in production and in use; and still better forms can be found in the future. Nor is there any way of knowing what could be invented if the large majority of mankind was once more given the challenge to be creative instead of being intellectually demobilized by the alpha structures and their vertical division of labor. The ecology can be used to work in the enlightened self-interest meaning the individual self and the collective Self - the synchronic solidarity with present as well as diachronic solidarity with future generations.

146. Another aspect of ecological thinking would bring in the ideas of maturity and complexity (high in entropy). A mature eco-system is one that has a lot of redundancy and particularly many mechanisms of stable equilibrium to draw upon; it can survive considerable instabilities in its relations with its environment. A complex eco-system is one that has a lot of diversity so that even if one form is wiped out there are other forms that will continue. The alpha/beta mix that we have been arguing here has both qualities as potentials: where alpha does not work there is beta to draw upon,(and many types of beta units since alpha will be less able to standardize) and vice versa - not in the sense that one is at the service of the other, but in the sense of complementarity and symbiosis. Clearly, alpha alone or beta alone would not have the same levels of maturity/ complexity, which also serves to indicate that alpha and beta elements should be very close to each other, both functionally and in geographical space. Again, it is safe to say that no good theory exists at presents - this theory will have to be gained through practice. But this is fundamental since we not only want to provide for basic needs but to make structures that will continue to provide.

147. One particular point that should be made in this connection would be to learn from past experience where the incorporating ability of alpha is concerned.

Alpha and beta do nor enter in a mix as equal elements: alpha incorporates beta, not vice versa. As indicated the only way to compensate for this asymmetry is by means of another asymmetry: strengthen beta and weaken alpha, pushing alpha back, modifying it so that it becomes more horizontal and less complicated. 30/ But alpha has also proven to have expansionist tendencies not staying for long in the role as a supplier of supporting technology only. One of the mechanisms is to extract problems from the beta communities to solve them centrally in a general way, compatible with the universalizing tendencies of science (in the name of epistemology) and standardizing tendencies of alpha bureaucracy (in the name of social justice). Another mechanism is related to capitalism as an economic system: the factor mix in a production formula will never be perfectly balanced, and imbalance is ideally taken as a signal to fill up on the lagging factor rather than to cut down on those that are in excess(in the name of economies of scale). At the same time there is the struggle through more or less free competition to gain monopolistic control over one, more or all segments of the economic cycle for one, more or all products - with all-encompassing state capitalism as the crowning achievement (in the name of general welfare). The big problem is to what extent these expansionist tendencies are built into any structure that satisfies the alpha characteristics, and to what extent it is culturally determined by the type of social cosmology referred to as Western. The bias of the present paper is in the second direction: it is very hard to see that there is anything in the structure itself that should automatically lead to expans But only expansionism as a cultural trait is not sufficient to explain the phenomenon. It is an expansion in spatial and material terms rather than in terms of fulfillment of non-material human needs or the eco-balance needs of nature. Hence, one might imagine some kind of "cultural revolution" in the West that would not necessarily reject expansionism and growth but redirect it towards inner man, and how to create local communities so as to provide him and her with the best conditions for personal growth. 31/ No doubt this is a basic factor in the total picture; how basic we do not know. All we know from

the experience with federal states and other multi-tier organizations is that the bottom level does well to watch the higher levels and the total structure with enlightened suspicion in general, and develop their own formulas for handling problems and conflicts (and refuse to be confused by doctrines of universalism) in particular.

148. One method here would be to weaken the alpha structure further not only by horizontalizing it and taking functions away from it, but also by segregating it spatially. In today's world the villages, and the slums, the potential beta units, are the ghettos of humankind - they are in the hush, at the end of transportation/communication networks, those that are not already incorporated, that is. The centers in the alpha structures are basking in the sun, receiving all the social attention. One method would be to invert the formula, making the commanding platforms of the alpha structures less glorious, more hidden away, even placed in ghettos [32] - treating a minimum level of hierarchical alpha life as a necessary social evil because of the goods and services that cannot be produced in any other way. Today this is only done when alpha is hiding something (plants for producing nerve gases, atom bombs, etc.) - in another social mix beta might decide to hide alpha away. Needless to say this will not take place without social struggle and it should be remembered that alpha is as well trained in fighting wars from underground bunkers as beta is in violent and nonviolent local struggle. Nevertheless, this kind of thinking belongs to the dimensions of the search for a better alpha/beta mix than in our present alpha dominated world.

149. As these paragraphs are dealing with the power aspect of the matter (and it could be done much less tactfully) another tactic on the side of alpha to prevent the "strengthen beta, weaken and modify alpha" strategy from being implemented should be pointed out. It is neither to fight beta (in the extreme cases by intervening militarily into the countries that engage in national and/or local self-reliance to keep them "open"), nor to co-opt beta by lifting important

functions out of the beta nexus to reserve them for the centers of the alpha structures. Rather, it would be to "help" beta, with the best intentions and practices. The capitalist version would be to invest in beta; but that is fairly obvious and easily detected. The more subtle approach might come from the political left in the center countries of today's international alpha structure, with offers to serve as catalysts in the processes needed to undertake a structural change. Unless there is a clear program for phased withdrawal, or a genuine pattern of joining the local communities such practices only amount to a continuation of the alpha structure. The obvious alternative would be for such groups to promote the beta structures in their own territorial or non-territorial environment, thereby also weakening the power of those very same center countries to intervene in weaker countries moving towards self-reliance. This is important because one of the most obvious implications of a program favoring beta-compatible and rejecting alpha-compatible techniques, would be to reject techniques that presuppose that other local, national or regional units are cast in the role of delivering the raw materials or the raw labor - and such policies have a tendency to be resisted. 23/ This does not mean that there is no scope for research, but it should take the form of crystallizing experiences made and making beta units more visible to each other, not the form of a new alpha structure.

150. It should be pointed out that the distinction alpha/beta is not only related to the distinction Occidental/Oriental, but also to a very universal distinction: male/female. If the carriers of the alpha structures tend to be Western and/or male, the best carriers of the beta structures may be said to be non-Western and/or female. In fact, the weak, almost extinct beta structures found in Western societies today are to a large extent the control and concern of women, particularly the softer aspects of family life (not the bread-winning and career making aspects). But that means that the struggle to strengthen beta and weaken

alpha is highly compatible with the struggle to strengthen the non-Western parts of the world and weaken the West, and with the struggle to strengthen not only the position of women in alpha society, but the culture and structure associated with women in most parts of the world. Since these are formidable factors to count on the prospects for a more humane alpha/beta mix are not bad in the short run and very good in the longer run. 34/

151. In conclusion there is one important point to be made. In this paper the emphasis has been on the structural aspect of the problem as the basic tool of analysis and of political action, assuming some constancy both to human needs and laws of nature. Human needs, then, direct our vision of the necessary social structure, that - in turn - directs our search for technology, or technological mixes in the double-tracked system advocated. However, there are countless other ways of slicing the countless conceptual cakes needed to reason about such matters. In the present analysis the structural part has been reduced to a dichotomy between alpha and beta structures, later to be transcended in a set of mixes - the gamma structures. But the Greek alphabet has many more letters, and there are many other alphabets. Actually, the major conclusion from this study is how rich the spectrum of human possibilities are - both in terms of human potentials, structures, culture - and techniques - and how many unexplored possibilities, and combinations of known options, there are. Once we are able to get away, that is, from the habit of single-tracked, unilinear reasoning, trying to solve all problems by techniques that reinforce the very same structures responsible for generating the problems. 35/

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