TOWARDS A NEW INTERNATIONAL TECHNOLOGICAL ORDER?

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1. Introduction

The United Nations Conference on Science and Technology for
Development (UNCSTD) is scheduled to take place in Vienna, August
1979, 16 years after the first UN Conference on "Science and
Technology for Development". In a period when the flow of history
seems to be running more rapidly than before, perhaps also with
more eddies, waterfalls and swift currents than before, much
will have happened during that period, and it is important to
identify some of these trends - as they should have at least
some impact on such major undertakings as UNCSTD[1] - over and
above the obvious environmental factors.

First, and most importantly: the power position of the Third
World countries is quite different in 1979 from what it was in
1963. One might argue what is the reason: an increased self-con-
fidence among Third World elites due to accumulated experience
since the major decolonization breakthroughs around 1960; the
basic change in terms of trade that took place for at least one
commodity for at least some countries (oil) around 1973/74; the
experience of having beaten the remaining western power, the
United States, in Viet-Nam with the fall of Saigon April 30, 1975;
or all the new expressions of some restructuring of the world
economy, related to all of these phenomena, summarized under the
heading of the New International Economic Order (NIEO). Whatever
it is the power relations are not the same, and will never be the
same again - that is, between countries and regions, not necessarily
within countries.[2]

Second, a critical awareness, a scepticism bordering on pessimism,
concerning science in the west that probably was not so clearly
felt in 1963. Like all phenomena it is not a clear trend, there

are ups and downs,[3] but the general faith in science as a key
to the solution of most human problems is probably undergoing
a rather significant decline. At the philosophical/epistomo-
logical level this takes the form of basic criticism, at
the more popular level the form of basic scepticism; the two
levels interact, at least to some extent.[4]

Third, there is <u>a corresponding feeling about technology</u>,
particularly technology developed in the west. It has not
passed unnoticed that there is more technology than ever,
yet major social problems do not seem to be more tractable
than before. On the contrary, there seems even to be a feeling
that some of the problems of modern industrialized societies
have not emerged <u>in spite of</u> modern technology but <u>because
of</u> modern technology: mental diseases, cardiovascular diseases
and cancer seem increasingly to be related to stress, the
latter also to pollution; both stress and pollution being
phenomena related to societies built on modern technologies.[5]
The point here may not even be whether these assertions are
scientifically tenable or not; they are probably increasingly
believed in. Although people continue seeking the fruits and
benefits of modern technology particularly in so far as it
is labor saving and brings comfort, the scepticism remains:
there is ambivalence rather than simple enthusiasm, no longer
a honeymoon affair with modern technology. What could be called
"social pathologies" - such as the changes in the disease
picture, the lack of increase in life expectancy, the increasing
criminality, all of them apparently having a rate of growth
somewhere between 4% and 9% per year in the major industrialized
countries[6] -have not passed unnoticed although the total picture
is not much spoken about. Admittedly, it could be due to other
factors than modern technology but it is tempting at least to
some extent to relate it to such a key <u>force motrice</u>.[7]
Fourth, <u>western industrialzed countries do no longer seem to
be so attractive as development models</u> as they were in the
early 60s. In one period between the two conferences this was
no doubt due to the rise of China as an alternative model: not
so much being a question of whether China was accepted or
welcomed as simply due to the empirical existence, in China,
of <u>something different</u>. When something different exists the

western mode of development no longer stands out as development per se, but as one out of several alternatives; like other things with positive and negative aspects.[8] It should be remembered that westernization to many people was identical with development, based on economic growth, which again was seen as natural,in the way that body growth is seen as something that happens to the human organism astime goes on.

All this scepticism directed against the west, both in its "capitalist" or "socialist" versions,is it a carry-over from animosities against countries exercising capitalist or social imperialism; a feeling the it would be impossible to bridge the gap and really become like these models partly because they were too far ahead, partly because the methods the western countries had used were either no longer available, impossible to use or totally immoral; or is the feeling rather based on the idea that it is undesirable to realize the western models? If the latter, it may be argued that it cannot be based on much knowledge of the social pathologies of the western countries since they seem by and large to be unknown in the Third World. Nor can it be based on much knowledge or insight in the interaction between western science/technology and western development patterns, for even where there is scepticism in the Third World about western societies enthusiasm for western science and technology nevertheless seems to prevail. In other words, there seems to be some kind of cognitive detachment between science and technology on the one hand and the rest of western society on the other, combined with an idea that it might be given to the Third World to put the former to a better use without having the latter as deplorable "side effects". A well-known technique to avoid congnitive dissonance![9]

The present article is directed against any such belief wherever it might exist. As such the article is in the tradition of the west raising a warning finger, putting up danger signs on the roads on which the Third World is already travelling or about to embark. And this raises the question of the politics of the warning finger. About warning fingers there are probably two hypotheses that could and should be stated immediately:

(1) Although presented as being in the enlightened self-interest of the person warned the warning, when heeded, may also be very much in the interest of the warner; (2) partly for that reason, but mainly because of the paternalism involved, the warnings have a tendency not only not to be heeded, but also to be counterproductive in the sense of becoming an encouragement rather than a warning.[10] The question is whether the present warning in connection with technology would tend to be one more item of confirmation of either or both hypothses, and the answer will probably have to be yes, to either. Nevertheless, it is difficult not to issue such warnings, in spite of the very poor record the west has when it comes to influencing the developmental trends in the Third World.

This goes beyond relatively well known ways in which economic imperialism is operating, to the ways in which new ideas are introduced so as to serve - deliberately or not deliberately - old purposes. We are thinking of, for instance, such slogans as "Environment", "Basic Needs", "Cultural Diversity" and "Self-Reliance". All of them can be seen as foundations on which development in a very genuine sense can be built, but they can also be seen in another persepective. What they stand for, in capsule form, could be translated as follows: respect for nature, respect for the genuine needs of human beings, particularly for those most in need, respect for the fine fabric of culture, and self-reliance: developing, using one's own forces and factors, not at the expense of others. These are excellent principles indeed,[11] but the Third World can with full right say that if they are so excellent, why did you people in the west never practise them? And what is the purpose in bringing them up right now, except to deter Third World countries from pursuing patterns of development that might make them strong competitors of First and Second World countries in the world market of goods, services and power? And does this not also apply to the debate about technology? No doubt there are technologies that are best for building strong states and there are technologies that are good for building strong people; ususally they are not the same technologies. Why should the Third World only go in for the latter kind when the west

herself did not do so in similar phases of development?
In other words, is all this talk about technology anything
else than simply one more item on the list of western
efforts to prevent former colonies from becoming serious
competitors?[12]

We leave the dilemma at this point for there is no simple
answer. The allegations against the west, e.g. hypocrisy,
of not practicing what they themselves preach are true,and they
do not only refer to the past, but also to the present. The
people in the west who consciously practice respect for environ-
ment, for basic human needs, material and non-material, for
cultural diversity (particularly among the ethnic minorities
in the west) and self-reliance, to whom these four principles
serve as guidelines for developing technologies,are few and
marginal - at least so far. And the accusation of duplicity,
of humanitarian stands with a clear non-humanitarian purpose,
is one that should be taken seriously: the record of the west
would point to the general accuracy of such accusations. The
problem is only, however, that hypocrisy and duplicity in
the western argumentation do not serve to improve the quality
of western technology; the problem is still there! Hence:, what
are the characteristics of western technology?

