Technology for Liberation

Appropriate Technology for new employment

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CHAPTER V

Technology for Liberation

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Appropriate Technology in the Third World

A. INTRODUCTION: APPROPRIATE TECHNOLOGY - A MORNING-GLORY IN THE EVENING TWILIGHT

1. The miracle of nature

A piece of rockcrystal is usually quite transparent, mostly colourless, hexagonal, come into existance by a process of slow coagulation of silic-acid in mountain crevices and hollows. Beautiful - just that and nothing more?
In Northern Ireland and some parts of Scotland people call the locally found variety of rockcrystal: 'godstones'. These godstones were buried along with the dead in the grave. Those people that are fervent believers in the hidden powers of the gemstones, claim that it is a property of rockcrystal to aid intuitive insight in order to overcome the darkness of ignorance.
Science has the facility to describe in minute detail the crystal's properties and composition, but such a description does not reveal the real essence of the crystal. Is here perhaps some 'hidden architect' at work that has designed and caused this crystal and all other innumerable forms of nature to come into being? Most people consider the answer to this question a matter of utmost importance and they grasp blindly for a solution like a man that has fallen into a raging torrent will grasp for a straw, hoping against hope that it will save him from drowning.
For the engineer of today the question as to the arrangement, the pattern of recurrence, the blueprint of living- and dead matter in nature is of importance, for this permits him insight into the events of nature and their causes. Armed with such knowledge, he is capable of imitating these events in the factory. He can even produce effects that do not normally occur in the processes of nature. Such capabilities permit the engineer and those that employ him, power to influence the natural environment and to control and dominate it. For the better or for the worse.

In the Netherlands there remain about 1300 plants of the higher species that still occur naturally. Biological studies indicate that more than half of these are at the point of becoming extinct. The same holds true for the remaining species of animals. In the space of 24 hours vast quantities of chemical waste enter our lowlands by way of the river Rhine, so that the picture doesn's look any brighter for the aquatic species of life. (Governmentpublications 1974 p. 6 to 10). This critical situation demands solution of the paradoxical problem

of how to protect ourselves from ourselves. Here we are faced not only with the question as to who might be the guilty party: the scientist or his employer, but also with the question if it may be feasible to apply technology in a different- and more appropriate fashion. Is it necessary to combat the dire consequences of present day technology and, if so, are we equipped to tackle such a task? Or does the entire concept of technology require drastic restatement such as: Technology - that what is beneficial to mankind and his environment: Appropriate Technology.

It may be safely stated that today's technology is loaded with contradiction and downright schizophrenic in its overall expression:

- Supposedly in order to safeguard our interest and protect our wellbeing there is a frantic- and continuous effort in the development, refinement and stockpiling of armament, while this very same armament is specifically designed to eradicate human life. Already the destructive potential of stockpiled armament is more than sufficient to annihilate the total world population and leave the planet earth unfit for habitation.
- The development of the impoverished third-world countries by means of technical adaptation is of vital importance in the maintenance of world peace, but the fact is that about twenty times as much money is spent on armaments as there is put into developmental co-operation.
- Our worries concerning the threat to living nature, such as is for example the case with extensive deforrestation in tropical areas, are wellfounded indeed; however, that very same tropical wood is used for the greater part by ourselves, in the construction of houses and furniture.
- We strive for security and comfort and stuff our environment with a vast array of technical products and innovations of which television is almost symbolic, oftentimes not fully realizing what dire effects are inflicted upon the people involved in the production of such superfluous articles and upon the natural environment.

It would be well if everyone - and in particular those responsible for the development and design of such technical innovations - were to come to some degree of awareness as to these lethal contradictions and the causes and conditions that continue to support their existance.

This publication is meant to serve as an urgent plea to everyone of us for a rational deployment and application of technology as a cultivating tool by which mankind may be elevated to a sane and sound form of society, not only

here but in the third world as well. It is intended for those that are willing to become rationally engrossed and engaged in the tremendous task of evaluating the possiblities that science and technology may yet have to offer towards the wellbeing of humanity and its natural environment.

Today it would appear as though technology has developed into a tyrannical master, reducing humanity to its abject slave. In our efforts to dominate the natural environment we have, at the same time, turned our backs on nature and, in consequence, also on ourselves, paradoxically, since we, like everything else in existance are an inseparable part-and-parcel of that selfsame nature. One might say that the existance of life itself is a matter of strict and irrevocable interdependance with the natural environment.
The array of technical products we are capable of producing is highly ingenious. On the other hand, it is oftentimes rather stupid and objectionable since it alienates mankind from itself and from its environment.
We find ourselves in a twilight zone as evidenced by the stockpiling of armaments on an unprecedented scale, the dehumanizing degree of poverty in the third world countries and a level of environmental pollution of staggering proportions everywhere. In all these problems technology oftentimes plays a preponderant part. In all likelihood, technology may also be employed to combat these problems. To do so, we'll first have to have an unbiased understanding as to precisely what technology in point of fact entails. The hidden danger of technology lies not necessarily in its visible manifestation but rather in the basis on which it is built, its actual starting point.
We should first understand this hidden actual basis if we are to discover the causes and conditions of alienation, pollution and large-scale stockpiling of armaments. To acknowledge that nature is a miraculous happening is another way of saying that we recognize the dire necessity for a responsible management of that nature by restructuring technology to saner proportions, that is to say: proportions that are selected solely on the basis of adaptability to the environment or, in short: Appropriate Technology.

