The Ecol-Humanistic Technology

The New Technology as Experiences from the Past

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THE ECOL-HUMANISTIC TECHNOLOGY -

The New Technology as Experiences from the Past

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ABSTRACT

The World's most dominating culture - the modern, industrial culture - is facing serious and fundamental problems in these years. Problems which to a great extent are self-created. The problems have various forms of manifestation, but fundamentally, they are either geo-physical-environment problems, socio-economical-social problems, or psycho-physical-individual problems.

It is obvious to investigate possible casualities between these fundamental problems in the society and the modern industrial technology. The "TES-Project", (the "Technology, Ecology, and Social Development-Project"), is aiming at investigating these matters.

In the project, an "ecol-humanistic concept of technology" is created. This concept consists of six elements 1) the technique, 2) the information and knowledge, 3) the organization, 4) the result or achivement, 5) the attitude or value regarding man's relation to man, and 6) the attitude or value regarding man's relation to nature. By means of these elements, mostly the two latter, fundamental traits in the modern, industrial technology are uncovered. Traits which are interfering the solutions of the fundamental problems in the society.

Having confidence in the fact that inspiration for changes in the elements of the modern, industrial technology can be found in culture, alternative to the modern, industrial culture, studies of such cultures are very interesting. The traditional Asiatic and African cultures are very interesting in that respect, and the technology of these cultures - historical as well as present - will be analyzed in accordance with the concept of the ecol-humanistic technology.

The aims of the "TES-Project" are to indicate methods for changes in the modern, industrial technology. Changes which can be promoting for the solutions of the present fundamental problems of the society.

So far some articles and project proposals have been published within the frame of the "TES-Project".

THE ECOL - HUMANISTIC TECHNOLOGY - THE NEW TECHNOLOGY AS EXPERIENCES FROM THE PAST.

I. Past and present - same problems?

At a crucial stage in China's history, LIN-TSE-HSU, then Imperial Commissioner at Canton, in 1839 wrote a letter to the Ruler of England (1):

> "Of all that China exports to foreign countries, there is not a single thing which is not beneficial to people. They are of benefit when eaten, or of benefit when used, or of benefit when resold. All are beneficial. Is there a single article from China which has done any harm to foreign countries? Take tea and rhubarb, for example; the foreign countries cannot get along for a single day without them. If China cuts off these benefits with no sympathy for those who are to suffer, then what can the barbarians rely upon to keep themselves alive? Moreover the woolens, camlets, and longells of foreign countries cannot be woven unless they obtain Chinese silk. If China, again, cuts off this beneficial export, what profit can then barbarians expect to make? As for other foodstuffs, beginning with candy, ginger, cinnamon, and so forth, and articles for use, beginning with silk, satin, chinaware, and so on, all the things that must be had by foreign countries are innumerable. On the other hand, articles coming from the outside to China can only be used as toys. We can take them or get along without them. Since they are not needed by China, what difficulty would there be if we closed the frontier and stopped the trade? Nevertheless, our Celestial Court lets tea, silk, and other goods be shipped without limit and circulated everywhere without begrudging it in the slightest. This is for no other reason but to share the benefit with the people of the world".

In this letter, LIN-TSE-HSU very clearly reflected the self-knowledge of the ruling class in China at that time. A self-knowledge which can be said to rest on three long-standing assumptions:

1) China's superiority in warfare,
2) her skill in civilizing outsiders, and
3) her possession of precious trading goods to bring foreigners to accept tributary status (2).

The Chinese empire, or the "Flourishing Empire" as she was also named (3) was the Ruler of the World, and nothing could be learned from the barbarians. Only a few among the Chinese leaders understood the challenge from the European countries, and saw what was to come from these countries' interest in China. Even fewer, and among them the above mentioned LIN, dared to think along the path that would later on lead to the famous recommendation "learning the superior skills of the barbarians". In the latter half of the nineteenth century, China found herself in a disintegrating process. Having been a world empire with a superior technological and political leadership, she found herself a second-rate nation dominated by foreign countries in the beginning of the twentieth century (4).

Kept in a long-term development perspective, the modern industrialized societies are in many ways in a similar situation like that of China 100-200 years ago (5). Like China, these countries have the world-leadership in all technological and political matters, and their dominating position is very seldom threatened in United Nations or elsewhere, where power relations can be observed. The self-knowledge of the modern, industrialized countries today, might be formulated by a Ronald Reagan or by a Margareth Thatcher very much in the same way as LIN-TSE-HSU did so many years ago. The words might be different but the contents would be the same. Undoubtedly the modern industrialized societies see themselves as the leading and dominating countries in the world. Like China in the nineteenth century experienced increasing problems, however, the modern, industrialized societies also seem to experience increasing problems in their societies. They have

problems among themselves (the East/West-relations), they have problems in their relationships with not-industrialized-countries (the North/South-relations), and they have first of all problems within their society as a result of their own industrialization process. Problems, which have something to do with the ecology, with the distribution of the results of the industrialization, and with the security of the necessary supply of raw materials for the future development.

In the nineteenth century, China might have solved her problems by "learning the superior skills of the barbarians", and one might remember that Japan in fact did so (6). The modern, industrialized countries today might not be able to do so, as most of these countries' problems are results of the industrialization itself, of their own development. Intuitively there exist no barbarians from whom to learn the superior skills. However, this view can only be intuitive, how accepted it might be among the leaders of the industrialized countries, and, in a later chapter, this viewpoint will be put into question in a more careful way.

The starting point for the solution of the fundamental problems in the industrialized countries must, however, be taken in a qualitative analysis (7) of the basic characteristic of these countries. In the present study the approach will be the development of the modern industrialized technology. This angle has been chosen partly because it seems as if many of the fundamental problems in the countries can be related to the development of their technology. But also because many of the fundamental problems seem to arise almost equally in all industrial countries, independent of their political system (8). Fundamental ecological problems, pollution problems, and problems in securing supply of raw materials for the future, e.g. seem to arise equally in socialist countries as well as in capitalist countries.