2. Some characteristics of western technology.

We shall refer to the technology in question as "western", for
regardless of roots that may be said to be more universal, the
technologies in question have been developed mainly in the
west, and spread from the west to other parts of the world
with or without some modifications. By the "west", then, we
refer not so much to a geographic area as to a civilizational
area which it is not so important to the limit in exact terms
for the present purpose.[13]

Using the very felicitous phrase developed by Amulya Reddy[14]
we shall see the western technology as a carrier of a certain
code, built into the structure induced by the techniques. In
other words, we conceive our technology as techniques plus

structure, where the techniques have hardware components
(tools) and software components (skills and knowledge) and
structures are mainly of two kinds: economic and social
structures on the one hand, and cognitive structures, deep-
lying assumptions about reality, on the other.[15] The assumption
is simply this: whenever a technique is developed, deployed,
transferred,a structure is being built, whether it is a
technique for production, for distribution or for consump-
tion. Hence, we shall use the term"technology"with the under-
standing that it is never "politically neutral" because it
always carries a code, expressed in the structure accompanying
it, social and/or cultural. Thus, a car carries a message:
it says something about the size of the unit that can travel
in the car with comfort,and consequently about the size of
the family. It not only limits that family to a maximum around
three children for most cars but also indicates the structure
of the family with the parents in front and the children behind,
with the father being the instrumental leader turning the
wheel, the mother watching, commenting, taking care of the
internal relations in the car, the boy peeping over the
shoulders of the father to learn the tricks, the daughter
sitting behind the mother doing likewise. And a car is an
expression of a certain attitude to other human beings (regu-
lated competition) and to nature (depleting and polluting
nature but running away quickly from the scene).

Without going into details let us simply split the code into
three parts: economic, social and cultural. The economic code
can be expressed in terms of factors, and the formula would
be that western technology tends to be capital-intensive,
labor-extensive, research-intensive and organization-intensive.
As to nature, it is difficult to have any clear view: modern
electronic industry, for instance, is not necessarily very
demanding in terms of "nature", meaning raw materials for
directly material or energetic purposes. However, economistic
reasoning in terms of abstract factors does not carry us
very far. Often it makes much more sense to say "capitalist-
intensive", "researcher-intensive", "manager-intensive" and
"worker-extensive", in other words, referring to concrete persons
rather than to "factors". Putting it this way one may see more

clearly what western technology has been about: laying the
basis for a mode of production that would call increasingly
on the skills of capitalists (the specialists in financial
matters), researchers (the specialists on general laws
in the sense of predictions), and managers/bureaucrats/
administrators (the specialists on general laws in the sense
of prescriptions) than on workers. Still put in another way:
western technology is leaning increasingly heavily on social
elites, less on the industrial proletariate; it may even be
seen as a way in which that industrial proletariate can
be eliminated.   One way in which this shows up is, of course,
in the famous increase of the tertiary sector and decrease of
the secondary sector where employment structure is concerned,
in western societies. [16] Still another way of saying this would
be to point out that western technology can only be put to use
where there is a sufficient concentration of capital/
capitalists, research/researchers and organization/managers
- and this would in general be in the capital of the country.
Given the scarcity of these factors and the necessity of con-
centrating them in a relatively low number of spots, the in-
jection of western technology will tend to increase tremendously
the existing inequalities.

Then, the social code. The term very often used in this con-
nection is that western technology is "dependency forming."
This is no doubt correct: once the technology has been im-
planted an everlasting demand structure is created for spare
parts, for more knowledge and skills, for new technologies.
This is important, well known and obvious; it is also obvious
that the same pattern is replicated as in a system of Chinese
boxes within countries, in general between center and periphery.
But it should be pointed out that the notion of "verticality"
as the general aspect of the structures accompanying western
techniques, built into the technologies, goes much further
and is much richer. It is not only that the command positions
are retained by the center for their material and non-material
enrichment, e.g. for the accumulation of profits by selling
the work product of scientists and technicians as commodities
(the price paid being referred to as fees, under the headings
of patterns, licences etc.) and by reserving the most important

and innovating tasks for the center because of the virtual
center monopoly on the means of intellectual production. It
is also that by doing so the center is _conditioning_ the
periphery, impressing its tastes on them, defining what pro-
ducts are worth producing and consuming (i.e. the products
that it is possible to produce with the techniques given),
the conditioning in the opposite direction being a very minor
one indeed. In doing all of this the center constitutes an
inner core _marginalizing_ the rest, turning them into "factors
of production", and clients who perform the roles as consumers.
It is also worth noting that western techniques of production
and consumption tend to be _fragmenting_ in the sense that they
can be carried out without much interaction or mutual help
among producers and consumers. Of course, workers in a factory
are tied together with the visible and invisible ties of that
particular form of organization, but they are not necessarily
in direct interaction depending on each other. And the same
applies to consumption: two persons watching TV are tied
together by that medium, but they are not necessarily watching
together in the sense of interacting. And western technology
tends to be _segmenting_: people participate in it with only
a samll part of their personality, often referred to as special-
ization or compartmentalization. In other words, western tech-
nology tends to drive wedges between and within people. All of
this is very often written about and commented on, the point
is that there is a total picture to it, a total pattern which
on other occasions I have referred to as the alpha-structure.[17)]
The thesis is that it is built into western technology.

Again, it may be objected that this type of analysis is too
structuralistic and that it should be accompanied by an analysis
in more concrete terms. Thus, who are the concrete people who
are in the center of this structure, who are on the periphery?
By and large it seems to be fair to say that they are the same
people that were pointed to in the preceding analysis of the
economic code carried by western technology: the specialists
on finance, research and administration. In general terms these
are key categories in what is loosely referred to as the
"tertiary sector", on the upper rungs of the social ladder

inside that sector. And the basic point in this approach
to technology can now be formulated: it is not that technology
by chance happens to induce structures of this type, it is
rather that the structure produces, filters out and accepts
only the techniques that will be accompanied by such structures,
thereby reinforcing the structures themselves.[18] Any technology
that demands less in terms of finance, research and administra-
tion will constitute a threat to specific groups of people,
and if in addition it is more horizontal in the sense of
inducing less difference between center and periphery, is less
conditioning of the periphery, less marginalizing, fragmenting
and segmenting,then the general power of the center over the
periphery will be reduced.