2. Development from within and coming down from above.

Everywhere in nature we can observe development from within. Silic-acid is the seed from which a piece of rockcrystal grows. In the same way, plants, animals and humans grow and develop out of their germinating seed. It ap-

pears evident that nature's blueprint involves the manifestation of living and dead forms from within, from the inside coming out. Men has continued to base its creative efforts on this blueprint. This occurs, in its early stage, by the utilization of whatever the natural environment has available. Useful implements are withdrawn from the environment and fashioned into applicable forms. As a consequence of a progressive development of technological refinement, men gradually impresses form on the natural environment in many different ways; such differences originally being somewhat dependant upon the local availability of raw materials. The various cultures that have originated in this manner may be regarded as an intimate dialogue between men and his natural environment. Technology is the visible manifestation of this dialogue and is, in its early stage, primarily directed to reduce men's dependence on his environment; however, this process causes at the same time a separation from the natural environment and an ever growing sense of alienation. A parallel development of organizational structures capable of supporting and stimulating the refinement and production of technology closes the viscious circle that separates men from his environment and entraps him in an irrevocable sense of alienation. Virtually all research in development of technology takes place in the wealthy, industrialized part of the world. The fruits of such technological development are, in carefully selected instances, passed on to development countries, clearly and often blatently as a development coming down from above in a co-operative arrangement of reciprocal benefit, in particular to the leaders of the industrialized - and development countries.

Because technology, developed in the wealthy industrialized countries is tuned-in to their specific requirements, it is oftentimes not suited to meet the needs of people in development countries where the main issue is bare survival - food, drinkingwater, health-care and shelter.

But technology may also be used as a means to reduce dependence. It can be directed towards the outside, to international markets and in this manner reinforce economic dependence; conversely, when it is directed towards the inside, tuned-in to local requirements in the village, a specific industrial undertaking or trade, technology will help to reduce economic dependence.

It would seem as though technology's most important function lies in meeting the real survival-requirements of people living at the existential basis of society. As long as these real survival-requirements of the masses are not met, a lasting state of peace would be difficult to establish and, indeed, it

may perhaps be undesirable to do so.
We may manage to pacify our troubled conscience when we have once again contributed to emergency relief for the Sahel countries or dropped a coin or two in the collection box of the Salvation Army around Christmas time, but somehow there is something that keeps on gnawing. We are becoming aware that we can do better, must do better.
A steadily growing number of scientists is becoming aware that technology should be applied for the promotion of peace and welfare. It seems likely that the development of this awareness cannot be held back, even within the ranks of those most conservative of scientists: the engineers.

The international economic edifice is coming apart at the seams. The aware scientists and the technicians will have to lend a helping hand - in the spirit of modesty and servitude- to gradually break down this weakened structure, neatly and carefully. On the remaining foundations - consisting of the masses that are currently subjugated to the games of power that permeate the structure of today's society- we may erect a different structure, one that permits each and every individual a positive state of freedom and independence. Technology may perhaps be capable of forging the appropriate tools that may be successfully used to aid and support this process of reconstruction, tools tempered in the fire of knowledge and total concern for the wellbeing of all beings.
To gain such insight, to attain to such a state of total concern, to understand the dire necessity for such radical reforms in existing structures, it must be recognized that this can only be accomplished if the process of reconstruction is started at its most basic level, from within one might say. From within the awareness of the individual that recognizes its personal place in- and its responsability for- the particular segment of the environment with its particular content of nature, culture and society to which the individual intricately relates.
The mental breakthrough (a reasonable alternative to a mental breakdown) comes into existence when the individual recognizes that he is at the same time a person and a part of the environment, which includes society. One might formulate that, similar to the two sides of the coin, the individual and the environment share one and the same existance, each part being of strictly dependant origination to the causes and conditions that irrevocably determine its functional properties and qualities, which include the functional properties of the intellect that enables the individual to recognize that within himself

lies a source of power that may be utilized to improve the quality of his personal existance and, with it, the quality of existance for the whole.

3. The sorcerer's apprentice

The question whether it is necessary or not that science and technology are far removed from the basis of society cannot be simply answered by the remark that it is necessary for the scientists to, quietly and sensibly, removed from the happenings of daily life in the world, work for the attainment of a deeper degree of insight. Science and technology cannot be goals in their own rights. They may be regarded as society's investment into a more humane existance for everyone. The training and education of scientists and engineers is big business. A business with its own particular culture, norms and values. The manner of operation has to be in accordance with its rules and regulations. Their calculations have to be correct. The specialists have to be in mutual agreement as to the content of the speciality they call their profession. Specialization has been promoted to religion, complete with initiation rituals. This poses the danger that the specialist becomes uprooted from his nutritional basis: the reality of the everyday people of which society is composed and in who's service he is supposed to be engaged. He answers all questions that come to him from the politicians, the industrial leaders and the bankers, oftentimes without lending an ear to the pressing questions posed by the environment, the unemployed, the hungry. When the demand for more energy is met with the engineer's question: "could we do with less, could it be accomplished more efficiently, could it be done in a different manner?" those that employ him are quick to call him inadequately specialized. The "specialized" engineer on the other hand oftentimes seeks for solutions without being aware as to precisely what the problem really is. For this he may be excused since his education and training do not really include the development of such a high degree of awareness.