The aim of this article is therefore to point out some basic factors in the modern, industrialized technology, which can be seen both as the main cause for the fundamental problems in the industrialized countries, and as a prevention for the solution of the same problems. Chapters II and III will deal with these topics. Some thoughts will also be given as how to change these factors, chapter IV in a theoretical way, and chapter V in a more strategic way.

The hardworking and able Chinese administrator TSO-TSUNG-T'ANG wrote in 1866 a document from which the below is quoted. Maybe we in the industrialized countries can find basic characteristics in our technology in the same way as TSO-TSUNG-T'ANG did in the Chinese technology in 1866. TSO wrote (9):

> "Both Japan and China see the potential advantages on the high seas; Japan has something to rely upon and we alone have nothing. It is like crossing a river where others are rowing a boat while we are making a raft. It is like racing when others are riding on a steed while we are riding on a donkey. How is this possible? All of us are human beings, whose intelligence and wisdom are, by nature, similar; but in practice we cannot help being different. Chinese wisdom is spent on abstract things; the foreigners' intelligence is concentrated upon concrete things. Chinese take the principles of the classics as the foundation, and mechanical matters as the practical details; foreigners consider mechanical matters important, principles unimportant. Each of the two believes what it thinks right and neither can understand the other ...".

Perhaps somebody could write almost the same lines today about the situation in the industrialized countries with the opposite contents, however! Maybe our technological thinking of today is too much concentrated on concrete and mechanical matters and too

little on principal things. Perhaps we have forgotten the more fundamental principles in our technological thinking, so that we almost ignore the more longtermed consequences of the technology. And maybe we should use our wisdom more in thinking on subjects of that kind TSO-TSUNG-T'ANG in 1866 called "abstract things".

II. The modern, industrial technology, and the technological self-knowledge in the industrialized countries.

Most literature about technological matters are based on the implicit assumption that the technology development can be seen as a continuous wave - or as a wide, progressive development stream. In this development stream the industrialized countries have the leading position in front of the stream, whereas the developing countries are behind, in a shorter or longer distance from these countries. In accordance with this view, nobody in the history of mankind has ever been so advanced in the development of technology than the present days' industrialized countries. And there is every indication to believe that these countries will still be in front of the technology development in future. Regarding the technological knowledge as well as regarding the capacity of the technology (see fig. 1).

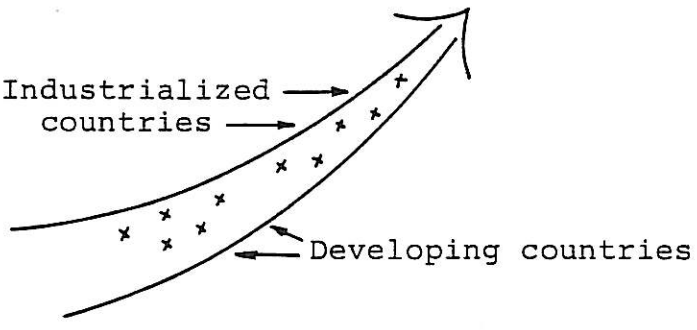


Fig.1.

The conception is captivating. And for many reasons the sympathizers can plead the history as evidence. Never before in history, mankind has been able to travel a longer distance in a shorter time than we can today, and never before mankind has been able to communicate more safely over longer distance than we can do today. Never in history mankind has had a higher production of material goods than we have today, and never before the number of chemicals and artificial products has been increased faster than today.

No doubt the technological development has been increased very fast, and at the same time brought man perceptible progress, especially within the combating of disease and the materialized standard of living. It is therefore easy to understand many peoples' believing in the development picture shown in Fig. 1, and in the same way it is easy to understand that the leaders in many less-developed countries wish to get their part of the technological development by transferring the modern industrialized technology to their own countries. The various UNTAD-conferences have been the dominating areas for debates about these wishes in the last decades and demands for a twentyfive percent transfer of all industrial production from the industrialized countries to the less-developed countries, free access to existing technological know-how, and similar demands, have been put forward with an ever increasing strength. So far, however, the less-developed countries have had no success in their demands.

In the last decades, however, doubt has been thrown with an ever growing strength on the unreserved advantage of the development of the modern industrial technology. This doubt has occurred concurrently with an ever growing realization of the fact that problems which might be solved along the road with the development of new technology, in a deeper sense can find its own cause in the same technology.

It is now realized by more and more researchers and practicians that we do not only have to develop new technology in order to solve earlier times insoluble problems, we also have to develop technology for the solution of new problems which we did not have before. The cause of these new problems are in many cases to be found in the technological process itself. In this way we can say that we in a way create new insoluble problems as a result of the technology we developed in order to solve the already known insoluble problems.

In the industrialized countries we see these problems in the increasing pollution, in the increased number of unemployed people, and in a growing alienation in the populations etc. etc. And in the developing countries we see examples of this kind, as problems in the wild growing metropolis, in local craftsmen who are now unemployed, because of imported mass produced articles, in the huge difference between the living conditions in a highly industrialized export sector, and the living conditions in the traditional agriculture.

Some people (10) believe that a continnous development of the modern industrialized technology is the best solution for these problems. That is the way it has been done so far, and in their opinion, nothing indicates that this can not be done in the future. To them the basic problem is how to develop new technology for new problems in the quickest and most efficient way. As an example they will care more about how to develop new pollution-opposing technology instead of being speculating on how to prevent pollution by avoiding polluting technology. In the same way they will pay more attention to the problems of transferring modern industrialized technology to the less developed countries instead of trying to develop new technology specialized for the cultures and the specific conditions in these countries.