Today it looks as if China is an important case for those who
want to study the structural aspects of technologies. If there
is anything the Cultural Revolution was about then it was
exactly to build production patterns that would be less vertical
The people's communes were a particularly important instrument
in this connection; less dependent on finance, on research
and administration and used techniques that could be more inte-
grative, induce more togetherness, more general participation,
more mutual conditioning and indeed more equity within and
between communes,and units inside the communes. But this could
not possibly take place except at the expense of the power of
certain groups: the state capitalists (the private capitalists
having been eliminated as a class at an earlier stage), the
researchers/professionals/intellectuals, the bureaucrats - and
to this one might then add the top military people and the top
party people as two particular elites closely related to the
other three.[19] It can be guessed that the five elites did not
like to see their power basis eroded, regardless of whether this was
done with or without much violence, with or without much personal
humiliation (probably without much violence but with much
personal humiliation). As far as one can judge they did not
wait long after the death of Mao Tse-tung before they hit
back, and the rest of the story during the two years
that have passed since his death is to a large extent the
story of basic technological change, meaning (re-)introduction
of techniques that can more properly be described as western

in the sense of inducing the particular economic and social
profiles referred to so far. In other words, the struggle,
indeed fight, about which technology to use is essentially
a political struggle about power, about the steepness of
the center-periphery-gradient of the society, about who
shall be in the center and who in the periphery.[20]

To this could then be added the cultural or civilizational
codes; the idea that built into the technology is also
a certain cosmology, an implicit way of viewing the world
in general and society in particular. This is not the place
to go into detail.[21] Suffice it only to mention that there seem
to be five components of western cosmology of some signifi-
cance: the tendency to see the geographical space in center-
periphery-terms with the center in the west, the tendency to
see time as linked with ideas of progress, with something
becoming better, more, increasing at least in a linear,
preferably in an exponential manner; the tendency to think
of reality in terms of units abstracted from the whole of
which they are parts and related to each other causally
and mechanically so that changes in one will imply changes
in the other; a tendency to see vertical and individualistic
relations between human beings as normal and natural; and a
tendency to see man as the master of nature with unlimited
rights as equally normal and natural. The point here is that
these are not necessarily formulated explicitly as manifest
ideologies; they are deep ideologies constituting a basis for
defining something as normal and natural and something else
as abnormal and unnatural. Western technologies fall in the
first category to the extent that they are compatible with
such assumptions; in other words to the extent that there is
dependency on a western center, that they do produce more
and more, that they are based on analytic rather than holistic
insight, that they do induce man over man and man over nature
relations. Technologies that fall short on these points or
even are the exact opposites would be seen as strange, quaint,
"romantic" (a very important term in the vocabularies of those
who defend western technologies) and tend to be rejected.[22]

Thus, the total picture is one of <u>transfer of technology</u>
<u>as a structural and cultural invasion; possibly of much</u>
<u>larger significance than colonialism and neo-colonialism</u>,
precisely because it is not necessarily accompanied by any
physical personal western presence, not even in the form of
elites with allegiance to the west. On the contrary, it is
entirely compatible with elites that reject the west in all
regards except for the technology - as mentioned in the intro-
duction this somewhat inconsistent attitude is not only possible
but may even be prevalent.[23] Add to this, then, <u>the environmental</u>
<u>factor</u>: the accusation against western technology that it
tends both to pollute and to deplete non-renewable resources,
not to mention that it also tends to have deeper impact on
the level of maturity of eco-systems, both at micro- and macro-
levels.[24]

How is it possible not to see all of this? One reason is very
simple: it belongs to the fragmentation induced by western
technology that visions of western technology also tend to
be fragmented: there are those who emphasize environmental
aspects, those who look at economic factors and particularly
at the capital costs, those who look at social factors, and
those who are concerned with compatibilities or incompatibili-
ties between western technology and endogenous cultures. Only
very rarely are these factors put together so as to constitute
a more general picture - as attempted in the preceding pages.
But even if such images became more prevalent they would not
constitute a sufficient basis for mobilization against
western technology; it would lead to consciousness-formation,
but not necessarily to political action.

The reason for this is that there is a second factor at work:
the argument that even if everything said so far is true it
is not the total picture. There are also good things to say
about western technology. More particularly, if that were not
true, and one assumes that western people are not all of them
fools or masochists, then westerners would themselves have
given up that technology! In short, there must be <u>something</u>
to it since it is so vigorously adhered to, in spite of all the
noises emanating from the citadels of the west to the effect

that it isn't all that good, like the millionaire telling the
destitute "money is not everything in this world" or the over-
educated double Ph.D. telling the illiterate "believe me, I am
sure you are the wiser person than I am". So,what about that argument?

3. Will western technology have the same positive effects in the Third World as in the west?

The position taken in this paper is certainly not that western
technology is all bad nor that it cannot also bring blessings
to the Third World, and indeed already to some extent has done
so. Thus, there are highly capital intensive projects that
perhaps, when properly evaluated, can be said to have rather
positive effects. One example in mind might be communication and
transportation facilities between peripheral points in a Third
World country (or in any country for that matter). Excellent
transportation/communication facilities between the capital
and the periphery have more mixed consequences; they tend
to be the media through which more control and potentially also
more exploitation may be exercised by the center of the peri-
phery. There are health schemes, perhaps particularly in the
field of preventive medicine, that are based both on capital,
research and organization having as a consequence that the life
expectancy at the age of four is not too different as between
developed and developing countries.[25]

Labor saving devices can eliminate excessively heavy, dirty,
degrading and monotonous work - but the monotony is then pro-
bably reintroduced by the way industrialized modes of production
tend to organize work. In general terms, western technology
also provides comfort, meaning by that a kind of protection
of the human body and psyche against less pleasant aspects
of nature. The argument that this has led to overdevelopment
in western countries, at least for some segments of the popu-
lation, among other reasons because of over-protection from
heavy work (including the type of "heavy work" referred to as
walking), and a distance from nature that must in some way
or another make us more vulnerable, does not carry much weight.
It can be argued that there is an interval between the under-

development of most Third World countries and the overdevelop-
ment in some parts of western countries, making the problem
a moot one (except for certain elites, usually located in
Third World capitals where the same phenomena may already
be present).