An engineer must be capable of building a sound bridge, design a good water clarification system, a smooth functioning machine gun - the consequences are not part of his responsability! It cannot be denied that technology also has its esthetic sides. Almost everyone gazes with awe at a structure like the Golden Gate bridge spanning the Bay in San Fransisco or at the latest design of riot-control-super-burp-gun used by progressive riot squads almost everywhere. Technology is awe-inspiring, almost like sorcery and it enables the

magicians to control the environment.
Today's engineer has become like a sorcerer's apprentice- he knows incantations and formulations but is oftentimes not able to undo the consequences of the things he has called up- the mountain of waste products is ever growing, men and his environment have reached the stage of exhaustion... We are not looking close enough at the roots of our past. The medical profession is rather condescending in its approach to natural curative methods, forgetting that it has to thank its very existance to such natural traditional methods, such as is the case for example with the knowledge handed down to us from the past, concerning the curative powers of plants. Since the arrival of the first white colonist on the island of Ceylon, the development of the more than two thousand year old traditional natural healing methods has come to a virtual standstill. The same goes for such traditional methods elsewhere. Research has shown, however, that these systems, even now, retain much that may be of great value (Labadie,1980).
Technology has changed the face of the earth, while the traditional handicrafts, from which the science of engineering has developed, have practically become reduced to a state of folklore. But in the disappearance of the handicraft there is a great deal more involved than just the loss of employment opportunity. Craftmanship is in the first place a unique personal expression of knowledge, creativity and artistry, an expression that is difficult to automize. Just recently, problems such as were experienced in a small foundry on the island of Java, were deemed to be at a level insufficient importance to warrant the specialized attention of a graduate engineer by a prominent Dutch metallurgist! One wonders if such an appraisal was caused by a high degree of vanity on the part of the sorcerer's apprentice or by the master magician's imagined qualities of judgement and perception.

The past is not over and done with. It is not a case of escaping into the past with fanciful and romantic ideas, but rather of gaining useful insight into the valuable traditional resources that lie waiting, as yet untapped. Untapped because the choice has been made for a system that promotes and stimulates massproduction, which brings products within the reach of the large population groups. Unfortunately, mass-production is not always the same as production for the masses; if that would be the case, the existential level of the majority of the world population would look a lot better than it does. Massproduction serves economic ends primarily, whereas production for the

masses would be based upon the actual living requirements of the majority.
A sorcerer's apprentice that has mastered his incantations and formulations seems like a programmed calculator, while an engineer, that has become free of his own (educational) program can rise up above that program and is capable of setting new goals for technology. The economic ends that motivate the sorcerer's apprentice will oftentimes come into serious conflict with ends that are beneficial to men and his environment

4. Technology for liberation

In spite of the fact that science and technology are the source of a great deal of good, their current development should be viewed with suspicion for reason that whatever good they may have yielded in the past, such good is being seriously overshadowed by a side that shows increasingly bad yields.
Nuclear energy is a volatile- and highly controversial technological case in point. This is a subject capable of inducing great emotional response almost anywhere in the world. Still, where it concerns the nuclear powerplant itself, its design and operation, we can find little fault. The engineers that design and build the nuclear powerplant do everything reasonably within their power to insure their safety.
The same can be said for the automobile for example. A technical product that is the cause of thousands of traffic fatalities in the small country of Holland alone. Here, faced with real statistical facts we hear little of protest demonstrations against such an extremely hazardous product of technology. What appears to matter is the threat that nuclear energy poses. The production of nuclear energy is, as everyone knows, closely related to the production of nuclear weapons and, in that context it can be seen as a threat to safety and liberty.
But, again, the same holds true, for example, for the invasion of personal privacy by the registration of personal data in the computer which currently is a very real and very serious problem in many of the industrialized countries. Again, there is almost no resistance against this very real threat. A great many more examples may be quoted where technology poses a threat to safety and freedom.
Nuclear energy only draws a great deal of attention because of the far reaching- and radical consequences of this particular technological problem.
It is clear that it is not the technological provisions by themselves that are

felt to constitute a threat, but also the manner in which these provisions are arranged: the organizational regulations. Evidently, these regulations assume a character that is specific for an industrial society.

A nuclear powerplant is a complex and vunerable technological provision that requires an extraordinairy form of management, involving a vast array of specialists on all levels. The same holds true in the mass-production of the automobile.

> Gigantic complexity together with specialization and stratification in the connected organizational regulations, plus the one-sided end of strictly economic benefit are characteristic for industrial technology.

A great many technical provisions, due to their magnitude, complexity and their products or waste-products are oftentimes a threat to the environment. The related organizational regulations, for reason of their built-in subjugation are, in fact, a threat to human liberty. This form of technology also opens the way to dependence, since mass-production necessitates export and therefore international economic relations of interdependence. Large organizations and bureaucracy moreover lead the way to political dependence of those working within that system. But the threatening aspects of all this penetrates to even deeper levels.