To these <u>technology-optimists</u>, as we shall call them, the debate will be concentrated on problems like the

efficiency of the technology, the influences of the technology on the standard of living, the employment and the balance of payment, the transfer of technology to less developed countries, the economical aspect of new technology etc. etc.

Other people (11) have the opinion that we are more or less technologicizing ourselves into death. They think we are creating more and bigger problems with the modern industrial technology than we can ever repair, and they feel we are coming closer and closer to a sort of technological brink of precipice from where nobody can return. This opinion is strong represented among the fire-and-brimstone preachers, and in the same way as the technology-optimist, the technology-pessimist, as we will call them, can find evidence for their opinion in the actual development. The global pollution of the ozone stratum, the subsoil and the oceans can for a great deal be referred to the modern industrialized technology. And the technology-pesimist feel that the shortage of important raw materials, such as uran, crude oil, etc., very well can lead to a catastrophe, where the ever growing military potential is released (12). From this point of view the basic problems for the debate are how to limit the pollution and the waste of raw materials, how to slow down the process of technological development, and how to prevent the rearmament throughout the world (13).

How different these two opinions might be, they are in my opinion based on the same conception of technology, namely the one shown in Fig.1. Both the technology-optimist and the technology-pessimist consider the technology development as a continuous development wave, in which we find the technology of the modern industrialized countries in front and the technology in the less developed countries as well as in historical societies further behind. Both opinions consider the modern industrial technology as the technological culmination so far, regarding the technical knowledge

as well as regarding capacity. In addition, the technology-optimist also ascribes the modern, industrialized technology the highest quality of life, whereas the technology-pessimist is much more doubtful to this.

A third group of people - to which I feel to belong - has an opinion which we might call the technology-alternative-opinions. To these people, the technological development does not have to be seen as a wide, progressive development river, in which all have to follow the same way. To them, the development is more to compare with a delta with many different branches of the river. In accordance with their conception of technology, the development can take place in many ways and offer plenty of different opportunities. In the past, many of these different branches of the river have been discovered and developed to a certain extent. Some of them to be forgotten for some reason or another, today we might not even know their existence, others to be the earlier stage of the present industrial technology. (See Fig. 2).

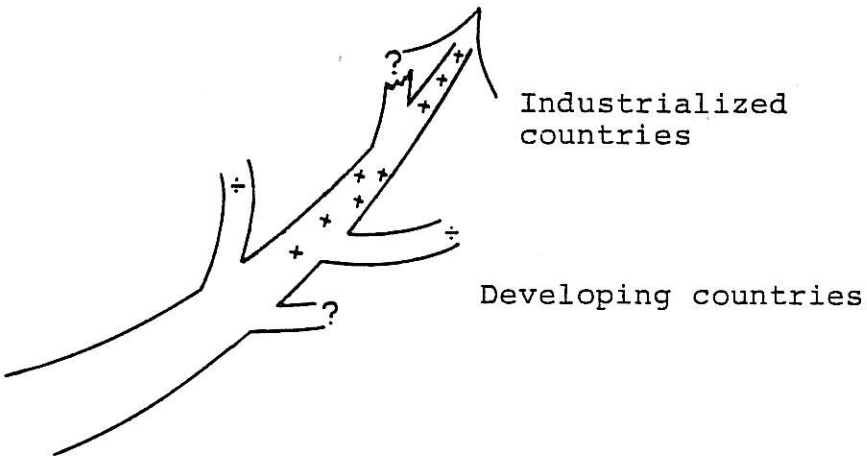


Fig.2.

As an example we can illustrate this conception by looking at the development of the technology of energy. For centuries the wind technology has been the principal energy-technology for man, and only the discovery of fossil fuel repressed the wind technology from this place. The development of energy technology left the wind-branch of the development river for a rapid discovery of the fuel-branch of the river, and for that reason we have now got a technology - the modern industrial technology - almost entirely based on fossil fuel (e.g. production of energy, plastic and many chemicals etc.etc.). Lately, however, the wind seems to be re-discovered, and the wind-branch of the development river is again navigated. Other branches of the energy development river, however, have never been navigated though navigable. Or at least we have today no knowledge about such navigation, if any. As examples to this I am thinking on energy technology which might be based on the electric voltage in the clouds, on the use of static electricity etc.etc. The energy development process might just have bypassed these branches of the development river. The question therefore arises, how many other branches of the development river did we bypass on our way to the modern industrial technology?

The prevailing concept of rationality by the ruling class in a given situation will be the determining factor as about which way - which branch of the development river - the technological development will go. In this way the development of the modern industrial technology has been closely linked to the money economical concept of rationality.

If, however, we could imagine that the ruling class attaches greater importance to an ecology concept of rationality (14) or a social concept of rationality (15), there is no doubt that new and other branches of the development river will be navigated.

This alternativistic opinion is based on a concept different in kind compared with both ones behind the pessimistic and the positive opinion. It is important to understand that in the alternativistic opinion, the modern, industrial technology is not an inevitable part of predetermined evolution. On the contrary it must be seen as a result of the ruling concept of rationality and some relative strength of the different powers in the societies. Consequently therefore, the alternativists do not see the modern industrial technology as the technical culmination so far. To them, the modern industrial technology might well be a mistake; and a continuous development along this line might be like sailing on a branch of a river leading to a waterfall or out in an endless swamp.

From the alternativistic point of view some other questions regarding the future technology have to be discussed rather than the important ones for the positivists and pessimists (16). To them, as an example, the less developed countries do not need to follow the same development as the industrialized countries, and consequently the question of transferring technology from the industrialized is less important than the questions of how to develop new technology, different in kind from the modern industrialized technology, for the less developed countries. From an alternativistic point of view the following questions are the important ones:

1. Can we imagine in our mind - and can we develop - a new "future-technology" which is taking advantage of the technical knowledge of the modern industrial technology at the same time as all negative consequences from this technology are avoided?