Much more important, however, is a different argument the
implications of which are not yet clear bebause history has
not yet moved that far. It is generally assumed today that
much of the living standard in the First World is at the
expense of the Third World; or in more particular terms that
it has been possible in the First World to obtain a much higher
level of equality because of export of the periphery to the
Third World. Today this takes the concrete form of export
of jobs to Third World workers, thereby cutting labor costs
with something like 90%.[26] Patterns of exploitation no longer
possible inside First World countries are possible at Third
World level, but they require a new international division of
labor.[27]

To repeat this trick with a technology that is inherently
periphery forming the Third World would have to have a fourth
world to exploit. It may be said that this is being done by
Third World elites in the capitals using the rest of the
countries as the fourth world, which then raises the question
who they are supposed to exploit. Answer: <u>nobody, as there
is no extra fifth world around; the process runs out of worlds</u>
(unless some celestial body is discovered).

Second, although the material conditions of workers in the Third
World may not be that different from the material conditions
of the First World workers as described by Marx in the last
century there are some important differences. Technology has
"progressed" further, the transition from electro-mechanical
to electronic industry makes the vertical division of labor,
the conditioning, the marginalization, the fragmentation and
segmentation even more pronounced - reducing the worker even
more to a robot.[28] And this raises the question whether the
worker will not soon be replaced by robots simply because they

are less troublesome and pay better returns? Also, it should
be remembered that the food basis for Third World workers,
the countryside, is also being increasingly exposed to the
same type of industrialization process, producing commodities
for First World markets rather than goods for subsistence.

Let us try to reformulate these arguments. Western technology is
in and by itself periphery-forming, in many ways. It does de-
liver goods and services, an astounding variety of them, but at
a cost - it is hard on people, hard on nature. The techniques
always induce externalities:by and large positive for the center
particularly in terms of the creativity demanded from the few, and
by and largenegative for the periphery, because of the sacrifices
demanded from the many, and from nature. To the general western
way of trying to run the world this is natural/normal; the
world is or should be like that. Colonialism was one expression
of it, capitalism another, western technology still another.
To internalize the positive and externalize the negative exter-
nalities is roughly speaking what the system is about. From push-
ing the negative externalities on their own masses the western
centers seem to be increasingly successful in pushing them onto
the Third World. By and large the Third world elites are cooperative.

The whole point we are now trying to make is that this does not
change if the same technologies are put to use inside the Third
World. There will still be externalities highly unequally distri-
buted. As it is rather unlikely that the First World will accept
the negative externalities by doing jobs for the Third World con-
tributing only raw nature and underpaid workers, being at the
periphery end of it all and in addition committing cultural suicide,
other Third World countries, and the masses and the nature of
all of them, will have to carry the burden. Because of the built-in
structure the technology itself will force the stronger Third
World countries to start exploiting the weaker ones and the elites
to exploit the masses and to overtax nature, for this is the
condition for that technology to be operative. And then the argu-
ment is not that this is a possibility   it is already happening.[29]
The argument is (1) it will not help the masses in these countries,
(2) those masses cannot be exploited further and (3) we are at
the end of the road, beyond where we are now there is nobody left
to exploit. The situation is qualitatively different. Hence it calls for a
qualitatively different approach.

4. Some criteria for the selection of technologies.

Given the type of critique of Western technology presented above, what would be the criteria that could and should be used in order to improve on, or completely avoid the more deleterious aspects of that technology? What would be the questions that should be asked of any technology, the guidelines that should steer the work of scientists and technicians concerned with real development? One such proposal is presented in Table 1 (see next page)[30/].

In the list of criteria or considerations proposed in this Table the broad headings "economic", "social" and "environmental" are used, subdivided into six criteria with each one, in turn, subdivided into two - yielding a total of twelve. It is in the nature of such lists that they may generate more controversy than consensus, potentially leading to a fruitful process of adding to, subtracting from and modifying the items - a process which in and by itself is a part of the consciousness-formation. The present list may derive its rationale from current thinking and practice in the field of eco-development,[31/] where development is seen as "development of human beings, not of things", interpreted as the satisfaction of material and non-material needs; and the "eco-" stands not only for counteracting depletion and pollution, but for building a stronger environment. These are broad criteria which have to be taken into account in arriving at decisions not only dealing with the selection of technologies but also with the processes that generate these technologies. It needs to be emphasized that the weights assigned to each criterion or combination of criteria will have to be determined in each individual case with as wide a participation as possible of persons directly involved in implementing them or being affected by their implementation.

The purpose of laying down criteria for the selection and development of technologies is to broaden the base for decision-making in this field, so crucial for any progress in the field of eco-development. The relative weight given to these criteria will vary from place to place and over time, but in making the criteria explicit at least some consideration will have to be given to any one of them, if they are adopted. There is a very important qualitative difference between, say, ignoring completely the extent to which a technology is self-reliance building and taking it into consideration, but giving it low weight; or giving it high weight, but conceding that the technology chosen does not meet the criterion. In the first case the decision-making agenda remains closed in that direction; in the latter cases the item is at least on the agenda, forcing a consideration of the issue. In so doing the criteria may

Table 1. Some criteria for the selection of technologies

ECONOMIC

(1) BASIC NEEDS SATISFACTION		– does it directly or indirectly (over short time) contribute to the satisfaction of such <u>basic needs</u> as food, clothes, shelter, health, education, transportation/communication?
		– does it produce goods and/or services accessible to those <u>most in need</u>;
(2) FACTOR DEVELOPMENT		– does it use <u>local factors optimally</u> over time?
		generating employment;
		developing medium and high level skills and engineering and R and D capabilities and using them for the purposes of further technological development;
		saving/generating capital;
		saving/generating raw materials including energy;
		generating more appropriate technologies;
		– does it increase the capacity to produce on a <u>sustained, cumulative basis</u> over time?

SOCIAL

(3) STRUCTURAL DEVELOPMENT		– does it reduce dependence and promote <u>self-reliance</u> (autonomy combined with selective exchange on an equitable and solidary basis and with mass participation) at the local/national/regional levels, enabling the society to follow its own path of development?
		– does it <u>reduce inequalities</u>?
		between occupational, ethnic, sex and age groups;
		between rural and urban communities, and
		between (groups of) countries, especially in the field of scientific and technological capabilities;
(4) CULTURAL COMPATIBILITY		– does it make use of and build on <u>endogenous technical traditions</u>?
		– does it <u>blend with/enhance valuable elements and patterns in the local/national/regional culture</u>?
(5) HUMAN ENRICHMENT		– does it lead to <u>creative involvement on a mass basis</u> by being <u>accessible, comprehensible</u> and flexible?
		– does it <u>liberate human beings</u> from boring, degrading, excessively heavy or dirty work?