The process of alienation that is part and parcel of todays technology and related organization and that has placed man in a state of spiritual dependence, is probably, in essence, the most threatening characteristic of the technology of the industrial age. The influence of the alienation process expresses itself through, for example, a feeling of impotence, a feeling of lack of influence over one's own work and life.

In this publication matters of spiritual, economic- and political dependence that, for the greater part, appear to be caused by the essence - and the form of expression of industrial technology, will be discussed.
In the first chapter the relation between technology and society will be stressed. Armed with a mental picture of the existing situation we can proceed, in chapter two, with an indication as to which possibilities may be

yielded by technology to arrive at a greater degree of spiritual, economic- and political independence. Thereafter we may proceed to device a working method whereby this independence may be established with the aid of technology. The sections that follow deal with examples of projects, education and research in these areas.

The essential subject matter of this publication as set forth in paragraph one, i.e. to develop insight into the deployment of technology for the benefit of society and to provide employment opportunity that is friendly to man- and his environment may be subdivided into three categories:

- The examination of arguments that necessitate the development of technology appropiate to man and environment.
- The construction of a theory that is generally comprehensible, on which appropriate development can be based and that can be used to analyse technological developments.
- To take such appropriate technology out of the sphere of alternative idealism and, in this manner, make it acceptable as a rational alternative for social development.

It would appear as though industrial technology in its current forms of expression tends to lead to the oppression of many and to the destruction of the environment. This book indicates that technology when designed- and applied in an aware manner may also lead to liberation and harmony and in that spirit may be likened to a morning glory in the evening twilight.

5. Responsibility

My personal viewpoints concerning technology are, on the one hand, based upon an extensive technical education and, on the other hand, on many years of experience in the multinational industries and the scientific education system. Through literature studies and field research in, amongst others, the United States, Canada, Laos, Sri Lanka, Bolivia, Mali and Indonesia, especially when connected with the scientific educational system, I have become convinced that it is possible to place in opposition to the only existing model for the development of technology another, different model. In the attempt to verbalize this developmental model especially the members of the Centre for Appropriate Technology and some members of the faculty of Technique,

Labour and Organization of the Institute of Technology (Technische Hogeschool) Delft have exerted great influence. The same goes for colleagues, messrs. Caesa, Siekmann and Gasch, of the Technical University Berlin, where I have been employed in the function of guest professor since the summer semester 1982. A number of co-members connected with the National Board for Recommendations for Development-Co-operation have assisted in giving expression to my concepts.
I am in particular indebted to four of my colleagues that have assisted in diverse ways with the realization of this book:
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Willem Riedijk
Berlin, Rijswijk, Summer 1985

Chapter I

TECHNOLOGY AND SOCIETY, UNITY AND CONTRADISTINCTION

1. Introduction - the marriage of technology and society

Technology and society are a married couple everyone meets daily. A problem of all marriages is that the serious consequences concerning the choice of partner only become apparent after the wedding has been consumated. When a choice has already been made for an automatic system or for nuclear energy it becomes a difficult matter to select another "partner".
It is, in fact, far more difficult to divorce a technological spouse than it is a human spouse, since it is not possible to use a given quantity of energy more than once and the shape imparted to raw materials implies, at the same time, a choice in relation to other means of application. Also the quantity of basic raw materials available on the planet has its limitations.

The marriage between technology and society has its curious aspects. On the one hand it is a happy marriage, judging from the leading part played by technology in the daily life of everyone living in the industrialized society, while, on the other hand, the ever growing problem of unemployment and the state of agitation concerning environmental pollution and atomic armament are an indication that the honeymoon is long since over. In making a choice for a specific technological item the conflict of interest existing between the industrialized- and development countries is of great influence. In the Netherlands the consumption of energy for the automobile represents 13% of the total. Considering that the population of the European Community and the United States combined form only 14% of the world population, they have a high consumption of energy indeed since it accounts for more than half of the energy consumption of the entire world (AER The Hague 1980).

The question arises as to what causes such a significant and ridiculous imbalance in the first place. Certainly not the existence of automatic systems alone. Many people, especially those belonging to the engineering variety, seem to think that technology is nothing more than the total of technological provisions and the knowledge and capability to produce these.

In the introduction to this publication it has already been revealed that part of technology is formed by organizational regulations designed to produce such technical provisions. In this light, the supporting structure of society may be viewed as being the totality of organizational regulations and technical provisions. In such a structure everything pivots around these two aspects and one wonders just how a specific social structure came to be, in preference to alternative structures.

The coming into being- and the development of industrial society has its roots in a specific way of thinking related to a specific ideology.
Technology may be said to comprise its "visible" aspect: its technique and organization, that expresses itself through a specific social structure and its "invisible" counterpart, the ideology, which functions as its program, supporting the manifestation of its visible aspect. The ideology may thus be regarded as the governing element of technology and society.
Where the specific ideology is motivated primarily by the requirements of those in leading positions, it follows that the technology of that society will primarily support the interest of those leaders. The establishment of a degree of harmony is, therefore, feasible only where mankind and his environment do not become victimized through an inappropriate distribution of spiritual-, political- and economic power. Also it is necessary that the partners know and understand one another if a mutual degree of influence is to become effective. This lack of understanding is also a serious problem in contemporary society.