2. In which way should such a "future-technology" be different in kind from the modern industrialized technology? and

3. how can such a "future-technology" be characterized in details?

4. Would it be easier for the less developed countries to create such a "future-technology", because of their looser connection to the industrialization? (17)?

5. And finally, how can a country direct the development of her own society towards such a "future-technology"?

In the following I will outline some fragments of a theory about a future technology, and give some thought to the practical possibilities of this technology. Before that, however, I find it useful with a further discussion of the term: Technology.

III. The Ecol-Humanistic Concept of Technology.

The concept of technology is a rather ambiguous concept like many other social science concepts, and one might find technology defined in many different ways. In this paper the concept of technology will be regarded very broadly, understanding technology as : all kind of human intervention in the ecosystem with the intention of changing elements or processes in this system (18). This concept of technology means that mankind has possessed, and applied technology ever since the first use of stone axes and the first burn-beaten land was taken into use by man.

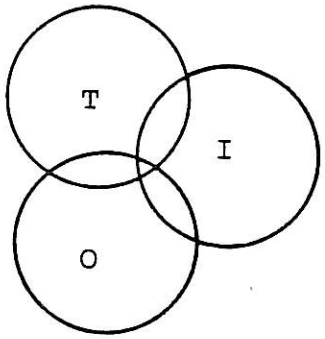
A concept of technology in this broad sense is not very operational, and many attempts have been made to classify the definition. One tendency in these attempts has been to deal with different kind of technology, whereas scholars following the other tendency have tried to divide the concepts in various elements,

so that the contents of each elements as well as the relations between these elements are determining the nature of the observed technology. To illustrate the first tendency; Galtung (19) operates with five different kind of technology: 1) technology of extraction, 2) technology of transportation and communication, 3) technology of consumption, 4) technology of production, and 5) technology of ecological balance. And already Karl Marx operated with 1) power technology, 2) transmission technology and 3) technology of tools.

Edquist (20) focus on the distinction between various elements of the technology dealing with 1) technique and 2) organization as the basic elements of technology. And Jens Müller (21) deals with 1) technique, 2) knowledge, 3) organization and 4) products or achievement as his basic elements. Galtung later on (22) speaks about key categories, and deals with the following elements: 1) structure of social space, 2) composition of social time, 3) nature of social process, 4) relation between man and man, and 5) relation between man and nature.

In order to analyse the possibilities of developing a future technology different in kind and released from the negative consequences of the modern, industrial technology, but - and this is important - founded on the technical knowledge of this technology, I will base the following analysis on a discussion of six elements of the technology. In this aspect, I find it meaningful to operate with a <u>limited, more static concept of technology</u> consisting of three elements, and a <u>broader, more dynamic concept of technology</u> consisting of additional three elements.

The limited concept of technology consists of the following three elements and their mutual relations:



"T": Technique
"I": Information and know-how
"O": Organization

Fig. 3.

Technique ("T") means the way in which more specific inputs are manipulated in order to achive a specified output. A technique has to be characterized both in the way of materials in use (tools, machines, instruments, etc.) and in the processes in which these materials are actually handled (pressing, glueing, chemical combinations, etc.).

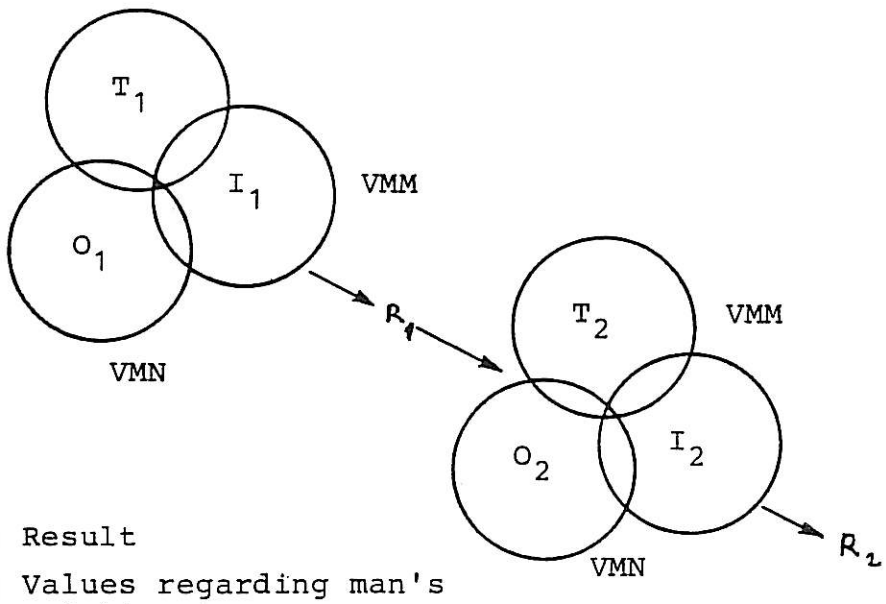
A certain technique may be utilized in combination with various social constellations at the micro level as well as at the macro level, and we are here talking about the organizational element ("O") of the technology. By micro levels I understand social constellation in organizations, companies, villages, etc., and by macro levels I mean social constellations in branches of trade, the market, nations, etc. Key words like centralization, division of labour, wages, management, the alienation of people etc. will be in focus when looking at the organizational element of the technology.

By information and know-how or knowledge ("I") I do not only understand the informative knowledge about the technology, but also the professional know-how about how to handle the various aspects of the technological process within various kinds of social constellations.

Knowledge as well as recognitions of and demand for non-existing knowledge will be key areas for analysis of the information and know-how element.

For analytical purpose, however, the concept of technology seems to be of little relevans without being connected to the results or the achievements of a certain technological process. And in the same way, it might be anticipated that the basic values or attitudes behind a certain technological process will have a determinating influence on the elements of the limited, more static concept of technology. Values regarding man's relation to man, and man's relation to nature may in this aspect be of most importance.