ENVIRONMENTAL

(6) ECOLOGICAL BALANCE BUILDING		– does it <u>minimize depletion and pollution</u> by using renewable resources, through built-in waste minimization, recycling and/or reuse and blending better with existing eco-cycles?
		– does it <u>improve material and man-made environment</u> by providing for a higher level of complexity or diversity of the eco-system, achieving balance and reducing the vulnerability of ecological systems?

potentially serve to increase the level of joint economic/social/environ-
mental consciousness, and not only among policy-makers, but also in scien-
tists, engineers and technicians, 32/ and above all in the population at large.
There is a general need for increased technological consciousness in the
population of most countries so as to generate demands on those who deliver
the technologies including popular inventiveness itself, making them accoun-
table in terms of such criteria.

An adequate generellay agreed upon methodology of selection, based on cri-
teria such as these, does not exist today. One reason for this may be that
excessive specialization and professionalization have led to such diverse
approaches in economic, social and environmental sciences that we do not
even possess a common language adequate for comparisons across disciplinary
borders, leaving alone a common unit of measurement. Without prejudging
future there is the need for a general development in these disciplines, or
the growth of transdisciplinary approaches, warning against any methodology
that would tend to exclude criteria that have not yet been quantified,
possibly even because they are intrinsically non-quantifiable (which may be
particularly true for some of the social criteria). Whatever can be quanti-
fied should be quantified; for whatever cannot "rules of thumb" can often
be developed - eg., the judgement of a qualified group of those affected
one way or the other by the decision as to whether the technology is "posi-
tive", "indifferent/unclear" or "negative" in its consequences along that
particular dimension. Whether quantitative or qualitative the net outcome
of such considerations would be a profile for any given technology, and it
is this profile or configuration in toto that has to be evaluated. The bias
should be in favor of simultaneous rather than sequential evaluation of the
profile lest sequential decision-making might (1) knock out already in the
first filtering process technologies that when viewed in their totality
might have highly redeeming characteristics and (2) play up to narrow spe-
cialization, disciplinary or otherwise, instead of fostering the type of
broad overview and approach that simultaneous evaluation would tend to
foster. In that evaluation there would still be room for making a criterion
an absolute condition (in the sense that if it is not met the technology
in question is out) - but only after giving the technology a chance by look-
ing at the total profile.

Criteria such as these should not be interpreted in a passive, static way
as yardsticks used for the selection of existing technologies (from a set
of alternatives), but in an active, dynamic way, as a heuristic leading
to the development of new technologies. Few technologies today will meet
all criteria, but this should lead to a quest for ever more appropriate
and environmentally sound technologies, and not merely for a trade-off bet-
ween criteria. Since the social and environmental criteria are the ones that
have received least attention so far the concrete consequence of adopting
such lists of criteria as general guideline will probably be more in the
field of generating new technologies than in evaluating already existing
ones, provided they are used in a constructive, not only in a critical spi-
rit, opening for new sources of inspiration in technological innovation.

Even given a much higher level of consciousness and inventiveness, including
popular participation, it is obvious that there will always be technologies
not meeting all criteria. More particularly, the criteria relating to local
self-reliance, human enrichment and culturalcompatibility may often best
be met by technologies related to relatively small scale industries and more
limited economic cycles. In such settings environmental criteria may also
often more easily be satisfied. Many of the economic criteria may possibly
be best met by technologies associated with large-scale industries and ex-
tended economic cycles, sometimes operating at the national, sometimes at
the regional, sometimes even at the global levels. Hence, the criteria
should be seen as a guide for <u>a better mix</u> of more appropriate technologies
operating at the various levels, in different and in the same sectors of
goods and services (eg., in the fields of food-production, or medical care).
In some countries this should lead to a strengthening of technologies at
the local level,in other places to a strengthening of other levels. What it
does <u>not</u> mean, however, is any all-out rejection of "Western" technology or
acceptance of "traditional" technologies. The criteria should be used con-
structively so as to <u>modify and develop further</u> "Western" and "traditional"
technologies alike, in addition to generating new technologies that cannot
be placed in either category. In doing so it will probably be recognized
that the unit of selection and modification/development is not only the
technology itself, narrowly conceived of withits hardware and software com-
ponents, but the total structure and process related to it. <u>Consequently the
selection process will be part of a general social dialogue that is part
and parcel of human liberation processes.</u>

While in no sense extolling one-sidely the virtues of the local and the shortcomings of higher levels of production/consumption, the trust of the total approach, in many countries, would be to strengthen the local level. Predictably this will lead to resistance from groups with vested interest in higher levels, not only groups engaged in centralized decision-making and resource-control (including the control over capital); but also scientists, and researchers in general. Science tends to be universalistic searching for general solutions; central administration tends to look for nationally standardized solutions; and capitalistically run enterprises tend to be both expanding and centralizing - leading to considerable harmony of interest between these three groups, not only at the national, but also at the regional and global levels (including intergovernmental agencies).[33] Modes of retraining and redirecting scientific research - to mention but one of the groups - to make it more relevant for and sensitive to the local level and local participation would therefore be an important ingredient in an action program devoted to the objective expressed in the criteria, blending scientists and villagers in ways unknown today.[34]

5. Some proposals for joint action

Given this kind of situation, where on the one hand there is a well developed technology with many built-in dangers and on the other hand there is a quite explicit list of wishes, desiderata, but not many technologies that meet them, what can be done? And more particularly, what can be done in a joint co-operative manner, involving both "north" and "south", both the First, Second, and Third Worlds - preferably in a mulitlateral,even a UN setting? The following are five broadly phrased proposals in that direction.

First, the basis for technology assessment should be broadened, including in addition to economic and environmental criteria more explicitly also social and cultural dimensions. Assessments should be made public, even including warnings. If it is possible to reduce smoking, at least among middle aged males in industrialized countries,by means of a campaign where pro-

spective buyers of tobacco products are warned that they may
be "dangerous to your health", it should also be possible
to reduce some of the abuses of careless technologies by
issuing warnings to the effect that they may be dangerous
to individual as well as social"health". It would be interest-
ing to see what joint north-south-commissions working on such
problems might arrive at, although it is quite clear from past
experience that the problem here is not whether the composition
is international but whether the composition is sufficiently
interdisciplinary,whether it includes a sufficient number of
perspetctives on technology, and perhaps also whether it in-
cludes people who are not intellectuals and for that reason do
not have our déformation professionelle.

Second, there is the task of developing together technologies
that better meet the requirements, for instance as listed in
Table 1. In doing so there should be a very good basis for
north-south co-operation on an equal footing: the south could
contribute with deep insight into traditional technology, the
north with much of what has been developed recently and is
still very quickly developing in the field of alternative tech-
nology. Often they are similar, often they are different. Thus,
an economic profile that might be interesting would be the
type of technologies that are nature-extensive, capital-exten-
sive, labor-intensive, research-intensive and organization-exten-
sive.[35] In other words, the major inputs would be labor and re-
search, work and ingenuitiy. It may well be that recent advances
in new ways of producing foodstuffs, based on a much broader
utilization of natural eco-systems, would fall into this cate-
gory. It may be objected that the research would probably be
carried out in the north and the work in the south; the problem
would be to find ways of transcending that type of contradiction.
One place where this has probably been done might be in
communes established on northern Europe, typically staffed by
highly educated intellectuals with considerable research train-
ing and skills, but also very willing to carry out manual work.
In short, another example of how structures may produce tech-
niques if the consciousness and the political will are present;
when these two important factors are not present, the techniques
will induce structures and human beings will be conditioned

by those structures.