The obscurity of technology

Society is being threatened, because it doesn't know- and understand its technical partner. There is ignorance concerning the consequences of its use and application on the natural environment and on our own physical- and mental conditions of health. There is also ignorance concerning the relation that exists between technology and the coming into being of certain organizational modes specific to our society. Most important perhaps, there is ignorance concerning the possibility of making technical choices that are safer.
The dependence on technology does not lie entirely in the dependence on the technical product itself; the automobile or industrial food-production processes for example, but rather in the apparent impossibility to make a choice for

ourselves as to how to direct our own lives, at home or on the job, because such technical products seem to necessitate a way of working and living that makes independence impossible.
The highly industrialized society, here as well as with our Eastblock neighbours, demands a structure wherein men is educated, prepared for and subjected to the industrial organization that makes it possible to employ directors, managers, bosses and workers for profitable ends. To realize the possibility of using technology in a less oppressive manner, it is essential that modern men at first analyse his viewpoints concerning himself and his relation to technology.

Our selfimage is strongly influenced by the popular media and the people we relate to. In industrialized society this selfimage - and also the image of the world - is to a great extent stipulated by the specialists as to the content of our viewpoints. Specialists in the field of pedagogics, education, nourishment, energy-provisions and, more recently, the new specialist, in the field of mental illness: the (psycho)therapeutist. These specialists, however,base their authority strictly on scientific appraisal of which the historic origins are not difficult to establish.
It is likely, for example, that today's body-oriented health care finds its origin back in 1845 when a form of pre-scientific thinking (Kuhn, 1972), that had its roots in a kind of scientific prejudice and that proposed that only physical- and chemical processes supported all expressions of life, gained general validity as declared by the Berliner Physikalische Gesellschaft (Verbrugh, 1974).
This point of view held by medical science undoubtedly also greatly influences the viewpoint mankind holds of itself. If it were true that we are no more than just a collection of complicated physical - and chemical processes, it would be valid to state that a pill containing almost everything, developed for astronauts would be as healthy and wholesome as would be a complete tasty meal, or an apple sprayed with insecticide would be as healthy as an unsprayed apple. Also, in that same vein, the curing of a diseased human organ would amount to the same as would curing a sick human.
According to Professor Reddy of India, employed in the field of Appropriate Technology, technology contains within its structure the "genetic code of a culture". If this would indeed be true, Western society is in poor shape. Our Technology, our production processes, our cities and our educational institu-

tions exude a musty spirit of gauntness, soullessness and massality. The view Western man holds of itself and its culture becomes abundantly apparent in the products of its celebral activity; bureaucracy and mass-production.

I believe that the problem of living in an industrialized society lies in that we have become a part of an environment that is predetermined by a technology that we fail to understand. The New Alchemists, a group working at Cape Cod in the United States on survival techniques for Western society have as their basic motto the unity of technology and men: technology must be beautiful - the creator, the owner and the user of beautiful technology will have a feeling of unity with it, whereas industrial technology leaves practically no room for human but only for economic qualities.
External design of industrial products leave a faulty impression that a state of unity exists between men and product, whereas industrial products have not been designed for the person, but rather for nameless targetgroups and markets.

It would seem that in order to establish a society where technology is employed as a means to fill the fundamental requirements of men, we must first come to a creative demolishment of industrialized society. It is true that the chance for succes is slight and that to better the odds it is a prerequisite to acquire insight into the essence of technology and into the possibilities to humanize technology. Craftmanship is an example of humanized technology that will be discussed in the following paragraph.

2. Technology and craftsmanship, balancing gains and losses

The making up of a gain- and loss account for technology and craftmanship is important, because such an account yields insight as to what precisely has been gained from the technology that has made industrialization possible and what has been lost with the deterioration of traditional craftsmanship. A significant phenomenon in this account may be observed in the altered relation between the employer and the employee and the gradual increase in the gap between producer and consumer.

These altered relations may be found at the roots of growths of state capitalism in the Eastbloc countries and the private enterprise capitalism in the

West and the coming into being of contemporary society together with its institutions.

It is disconcerting to realize that while preparing this subject matter, little information is available concerning the gradual deterioration of traditional crafts, while it is these very crafts out of which industrialization has grown.

The craftsman, whether stone-mason or woodworker, is familiar with the properties of his raw material and knows the tools needed for its preparation and fashioning. He is capable of independently turning his material into the form intended from the beginning to the end. This factor of being responsible for the shaping of the product, giving it form, is a significant element in craftsmanship and in that respect it represents the connecting link between the arts and technology in our society. This link, however, has become progressively weaker with the development of the industrial revolution. Traditional craftsmanship requires technology and organization on only a very small scale and a short distance between the producer and the consumer.

In the developmental chain of trade, handicraft, manufacture and factory to industry (Pieterson, 1981) the circle of employees becomes ever greater, that of empoyers smaller, while, at the same time, the division or division of labour increases as does the distance between the workers and the consumers. Because it was through home-handicraft, the subletting of certain tasks, that the initial division of labour occurred.