The broader, and more dynamic concept of technology may therefore consist of additional three elements:



"R" : Result

"VMM": Values regarding man's relation to man

"VMN": Values regarding man's relation to nature

Fig. 4.

Values regarding man's relation to man ("VMM") have something to do with the way in which individuals and group of individuals stand in relation to each other in the technological process. Both in the process itself and as user of the final results of the process. Terms like competition, cooperation, exploitation of manpower, solidarity, power, etc. etc. will be the crucial problems in analysing this element.

Values regarding man's relation to nature ("VMN") covering values behind man's treatment of nature. Based on some VMN earth will be considered as an endless garbage receiver for the waste from the various technological processes, and in the same way as an inexhaustible source for raw materials, whereas other VMN might lead to a situation, where the technology is considered as an integrated part of the ecosystem. In this case, nature will be an essential source for the technological processes, in the same way as it will be a restriction for the same processes. Ecological questions, such as questions about pollution, chemical additives in industrial products and exploitation of raw material etc., will be in focus in analysing this element.

The material as well as the immaterial output of the technological process is considered as the result or the achievement ("R") of the technology. This output is an important element of the concept of technology for two reasons. Firstly, the result is important, because it is very often determining the other elements of the concept of technology, because of the fact that the results mostly serve as the goal of the processes. Secondly, the result is determining, in the way that part of it, the unconsumed part of the result, will enter into future technology, in the same way as the results of past technology had entered into the present-day technology.

It is obvious that the above mentioned elements of the concept of technology might be characterized in different ways in various social systems and cultures,

and that they might vary in time. As a consequence the existing knowledge and technique in a social system are not the only ones to characterize the technology as usually assumed. The other elements might be just as important - and perhaps the most important ones. Consequently one might very well imagine that a certain technique or a certain knowledge, as an example some of the present, modern industrialized technology, might be able to form a part of a "new" technology very much different in kind from the present industrialized technology. In this case, it would mean a technology where the four other elements are completely different from the present ones in the industrialized countries. One important question, therefore, will be whether the individual elements of the modern, industrialized technology are so close interrelated that one element, characterized exactly as in the modern, industrial technology, can only go together with five other elements, characterized exactly like the present ones in the industrialized technology. Or conversely, whether they are so independent that the modern, industrialized technique and knowledge, as an example, could be combined with alternative values regarding man's relation to man and man's relation to nature to create an alternative technology different to the one of the modern industrialized countries.

If we mentally soften the tight connection between the six elements of the concept of technology when analysing the problems of the modern, industrialized technology, and if we in the same way mentally imagine the individual elements characterized in various ways and combined in different combinations, we might have the opportunity to create a new future-technology based on the best from this industrialized technology, but free from the main problems arisen from it.

In the next chapter we will discuss such a future technology in a broad, theoretical line.

IV. Fragment of a Future Ecol-Humanistic Technology.

The headline of this chapter may be considered humbly and superciliously at the same time. Humbly because of the term "fragment", indicating that readers may not expect to be presented for a full-fledged theory of technology, submitted in formulas and graphs. And superciliously because of the term "future ecol-humanistic technology" which might lead to the impression that no technologists of today are thinking in ecological and humanistic terms when dealing with technology. Of course, nothing could be more wrong. At any time there have been people trying to introduce ecological thinking and humanity into daily life - and therefore also into the present technology. Today many conscious people are experimenting with different kind of ecological and humanistic aspects of the technology. These experiments, however, do not change the fact that the modern industrialized technology is far from being based on an ecological and humanistic foundation. And that is the kind of technology we have to investigate.

One has to make heavy demands on a future technology in a twofold way. On the one side this technology has to create just as many benefits to the people as the present modern, industrialized technology, and on the other side it must be without the unintended damage to the societies we today experience from the modern industrialized technology in an increasing way. These are heavy demands - maybe they might also be unrealistic demands - but nevertheless they are crucial and essential demands for a future technology.

In this paper, however, the primary intention is to deal with the demands on the future technology caused of the wish to avoid the damage of the present modern, industrial technology. The elements in our conception of technology will be connected to the negative side effects of the modern, industrial technology, and for that reason, it is necessary to characterize these side effects more carefully. The negative side effects can

meaningfully be divided into the following three categories:

1. the geo-physical environment problems
2. the socio-economical social problems, and
3. the psycho-physical individual problems.

The geo-physical environment problems can be observed in two different ways: the technological pollution problems, and the problems of having sufficient quantities of raw materials for the technology. The pollution of the geo-physical environment can be observed directly in the pollution of the air and sea, caused by the large-scaled industry, and more indirectly in connection with the pollution of the ground water and the space, caused by the same industry. The problems of having sufficient quantities of raw materials are strongly connected to the huge industrial exploitations of not-reproducible raw materials such as fossil crude oil, minerals, etc. In the same way, however, the erroneous exploitations and overproductions of the reproducible raw materials on a large scale, can create serious problems for a shorter or longer period of time. In many cases such erroneous exploitations and overproductions can already be expected to create problems for the future. Of course man has interfered in the ecosystem ever since he learned to cultivate the soil and to use the fire for his own benefit. Only recently, however, the man-made destruction of the environment has reached a dimension of such a size, as is the case today. In addition, the exploding development of the technology during the second world war and the years after that, has in many peoples'opinion (23) led to environmental problems of potential lethality to man-kind.