Third, to develop a new mix of different types of technologies,
whether they are referred to as western/non-western, alpha/
beta or whatever. This is very much a field in search of not
only practice but also in search of theory. How much and
what should be given to western technology to produce, how
much and what to other types? Again, this constitutes a field
where north-south co-operation could be on an equal footing.
As long as that "co-operation" is about conditions of transfer
of western technology it is obvious who has the upper hand. But
the political wish for more equitable relations north-south
is an expression of structure, that structure should itself
serve to direct the composition of that mix so that more equal
relations can be obtained. For this to happen much political
skill is needed, and it will not be easy to produce the necessary
willingness to let the opponents of "modern" technology in the
north, and in the south as well,have as much of a say as the
very vociferous proponents.

Fourth, the possibility of more transfer of technology the
other way,from south to north. The argument would not in general
be in terms of transfer of traditional technology in the south:
it would probably usually be as unsuited to the north as western
technology is to the south - according to the analysis in
section 3 above.[36] The only condition under which that type of
transfer would be possible would be the reverse of the condition
that has obtained in the world: 500 years of domination exercised
by the south over the north,preparing the ground. This con-
dition not obtaining, what would be of interest today would be
much more openness in the north to consider new ways of develop-
ing "mixes". Thus, one interesting example is how a country
that one century ago would have been classified as belonging
to the "Third World", Japan, was somehow able to build a
buffer around western technology, encasing it in a social structure
somewhat different from the western one.[37] Today there is tech-
nical co-operation from north to south, the beginning of tech-
nical co-operation between south and south (TCDC); it is high
time that some patterns of technical co-operation from south
to north should emerge.

Fifth, what about a possibility of <u>other channels of transfer</u>
<u>of technology, or dialogue about technology than the channels</u>
<u>most prevalent today</u>? When we say transfer "from north to
south" even that is actually a non-valid metaphor: in fact it
is a transfer from certain groups in the cities of the north
to certain groups in the cities of the south. It is urban-
urban-co-operation, which leads one to ask the question what
rural-rural-co-operation might look like. How would it be if
more direct dialogue and co-operation were possible between
rural communities, for instance communities that try to become
more self-reliant whether they are located in southern Tanzania
or northern Norway?[38] Today they may articulate demands, or
needs maybe imposed upon them; but the channel through which
dialogue and possible co-operation takes place would be fora
for negotiating elites drawn mainly from the two capitals
concerned, in bilateral or multi-lateral settings. Needless
to say, the world communication structure is made in such a
way as to steer co-operation that way, and away from those that
potentially might benefit most from direct contact.

6. Conclusion

The general thesis of this paper can now be stated in one
sentence: techniques are accompanied by structures, these
structures eventually decide which techniques will be seriously
researched, developed and deployed. The structures steer the
techniques once they have become sufficiently well rooted.
Techniques that induce very different structures will tend to
be rejected, left undeveloped, or marginalized as something to
be indulged in by small,peripheral groups. For these tech-
niques to come to the forefront and dominate the social picture
more a highly conscious attitude to the interplay between
techniques and structures is needed, and a political will to
change the structure and to use alternative techniques as one
instrument in this structural change will have to be present.
That political will is not easily mobilized when everything
seems to proceed relatively smoothly. More particularly, it
is not mobilized when the negative effects of the technologies
can by and large be pushed onto others, even onto other countries,

other regions.

From this it would follow that it is mainly during crises
that a major change of techniques will take place; in other
words when the dominant structure is sufficiently weak. Thus,
there has probably never been such a lively debate about alter-
native technologies in the west as during the oil crisis.[39] If
that type of crisis situation were to return it is likely that
the movement towards alternative technologies will be given
even further momentum, not only in terms of new technical
innovations, but also in terms of social practice. And thus,
we may very well end up with the following situation: as the
crisis broadens and deepens in the west[40] the search for alter-
native technologies and for better mixes will be intensified;
possibly leading to much more felicitous combinations in the
west. And at the same time the wave of western technology
will have continued unabated into the Third World, enriching
the few and empoverishing the many, materially as well as
non-materially. So once more the west may end up with the
better part of the deal --- .

To avoid this there is only one course of action that bears some promise
for the future : that the West itself starts assessing its own technology
in more mature ways and starts drawing conclusions in action terms for this
evaluation. If the conclusion of all of this is in the direction that somehow
Gandhian technologies are better, more human, than the typical Western approach,
well, then it is good for all of us, not only for the masses in India. If
appropriate technology is to be an export product foisted on the masses of
the Third world by First world elites so that the latter can continue plun-
dering Third world lands, then it is wrong. If it is something that the First
world also wants to start practising simply because it is better, using its
ingenuity to develop new technological mixes, less harmful to human beings
and to nature, at home and in other countries, then that may convince more than
any declaration, papers or books will ever do. And fortunately, there are
some moves in that direction - the situation is not entirely dark.[41]

* * *

NOTES

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1. The importance of listing the major discontinuities in thinking and practice between the two conferences was conveyed to me by Professor E. Naraghi, Tehran - but his and my lists differ somewhat.

2. For an analysis of the likely impact of the New International Economic Order, see Johan Galtung, "Poor Countries versus Rich; Poor People versus Rich: Whom will NIEO Benefit?", in Self-Reliance and Global Interdependence, Ottawa, CIDA, 1978 (also available as Papers, No. 62, from the Chair in Conflict and Peace Research, University of Oslo).

3. A barometer here might be the tendency to enrol in colleges of engineering and natural science faculties. From a down in the early 70s there was an upward trend that then seems to have flattened out, perhaps even with a new decline. The time period considered is much too short, however, to arrive at any conclusions.

4. See Ornauer, Sicinski, Wiberg, Galtung, eds., Images of the World in the Year 2000, Mouton, 1976 for analyses of the deep pessimism with regard to science in the more "developed" regions of Europe, relative to the science optimism encountered in the less developed parts and in the Indian sample in that ten nation study.

5. For an analysis of this relationship, see Johan Galtung, Development, Environment and Technology, Geneva, UNCTAD, 1978, chapter 3.