In a manufacturing process these various split-out tasks were gathered under one roof. In those early days only little use was made of machines. Manufacture, as productive form, simply saved the having to transport raw materials from one place to another. In the factory, machines gradually took over the work of the traditional craftsman and, at the same time, individual skill and experience became less important. Industry, after all, is characterized by the fact that machines "co-operate", whereas the required human labour has become an extension of such mechanical co-operation. Parallel to the splitting of the labour process runs an organization-development process that tends to concentrate an ever growing degree of power with a relatively small number of entrepreneurs (Dickson, 1974). It is true that industrialization makes a vast array of products available to the masses, whereas according to the content of today's ideology, it would be impossible to do so with the techniques of the traditional crafts.

For the worker, the loss lies in the advanced state of labour division and, with it, the impoverishment of the labour process and, also, the loss of any indivi-

dual influence within the organization, plus greatly reduced possibilities of meaningful indentification with the final product. This is characterized by a gradual transformation of the production process, that formerly required people and their personal tools of trade, while currently requiring machines using people as expendable extensions, as tools. This, however, is a picture that needs refinement. The craftsman-cabinetmaker is capable of creating a beautiful chair, but, quite apart from price considerations, it remains an item available to few, since he cannot produce as many chairs as can the machine. A chair, produced by the furniture industry is a massproduct that may be labeled with the term: "beautiful" through advertisement and is, indeed, a useful item for the many. The gain- and loss account of technology and tradecraft could be made to balance if the notion as to what precisely constitutes product- and process quality were to receive a broader interpretation and content. At present, the concept of quality encompasses only a number of technical properties, enhanced further by measurable factors, such as economy and usefulness. But it is also possible to enrich the concept of quality by enlarging its content to: a meaningful process of labour designed to produce something that is beautiful, a product one can identify with.

Such identification becomes manifest in the production-process by a simultaneous expression of knowledge, skill and creativity during manufacture. According to Huppes (1985) the traditional craft is characterized by three interconnected elements:

- minimal division of labour within the organization
- a high degree of skill and craftsmanship where it concerns knowledge, ability and creativity
- quality of labour and product

In the process of changing labour-relations and the growing distance between producer and consumer, expressing itself in subservience and the splitting of tasks, creativity and artisticity have gradually lost all meaning, obliterated by automation. Labour has become a concept of purely economic consideration, where it could well be a means for life's fulfilment. It would be well to consider establishment of an entirely new branch of science with the sole object of fathoming the essence of the old tradional craft.
Contemporary industrialized society, however, does not seem to be in need

for such a science, since tradional craftsmanship is considered to be excessively expensive.

Volvo of Sweden, for example, attempted in an experiment some time ago, to arrive at some degree of task enrichment for a group of employees, normally involved in the massproduction of automobiles, by jointly producing an automobile from beginning to end, each worker related to every aspect of its manufacture. The experiment was a complete success - the employees enjoyed their work far more than usual and the quality of the final product, the finished automobile, was also excellent. Naturally, the experiment was halted, since this manner of production was far too expensive. Obviously, with the existing relation between capital and labour, technical-economical quality is considered far more important than is the more human quality of work-content. As long as the main objective of industrial processes is found in the making of profits it will be near impossible to change this status quo, particularly where the traditional entrepeneur is at liberty to choose as he pleases when it comes to replacing workers by machines and automatic systems. It might be feasible on the other hand, to give a greater deal of attention to employment opportunities using production-processes requiring a lesser degree of task splitting, with the accent on craftsmanship and a product quality that includes the human factor as overriding end. Such opportunities may well be developed side by side with the ruling automatic production system. Also, it may be reasonably anticipated that by the turn of the century employment opportunity will, for the greater part, result from the traditional tradecrafts and small-scale enterprise, particularly in those fields of work that cannot be automated. By that time, the factory as a source of employment opportunity will have lost its significance, since those production processes will be largely automated (Huppes, 1985). To summarize, the profit- and loss account of technology and tradecraft, give ample reason to pay special, separate attention to traditional craftsmanship in the framework of technology and society.

3. The sociological history of technology; power and impotence

The importance of viewing the development of contemporary technology in a historical perspective is recognized to an altogether inadequate degree. Society is quite thoroughly saturated with the idea that nothing better could exist outside a social order severily based on - and supported by - science and

technology and in this respect it makes society appear akin to an island floating between the past and the future, without having any real ties with either.

Our specialists and experts would like to convince us that they know all the answers to questions posed by society; whether this is actually so or not remains to be seen and is questionable indeed.

The apparent power, yielded by scientific specialistic opinion over all of us, is based, amongst others, on a sort of vanity concerning what they consider, the trifling - and insignificant influence exerted by the past. Yet it is time itself that has altered the place of the scientist, together with the relevant alterations in relations of power that have given shape to contemporary technology and the labour relations that belong to it.