The socio-economical social problems are close connected to the way in which we distribute our resources globally as well as nationally. When such distributions are considered unequal to a certain extent, the way is open for oppressions, revolts, crises, and wars. As

long as the unequal distribution of the global resources, as well as of the national ones, go hand by hand with a continuous increase in the standard of living, the unequal conditions might exist for a longer period of time. If, however, the growth is stopped, or more clearly, if it is actually falling, the maladjusted condition can be observed as a glaring contrast between the living conditions of various groups. The development of the modern, industrialized technology, as we know it today, has contributed very much to the present maladjusted distribution of the global resources (23), and the continuously growing industrialization all over the world, just seems to increase the pressure on the not-reproducible raw materials, resulting in a growing risk for conflicts and wars. Such conflicts might be based on one group's wishes for having a fair share of these resources, or on another group's wishes for keeping their advantage, the results will be the same. The protracted crisis in the Middle East for getting - or keeping - control over the oil-resources in that area, is an example of that, and the slowly increasing crisis in the negotiations on how to control the raw materials in the oceans is another example.

The psycho-physical individual problems can be observed in the industrialized countries in the shape of vascular disorders, chemical-poisoning and more psychological stress-symptoms. Contemporarily with the process of industrialization most of the physical wear and tear of the labour-force have been reduced considerably, truly enough, as practically all "hard physical works" have been mechanized or automatized, but at the same time, the use of chemical compounds in the industry has been increased considerably, and the psychological pressure on the labour-force intensified. The consequences of this trend have not always been clearly explained to the people involved, and in many cases a clear physical attrition has been replaced by a more hidden physical attrition. This hidden and slow attrition is for many people intensified by a monotonous daily work. And in

addition to this, the increasing claim for economical efficiency, the fear for being unable to keep up with one's colleagues, and lately also the fear of being unemployed, have put large groups of people in the industrialized countries under great psychological pressure. Violencein the big cities, suicides, and excessive use of alcoholic beverages, hard liquor and all kind of drugs, in many ways have to be put down to the modern, industrialized technology.

If we now combine the outlined complex of problems with the concept of technology presented in chapter III, we can characterize each of the six elements in a future eco-humanistic technology and the relations between them in principal terms as follows.

The two value-elements in the broader, more dynamic concept of technology, the values regarding man's relation to man (VMM) and man's relation to nature (VMN) in some way create the ideological foundation of the other elements of the concept of technology. In a future ecol-humanistic technology, these two elements, therefore, in principle have to be characterized in a way something like below.

Man's relation to nature must be like man's relation to a living organism in which the biological circulation has to be maintained in order to keep the organism alive. In nature, the ecosystem has to be maintained without being damaged in a serious or unpredictable way by the technology. More exactly this means that the process of technology has to take place without leading to an eliminating of not-reproducible raw materials, to erroneous exploitations of slowly reproducible raw materials, or to a discharge of not-decomposable wastes in the eco-system. Not even the very slowly decomposable waste, or unpredictable wastes resulting from the technology must be discharged into the eco-system.

Man's relation to man has to be characterized by an uncompromising loyalty to all other people. This loyalty must be expressed in a constant striving towards the greatest possible physical and psychical well-being for all people involved in the technological process as well as for people in their capacity as present or future users of the technological products. The loyalty must, therefore, be an integrated part of all planning of the technical processes, and the organizational structure; in the same way as the results of the technology must meet not only the needs of the present generations, but also the needs of future generations without creating problems for these future generations at the same time.

As input for future technology, the results of the ecol-humanistic-technology have to be made out of materials which can be re-used in a new technological process. Reproducible raw materials have to be used as much as possible, in the same way as the technology has to be based on renewable energy.

As output ready to be consumed in one way or another, the products must be made out of materials expected to be worn out approximately after the same period of time. The products should only consist of reproducible raw materials, or materials decomposable in nature, and no materials harmful or dangerous to man should be accepted in the products. A claim for products suitable to meet the so-called "basic needs" and other essential needs for the society, might get the priority as a consequence of the VMM, leaving only a little attention for specific luxury needs.

The technique must, in its input-output-relations to nature, be submitted to the same requests as mentioned above for the technological element "result". In addition to this the technological processing of the input must take place in accordance with the above characterized VMM and VMN, so that waste of materials and pollution of nature as well as of the involved individuals must be eliminated or minimized as much as possible.

The technical process in addition has to be adapted to the human mentality and physique, and not like the modern, industrial technology, where man has to adapt to the technique.

In accordance with the VMM the element of organization in the ecol-humanistic technology must be adapted to a situation, where the population consists not only of young, healthy, and well-educated individuals, but also of old people, cripples, psychical disabled persons, etc. etc. These groups must be considered integrated parts of the communities, and as valuable individuals in the technological process. The organizational element of the ecol-humanistic technology must be designed in such a way that the above mentioned groups are not marginalized - or scraped - like in the modern industrialized technology, where only the young, strong and healthy persons with a good education are considered as useful.

In addition, the organizational element has to be adapted to the various countries' more specific culture trait. In case of conflict, however, with due considerations to the VMM and the VMN. This leads to a situation, where the ecol-humanistic technology element of organization very well might be different from one culture to another, and the present situation in the modern industrialized technology, where the organizational element is almost entirely adapted to the technique will be changed.

The need for information and knowledge in a future ecol-humanistic technology is closely dependent on the existing knowledge and the demand resulting from the characteristic of the other five elements. It will be seen from this relation that our present knowledge, developed in connection with the development of the modern, industrial technology, leaves us with a big gap in our knowledge, essential for us in order to develop

an ecol-humanistic technology. Today the greatest importance is attached to the efforts of creating new knowledge in improving the money, economical concept of rationality, whereas at the same time only a little effort is made to extend our knowledge of how to improve the ecological and humanistic concepts of rationalities. New areas of research as well as backwards ones have to be developed. By way of examples I may mention lack of knowledge about the relations between technique and organization on the one hand and various cultures on the other; lack of knowledge about the consequences of the use of many chemicals to man and nature, and lack of knowledge on renewable energy - at least compared to our knowledge of energy based on fossil fuel.

New areas of research, therefore, have to be identified and developed, and already existing areas extended in order to be able to develop a future ecol-humanistic technology.