6. See Johan Galtung and Monica Wemegah, "Overdevelopment and Alternative Ways of Life", Summary paper from the GPID/UNU/SID Alternative Ways of Life Conference, Geneva 21-24 April 1978, presented at the SID North-South Roundtable, Rome, May 18-20, 1978.

7. This, however, is only possible if a sufficiently broad definition of "technology" is made use of, not restricting the concept to tools, skills and know-how, but also including the structure - between countries and regions, within countries, and between people - needed for a technology, of production or of consumption, to be operative.

-2

2.

It may be argued that this is a trick: to relate techniques to social
pathologies an intervening variable is interspersed; social and cog-
nitive structure. But how can techniques operate except through the
medium of social structures, and how can the knowledge be developed
and imparted without a cognitive matrix capable of embedding that
particular type of knowledge ? Moreover, given these structures the
thesis also runs the other way: the structures serve as filters in
the sense that only those techniques that are compatible with the
structures will be accepted as serious candidates for socially rele-
vant research and development - those that run counter to the dominant
structures will at best remain marginal as something for peripheral
groups, at worst be eliminated as archaic, or even as dangerous.
These points are discussed in some detail in chapter 2 of the book
referred to in footnote 5 abice. Also see Persson, B. and de Monthoux
P.G., Filters - Limits to Technological Choice.
8. For an effort to spell out the Chinese development model in struc-
tural and cultural terms, for the period 1966-76, see Johan Galtung
and Fumiko Nishimura, Learning From the Chinese People, Georgi, 1979.
9. In a sense this is an outcome of the Western ability to propagate
its particular form of science and technology as universal rather than
qualifying them with the civilizational/cultural/ethnic term "Western"
or some equivalent. As a matter of fact, the "qualifying" adjective
most used in the West is probably "modern", which together with the
implicit and explicit universalism well expresses Western arrogance in
these matters. But it facilitates cognitive dissonance resolution by
permitting non-Westerners to be against the West for any number of
reasons, yet be positive to S&T. In doing so much will be done to iden
tify non-Western parallel development or contributions to the Western
mainstream, thereby underpinning the thesis of universalism, trying to
make it look more symmetric. Of course, there is no clear cut dividing
Western and non-Western technologies in geographical terms; the thesis
can only be that Western technology is predominantly a carrier of the
code described in section 2 of the paper, and that there are other te-
chnologies in this world. Curiously enough the lack of analysis of the
structural aspects of technologies also applies to marxist thinking in
this field - contrary to what one should have imagined, viz., that
marxism more than any other orientation would sensitize analysts to the
relation between techniques and structure, between means and modes of
production. Thus, in a paper "Social Side-Effects of the Introduction
of New Technologies", VIIIth World Congress of Sociology, Toronto

August 1974, Alexander Szalai of the Karl Marx University of
Economic Sciences in Budapest comes close to seeing the obvious,
that "modern" technologies do reinforce class differences,without
saying so:

"As a consequence of the up-to-date conditions of production and
the inordinately costly investment in new high-capacity productive
equipment it became necessary to introduce two- or three-shift and
even continuous utilization of the work force (day and night turns
comprising even week-ends). This was often extended to fairly great
masses of workers without having previously considered and analy-
sed what kind of changes should have been brought about in the
various social institutions and services-- (italics ours). p.13).
What kind of changes? He mentioned "whether workers' homes had
adequate shutters, blinds, curtains to darken the bedroom in the
daytime" (p.14). So, "it became necessary"? For whom? To use the
technology as an excuse when "there are problems arising from the
fact that husband and wife are working different shifts"? (p.14).
A good example of the shallowness of the characterization of Hun-
gary as "socialist" when such aspects appear as side-effects, and
even as surprise-effects! If technological policies were in the
hands of workers and not in the hands of bureaucrats/intellectuals,
and these workers had been given the opportunity to develop their
consciousness about such matters they would have been given top
consideration. It is also interesting that solutions are in terms
of shutters, blinds and curtains -- in other words, the technology
is not challenged, only the "side-effects" are attempted muffled.

10. And this is, of course, particularly true if the warner him-
self does not practice his own warning but never seems to tire of
the S&T he warns against. Deeds probably communicate warnings
better than words.

11. Both the International Foundation for Development Alternatives
in Nyon, Switzerland and the Goals, Processes and Indicators of
Development Project of the United Nations University are built
around such themes; all of them also embedded in the Cocoyoc De-
claration of 1974. (For one presentation of the text of that de-
claration, probably about ten years ahead of its time, see Deve-
lopment Dialogue, 1975.

12. And the point can be driven further: by insisting on modesty
and frugality in various ways for the Third world it also becomes
easier for the First world to continue abusing the resources of
the Third world, growing raw materials for its own industry on

Third world soil, cutting down the forests, mining mountains and
oceans for resources, etc.

13. For a more explicit statement about the "Western civilization",
see Johan Galtung, Tore Heiestad and Erik Rudeng, "On the Last 2500
Years in Western History", ch. 13 in Vol. 13, The New Cambridge Mo-
dern History, 1979.

14. See his article in CERES.

15. For details see the book referred to in footnote 5 above, ch.1.

16. It should be noted that statistics dividing the "active popula-
tion" according to primary, secondary and tertiary sectors show
increase in almost all countries in recent years; but even more so
in the first world countries. Moreover, since the tertiary sector
covers anything from the shoeshine boy to the head of state, passing
through the bureaucrats, capitalists and researchers it is a mixed
bag indeed, comprising both "service" and "serviced" sectors.

17. See footnote 15.

18. In an excellent article, "L'industrialisation: imitation ou inno-
vation", Revue 2000, No.34, 1976, pp.33-38, Daniel Thery gives eight
examples of alternative technologies, among them such examples as bio-
gas the bamboo tubewell and imaginative uses of bicycles. For all of
them there are indications of local creativity the moment there no
longer was dependency local bureaucrats, capitalists and/or resear-
chers," -- ces faits démentent les thèses communement répandues sur
l'inertie des petits fermiers et leur résistance au progrès téchnique"
(p.36). What is quite clear as to resistance, however, is how exactly
these elites resist such initiatives. Or take another example: Cain,
Afshar, Norton and Mohammed-Reza Daraie point out in their article
"Traditional Cooling Systems in the Third World", The Ecologist, Vol.
6 no. 2, pp. 60-64 how effective ancient cooling systems such as the
porous water-jar (the Maziara) are, keeping water cool throughout
the day even when the outside temperature fluctuates between $19^{o}C$ and
$36^{o}C$. But what gains would there be for these three categories with
a system as simple as that? Or for the oil companies who ultimately
make profit on producing the electricity that is used in mechanical
refrigeration?