Based strictly on their scientific opinion as to how precisely society and the restricted populationgroup they belong to should be constituted, our scientists and engineers support their specialties and so the circle of specialization-power is securely closed. Against their power the consumer stands virtually powerless. But it also reveals the impotence of the specialists in their effort to completely deform and twist mankind in just the desired shape as is useful for society. For example: In spite of the oppression of farmers in Bolivia, aided and abetted by Western interests, they have revolted, persistently falling back on the heritage of their own culture, in order to regain their lost rights to freedom as inbedded in their particular culture.

This, for the greater part, has finally caused the establishment of a democratic type of government in Bolivia.

The addiction to energy by industrialized society serves as the most pungent example of power and impotence in technological science as viewed in its historical perspective. Adjustment to this addiction can only mean a suppression of the symptoms, whereas the actual underlying causes of the illness remain untouched. The injudicious deployment of energy runs like a red thread through the history of origination of industrial technology.

Injudicious deployment of energy should not be seen only in its narrow sense of the use of labour, capital and raw material for a single enterprise, but rather in the highly destructive effect on man and its environment, of the entire chain of production; from the manner in which raw materials are obtained to the disposal of industrial waste products. And with it all, a strong sense of impotence in dealing with the problem, since it is rooted in a system of industrialization where waste is the keyword. Frustrating, to say the least,

since it can be clearly - and convincingly demonstrated that energy-conserving programs, based on personal initiative and easily learned skills, are capable of creating permanent employment opportunity (Lovins, 1979). The power exerted by the industrial system becomes apparent, when we consider the disproportional seizure of energy and raw materials by Western society, which constitutes only one-fifth of the world population, while seizing two-third of its total resources.

This sense of impotence, where it concerns the breaking of the vicious circle, may not be blamed on ill-will alone; more likely it arises from the prejudicial viewpoint that a small-scale approach to the introduction of regulations intended to conserve energy and raw materials would not be feasible today for reasons of economy.

The roots of addiction to energy and raw materials are to be found in the onset of the industrial revolution; such a retroactive declaration of cause is simpler to formulate than it is to observe this cause while the industrial revolution is actually taking place, even as it is today. The manifold changes in society occur more rapidly than our understanding of them - what held true in the past holds true today.

Today, as in the past, there are those lacking the critical viewpoint and that wholehartedly support technological progress, also, then as now, there are people that attempt analysis of existing social structures and the processes of change that occur within it (Pieterson 1980).

There has always been a greater degree of interest in the symptoms than in the underlying causes of the ailment and today we are again witness to this fact of life: we are all busy making "reasonable" and "rational" use of the opportunities presented by life in the here and now, meaning that we support modernization of production processes, promotion of large-scale enterprise, unabated advertisement for "progress" as a soulsaving principle, all this stimulated for the benefit of the up- and coming class of entrepeneurs.

It would, however, not be true to point the finger at some kind of premeditated conspiracy on the part of some select group of big bosses owning all of the capital, but rather a gradual shift of power belonging to the old leading elite class, the ground-owning landlords, to the new leaders of today: the proprietor-entrepeneur.

In the line of development stretching from craft to industry there is a built-in transition of individual means of expression of the craft to the standardized copy-work of machines tuned to other machines. The replacement of human

labour by the standard copy-work of machines is one of the causative factors in the addiction to energy; such replacement generally increases energy consumption.

The recognition that energy-sources have their limitations was, understandably, practically non-existant during the industrial revolution. The limits to expansion had not as yet become manifest. Quite naturally, there was considerable resistance to the replacement of human labour, particularly by those directly effected:

> "The transition has not been an easy process, but rather painful and somewhat slower than one would expect considering the amount of pressure, the oppression-, the hunger- and poverty involved. There was a great deal at stake: a more pleasurable work-environment, labour circumstances governed more by humane than economic needs, the location of work was closer to the home or in the home itself, there was far less noise and one could afford to take a break as needed or have a beer as liked; also the working atmosphere was far more relaxed and peaceful since there were no machines to exert continuous agitation and pressure. People worked in spurts of activity as orders for production came in, timed to rather flexible deadlines. In strict opposition to this stood the sternly governed monotonous regularity of the factory, where machines created a hellish din; to men of the eighteenth century probably sounding as issueing from the mouth of the devil himself.
>
> The expressions of impotence and frustration by those, full of stubborn pride in their craft, are tragic and fierce; they, from time to time, waged an unequal battle against the uniform production-capacity of the machine, a battle they were bound to loose right from the beginning. Import restrictions were imposed on machines and where machines had already become operational these had to be dismantled or destroyed. A periodic series of convulsive - and violent resistance expressed itself, titled: machine-breaking - the destruction by breaking or setting fire to machines in factories" (Pieterson 1980).

The government calls out the armed forces and, finally, when in 1812 the death penalty by hanging is imposed for crimes against the machine and in 1813 a large number of offenders are tried, convicted and hanged on the gallows or deported in a mass-tribunal at York, the power of the new economic order becomes firmly established and institutionalized. This process of

power-affirmation continues today, quite in spite of the hard fact that the progressive destruction of the natural environment, resulting from the injudicious deployment of industrial processes, has become manifest nearly everywhere and also in spite of the fact that many people, including scientists, are today revolting against political- and economic dependence that appears to be caused chiefly by western domination of international relations.
One of the most ignoble effects resulting from the introduction of industrial technology is the annihilation of culture, a process that goes on even today, particularly in - but not restricted to - the third world countries.