V. The Road towards an Ecol-Humanistic Technology - a Dream or a Practical Possibility for the Future.

The question mentioned above has to be considered as relevant as well as important. It is relevant in the sense that lack of practical possibilities in the future, would eliminate any interest for further research on ecol-humanistic technology. And it is important in the sense that the existence of future practical possibilities for the ecol-humanistic technology will very likely in itself increase the generation and developmen of such technology.

This paper, however, does not allow an adequate answer to the question, as this would require a far more detailed discussion of the six elements in the concept of technology, as well as of the concept of development.

However, it is permissible to state that lots of events in the world of today indicate attempts of breaking away the technological development from the modern, industrial technology. And that, of course, increases the practical possibilities of an alternative technology as the ecol-humanistic technology. Examples of this will be found in the developing countries and in the practical results of the work of the growing grass-root-movements in the industrialized countries.

By way of examples one might realize the growing wish for better understanding of own history characterizing the populations in many developing countries, and, as a consequence of this, the growing interest in a development, grounded in the local culture and based on own premisses. Such wishes do not fit well in with a heavy import of modern, industrial technology from industrialized countries, as much more than technique is importes at the same time, cf. chapter III. A development, dominated by an imported, industrialized technology, might very well separate the development from the local traditional culture and turning it towards the modern, industrialized culture of which the imported technology is an integrated part. The wish for a development, grounded in the local culture will consequently lead to wishes for a technology alternative to the modern industrialized technology.

The fact that the characterization of the two central elements of the ecol-humanistic technology, the "VMM" and the "VMN", in many cases fits very well to the local cultural values of many developing countries, will increase the wishes for alternative technologies similar to the ecol-humanistic technology. The increasing recognition of the negative consequences of the modern, industrialized technology, as emphasized in chapter IV, will in a similar way draw the attention towards an alternative technology, and in achieving this, the developing countries may very well turn up to be in a better position, because of their looser binding to industrial investment, infrastructure

created to fit into the modern, industrialized technology, etc. etc,.

It is not only in the developing countries, however, we see these tendencies for alternative technology. Also in the industrialized countries we see such efforts, mostly as experiments in changing the individual elements in the concept of technology, and mostly carried out by small groups of the population.

From a research point of view, the road towards an ecol-humanistic technology must pass through three complexes of problems, each of which giving reasons for several research projects. These three complexes are the following:

1. In the first complex of problems, the main task will be to isolate and describe common traits, if any, for the six elements and their relations in the modern, industrialized technology, as well as to investigate the effects of such traits to the negative side effects from this technology.

2. Secondly, the task will be to find or create alternative technology by analysing societies of the past and societies of today, and to analyse the expected effects of such alternatives to the negative side effects of the present, modern industrial technology.

3. The final complex of problems will deal with the needs for strategy and planning. How can new development models be created? and how can future technology development be directed towards something like the ecol-humanistic technology.

Below some thoughts are given as about how to work with these three complexes of problems.

As regarding complex one, the research programme will include empirical analyses of the technology in specific areas or sectors of the society such as the energy sector already mentioned in chapter II, the agricultural sector, the fishing industry, etc.etc. The research programme will also include empirical and theoretical analyses of general concepts in a society, such as the concept of efficiency, the concept of profitableness, the concept of management, etc. etc.

The empirical foundation for this research programme might be laid down from new projects, specific designed for this purpose, but it might also be laid down on the basis of the results from studies already carried through by other researchers.

In investigating complex two, there is a big need for being flighty and close-to-earth at the same time. Flighty in order to be able to combine knowledge not usually combined, such as knowledge about history, knowledge about engineering, knowledge about philosophy, etc. etc. And close-to-earth in order not to leave the track at the same time. At the present time the field of study seems to fall within the following five areas:

a. Practical experiments made by grass-roots and individuals in the industrialized countries.

b. Not-industrialized countries in the world of today, such as the Polynesian culture, the Eskimo culture, etc. etc.

c Historical, not-existing high-cultures and civilizations such as the pre-Egyptian culture, the pre-Chinese culture, the Inca culture, etc. etc.

d. Theoretical and practical utopians existing today as well as in the past.

e. Modern, scientific experiments in laboratories as well as in practical productions.

Re a.:
In the last decades the society has been bubbling with alternatives to the usual elements in the modern, industrialized technology. New forms of organization have arisen within the industry, agriculture and fishing, examples of new relations between man and nature have arisen within the energy sector and the agriculture, and new relations between man and man can be seen within the manufacturing industry. The problem of researching this area is mostly a matter of capacity in collecting facts, as many alternatives have already been described by others.

Re b.:
In different societies we can observe, how the same sectors of the technology in these societies are organized in various ways and based on different kind of knowledge and technique. By way of examples we can even observe such differences within the same geographical conditions in the various kind of fishing-technology used in Greenland, Norway, Iceland and the Faroe Islands.
Neither in this area of research will serious problems arise regarding the methods, as our analyses might essentially be based on already existing studies.

Re. c:
This area of research obviously offers the highest challenge to economists, engineers and other types of researchers traditionally dealing with the industrialized technology, since specific as well as more general historical knowledge will be necessary. The basic idea rests on the fact that many different kinds of culture have existed in the history of mankind. Some of these have had a highly developed technology within a certain area, and very often this technology has been based on elements characterized in a different way from the ones of todays' technology. Some of these cultures

disintegrated even before the modern, industrialized technology was brought out, e.g. the ancient Egypt, whereas others are destroyed or replaced more as a result of their encounter with the modern, industrialized culture, e.g. the Inca culture in Latin America, and the Mali culture in North Africa. Other cultures, again, are still existing in something like their original forms, even though they might be pressed by the modern, industrialized countries, e.g. the Eskimo culture and the Polynesian culture on small islands in the middle of the Pacific. The technology in some of these cultures might be observed even today, whereas the technology of other cultures can only be read about from these cultures' own sources, such as reliefs or tables, or in second-hand reports made by earlier explorers in Africa or America. For some cultures, however, only the results of the technology are to be observed, leaving us without any kind of explanation as to the origins and the aims of these results. I can only hope that our concept of technology, including the six elements and the relations between them, might create a meaningful analysis, being able to inspire the future development of the technology in our present-day industrialized societies. How, can not be stated so far, as this analysis might be the most critical part in the first period of the project.