19. For more details, see the book referred to in footnote 8 above,
last chapter, "China After Mao".

20. The blindness of one particular social science, "economics", to
such aspects of production, distribution and consumption should make

one venture the hypothesis that the major social function of that science is exactly to mask the real relationships between people. Marxism did much to lift that veil but not enough: there was and is far too much concentration on ownership patterns, a very special and juridical (as Marx himself points out) aspect. There is not enough about exactly what should be the strong point in Marxist analysis: the relation, often contradictory, between means and modes of production (Marxism, incidentally, also has relatively little to say about consumption). In a sense marxists are worse off than others for they may be led to believe that a change in ownership patterns is not only a necessary but also a sufficient condition for more basic changes to take place.

21. For a fascinating analysis in a historical perspective, see Lynn White, Jr., "Technology Assessment from the Stance of a Medieval Historian", Technological Forecasting and Social Change, 1974, pp. 359-369.

22. The debate over energy forms for the future after the Western robbery of the Middle East is coming towards an end is a good example here. From a B, C and I point of view (the three elites mentioned) nuclear energy systems stand out as ideal: they are impossible without a highlevel supply of heavy bureaucracy, capital and research. However, it cannot be presented that way; the decision to build the future around nuclear energy has to come as a "rational" decision. One way of arriving at a foregone conclusion is as follows: by a biased choice of competing systems (eg., only coal), and by a limited spectrum of criteria (eg. limited criteria of economic efficiency , including ecological considerations).

23. And these are the elites that will meet late August 1979 in Vienna for the UNCSTD. Volker Rittberger discusses UN conferences in an excellent paper for the Lund Seminar; "The New International Order and United Nations Conference Politics: Science and Technology for Development as an Issue Area". No doubt UN conferences can serve to articulate problems, but our simple thesis will be that it can only articulate those problems over which there is sufficient dissent in the conference room itself. In connection with UNCSTD, roughly speaking a conference of national delegations, ie. elites interested in preserving internal power structures cemented by the technological structures referred to, there will be articulation about terms of transfer, not about the nature of that which is transferred. For a remarkable

effort to overcome this problem and build more genuine articulation into the UNCSTD exercise, see the series of The Lund Letter on Science, Technology and Basic Human Needs (Notes on Preparations for the 1979 United Nations Conference on Science and Technology for Development), starting with no. 1 July 1977 (issued about every three months). Together with the document by Stefan Dedijer, The Failure of the 1978 UN Conference on Science, Technology and Development, Off-print Series No. 2, Research Policy Program, University of Lund they give us one side of the sociology of a conference. The UNCSTD side, one would assume, is that of a vain secretariat, unable to accept that type of criticism and advice, trying to fend it off by characterizing the critics as marginal. And yet it is probably safe to assume that future historians of UNCSTD and similar efforts will say "if they had only managed to overcome hurt vanity and had paid more attention to such critics".

24. See chapter 3 in the book referred to in footnote 5.

25. The difference between the life expectancies at birth, E_0, is of course high, as known from the general development literature. The infants and small children are the major victims of underdevelopment in that sense; of course, they do not have much of a voice of protest.

26. The best work available on this topic is Otto Kreye, Jürgen Heinrichs and Folker Fröbel, Die Neue Internationale Arbeitsteilung, Hamburg, rororo aktuell, 1977.

27. There are, of course, two major methods: the import of foreign workers to carry out menial jobs no longer wanted by local workers (eg. garbage collection), and the export of jobs to places where workers are more available for such jobs/less mobilized politically/willing to accept much lower wages.

28. Kreye et al. make this one of the key conditions for the new international division of labor, the other one being the lower transportation costs making it economical to produce far away from the markets (although a local market close to the production site is no objection)

29. The countries to watch would be the Third world countries capable of investing abroad, such as Mexico, Brasil, Nigeria, Saudi Arabia, Iran, India and the four mini-Japans: South Korea, Taiwan, Hong Kong and Singapore. At this point the sub-imperialist model is probably no longer so applicable - these countries may start exploiting other

Third world countries not on behalf of the classical imperial
countries (the US, the UK, Japan etc.) but on behalf of themselves,
although probably not if it is at odds with the interests of the
"mother" countries.

30. This section is based on a presentation made at a UNEP seminar
on selection of technology, Nairobi, September 1976. I am indebted
to other participants in the seminar,and particularly to Amulya
Reddy, its able chairman,and to Surendra Patel of the UNCTAD Divi-
sion for Transfer of Technology.

31. For a good introduction to the topic of ecodevelopment, in Eng-
lish, see the special issue on Ecodevelopment, edited by Bernhard
Glaeser, of Vierteljahresberichte, Probleme der Entwicklungsländer,
No.70, 1977 from the Forschungsinstitut der Friedrich-Ebert Stif-
tung.

32. For an effort to explore ethical problems confronting any scien-
tist from a point of view of basic needs, see Johan Galtung, "Scien-
ce and Neo-colonialism", chapter 5 in Papers on Methodology, Copen-
hagen, Ejlers, 1978.

33. Indeed, the harmony between all these actors, or limited, disci-
plined disharmony, is an essential precondition for all these orga-
nizations to function.

34. Yash Pal, in his contribution to the 25th Pugwash Conference,
Madras, 13-19 January 1976, "Alternative Development Strategies for
Developing Countries", makes a strong plea for scientists and tech-
nicians to work with the people in the villages,and also reminds us
that "appropriate science and technology is not necessarily archaic
science and technology".

35. I am indebted to Bernhard Glaeser for sensitizing me to this com
bination,particularly important in the field of locally self-reliant
rural technologies with an initial high research input (such as new
developments in the biomass field, in the coupling of algae dams to
biomass converters,etc.).

36. Thus, much traditional technology, eg.in the field of medicine,
is so interwoven with religion (indeed, the effort to separate the
two analytically is in itself very Western)that Westerners would
probably feel rather alienated.

37. In sociological terms the Japanese structure combines the uni-
versalism of the Western approach (and not only Western) with the

diffuseness of the traditional approaches – in patterns where wor-
kers and functionaries are treated very "objectively", but with a
wide spectrum of their persons taken into account, not so narrow as
in the West.

38. The closest project in the world today to this kind of idea, to
our knowledge, is the UNU project directed by Chandra Soysa from the
Marga Institute in Colombo, Sri Lanka, "Sharing of Traditional Tech-
nology".

39. A personal experience : living in a high rise appartment house
with absolutely no other heating possibilities than oil-fueled bur-
ners in the basement it stimulates thinking to read the janitor's
note on the bulletin board to the effect that the temperature will
be lowered by one degree per day (late fall 1973, Oslo – a very cold
winter too).

40. See the papers referred to in footnotes 2 and 13 for more de-
tails about the crisis.

41. For an excellent report, see Harper, P. ed., Radical Technology,
London, Wildwood House, 1976.