Re d.:
In using the works of the utopians in this analysis, the concept of technology presented in chapter III will be applied, most likely in a theoretical way only.

Re e.:
The modern, scientific experiments may, in a later stage of the research programme, play a role, as a way of testing theoretical results. In an earlier stage of the programme, however, the already ongoing experiments might also be important, as they may offer alternatives to the elements of the present industrialized technology.

The third complex of problems, stated above, is more or less the object of the entire research programme, as the results of the two other complexes should end up in a proposal for an alternative policy of technology, as well as in some kind of a guide line as how to carry through this policy. A change in the prevailing policy of technology, however, will not take place just because of the creating of a better policy - better in the sense of being able to control the negative side effects of the modern, industrial technology. This third complex, therefore, also has to include an analysis of the present economical and political situations in the industrialized countries. In general as well as for the individual country. Most likely our present knowledge of this situation is sufficient in general, but this general knowledge then has to be linked to the ecol-humanistic technology, in order to achieve any results in practice.

This paper is an attempt to give an outline of a theoretical and practical problem in which I am specifically involved. At the moment I am working mostly on the theoretical aspects of the problem, at the same time as I am reviewing my experiences from studies in Polynesia (24) and Greenland (25). The main purpose of the paper is, however, to get in touch with researchers engaged in a similar problem, and hopefully with another cultural and professional back-ground than the one I have, being Danish Economist and Sociologist.

NOTES:

1. LIN-TSE-HSÜ's: "Moral Advice to Queen Victoria", 1839, in SSU-YU-TENG and John K. Fairbank: "China's Response to the West - A Documentary Survey 1839-1923", Cambridge, Mass. 1954. Here from: Per Sörbom: "Learning the Superior Skills of the Barbarians", p. 5, Lund 1982.

2. Per Sörbom, op.sit. p. 7.

3. J. Henningsen: "Det himmelske rige - skitser fra Kina", p. 7, Copenhagen 1887.

4. It is always debatable when a specific society is no longer existing, as long as more or less the same population is living in the same geographical area. When we, therefore, in this paper state that China was no longer existing as an empire, we mean that its relations to the surrounding world, its internal structure, and its institutions, etc. had undergone such radical changes that one could no longer speak about the same society.

5. We do not only speak about the western countries when speaking about the "modern, industrialized countries". Many socialist countries such as DDR, USSR, Czechoslovakia and others are also included, and so are some of the socalled NIC-countries, such as Taiwan, Singapore and others.

6. Per Sörbom: op.sit. p. 48 ff.

7. By a qualitative analysis we mean an analysis based not only on the growth-criterion but also on some value-oriented criterions.

8. Rodolf Bahro: "Alternativet", p. 149, Copenhagen 1977.

9. "TSO's Plans of 1866", in SSU-YU-TENG and John K. Fairbank: op.sit. p. 83. Here from Per Sörbom: op.sit. p. 59.

10. Among these Mogens Boserup: "Vor voksende verden - om dommedags frygt, energi, vækst og befolkning", Copenhagen 1974.

11. Among others: 1)Donelle H. Meadows et al: "The Limits to Growth", New York 1972, 2) The Ecologists: "A Blue Print for Survival", London 1972, and 3)E.F. Schumacher: "Small is Beautiful", London 1973.

12. Among others: Fred Hirsh: "Social Limits to Growth", London 1977, and Jan Øberg: "At udvikle sikkerhed og sikre udvikling", Copenhagen 1983.

13. Jan Tinberger: "Rio - Reshaping the International Order, A Report to the Club of Rome", New York 1976.

14. Rationality, measured in relation to pollution and the consumption of not-reproducible raw materials etc.

15. Rationality measured in relation to social welfare etc.

16. See among others: 1) Hugh Stretton: "Socialism, Capitalism and the Environment", Cambridge 1976, 2) Marvin Harris: "Cannibals and Kings - Nature's Influence on Culture", London 1977, 3) David Elliott and Ruth Elliott: "The Control of Technology", London 1976.

17. A new technology, so that developing experts in the future might come from the present developing countries and go to the present industrialized countries.

18. This definition of technology is very much in line with the one of Johan Galtung in "Development, Environment and Technology: Some Non-Economic Aspects", Oslo 1976.

19 Johan Galtung: op.sit. p. 6.

20. Charles Edquist: "Teknik, samhälle och energi", Stockholm 1977.

21. Jens Müller: "Afvikling eller udvikling af smedehåndværket i Tanzania", Copenhagen 1978.

22. Johan Galtung: op.sit. p. 8.

23. Jan Tinberger: op.sit.

24. Hans Gullestrup: "Community Development in Western Samoa - Survey of a Project Form and its Implementation", Copenhagen 1977.

25. 1) Hans Gullestrup: "Bygdesamfund i Grønland - rapport om nogle udviklingsproblemer" ("Settlement Communities in Greenland - A Report on Some Development Problems"), Copenhagen 1976.

2) Hans Gullestrup et al: "Udviklingsproblemer i grønlandske bygder" ("Development Problems in Greenlandic Villages"), Copenhagen 1976.

3) Hans Gullstrup: "The Influence of the Royal Greenland Trade Department on the Development of Greenland" in Sørensen and Sørensen: "State Enterprise: Development or Business as Usual?", Aalborg 1982.

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