4. Technology and culture, the tragedy of the snowmobile revolution

Antropologists attempt to study men in their natural - and cultural environment and circumstances, not in the manner as is typical in the factory, with a timeclock in hand and from a distance, but rather by becoming personally - and intimately involved. The ethnologist always tries to become a part of the particular society or community that is to be studied and observed; in this manner he really gets to know the people and their natural needs and habits.
The following section deals, in condensed form, with an antropological study conducted with the Lap people of Northern Europe and the social consequences resulting from the introduction of the snowmobile in Lapland. (Pelto 1973).

The Lap people prior to the introduction of the snowmobile

The area inhabited by the group of Lap people that were involved in the snowmobile study is found some 200 miles north of the polar circle on Finnish territory. It has a wealth of rivers and lakes and is covered with various types of grass and moss, low brush and, here and there, some forrest. The population of some 350 people (1959 census) is made up chiefly out of Skolt Laps, divided over approx. 50 families. Each family maintains their own stock of reindeer, fishing equipment and various other items such as are required for survival and, in this manner, each family may be regarded as selfsufficient. There is, however, considerable co-operation, particularly where it concerns the herding of reindeer.
The Skolt-Lap people were familiar only with fishing and the breeding of reindeer as the immediate means of livelihood and survival. Reindeer were

not used as a source of food alone, but also for draughing sleds and other scores while the hides were used for the making of boots and fur garments and the meat exchanged - or sold - in trade.
As long as a man owned a herd of reindeer, there was no difficulty in providing the required sustenance for his family; also, when some actual money was needed, he could sell-off some of his reindeer. A most significant characteristic of this Lap society, prior to the introduction of the motorized - sled, was that of equality. To quote Pellto: "by equality I mean to describe a social system that permits free and unrestricted access to the scant resources available in the area, on a basis of complete equality, valid for all people equipped with the necessary physical - and mental faculties as are needed to utilize these resources". An important facet of such a society, based on this form of equality, is that the initial capital requirements to participate in this society are very minimal. The differences in wealth or position such as exist are due chiefly to the differences in individual skills or degree of wisdom, however, this social structure does not permit such differences to develop unfavourably since such priviliged differences are usually not subject to inheritance. To put it a different way: the Skolt-Lap people, in order to maintain and improve their level of existence, have waged their battle of survival with their natural environment rather than battling their fellow human beings. Those being endowed with a greater degree of cleverness had thereby no greater power over the available natural resources, that would otherwise have permitted exploitation of the poor. Prior to the introduction of the snowmobile the natural circumstances dit not include an opportunity for the richer and more succesful families to impose restrictions on their less fortunate tribal members.

Also, prior to the introduction of the snowmobile, there existed a cycle that recurred annually, whereby the activities of the herdsmen were governed chiefly by the seasonal behaviour of the reindeer herds. In essence, this cyclic pattern involved the driving together of the many small groups of reindeer into one large herd, during the fall, in order to make safe wintering possible. This large herd was thereafter divided into smaller "home" herds, maintained on the family pasture ground and, after the calving season, the animals were branded and, together with the mother reindeer, released and left free to roam in whatever pasture-ground as may be found in a large surrounding area. The Lap people maintained a transportation system that consisted solely of

draught-reindeer and sleds and it was practical and highly efficient. The maintenance of this system required a great deal of patience and skill. Only the very best of the reindeermen owned reliable gelded reindeer and high-quality groups of draught-reindeer that guaranteed a degree of mobility as was prerequisite for the proper accompaniment and guarding of the herds. This transportation system had functioned adequately since prehistoric times, right up to 1960.

It is significant that their pre-snowmobile-age did not require any other kind of fuel or other material from sources outside the Lap community. Local sources of energy, chiefly from animals and firewood, were locally deployed. Every herdsman was capable of producing his own sleds, reindeer harnesses, fishing gear and clothing. It was a system that required a great deal of attention and maintenance, yet made possible a kind of harmony between men and their environment.

The arrival of the snowmobile: a calamity for the Laps?

The first snowmobile arrived late 1961, from Canada. Ten years later a total of 70 such sleds were used in the Skolt-Lap territory. Also in other northern areas dependent on the reindeer herds, the growth in the use of the snowmobile sled was very similar. By the end of 1966 there were a total of 335 sleds used in the entire northern Lap territories.

Superficially, the use of the snowmobile showed advantages:

	reindeer sled	snowmobile
. preparation for a trip	1 - 3 hours	5 - 20 minutes
. necessary rest-period	1 - 2 hours	15 minutes
. draught-herd maintenance (movement for pasture ground)	1,5 hours	none
. freight transport to Norway	3 days	5 hours

Fig. 1: Comparison snowmobile and reindeer-sled.

The above indicates a tremendous time saving and time is money. Yet, the mechanization of the herding of reindeer had catastrophic consequences for the Skolt-Lap people.
This is what, in fact, took place:
Prior to the introduction of the snowmobile the rounding up of the herds was a peaceful and relaxed process, sometimes lasting for weeks. As the herds gradually increased in size, a social system developed simultaneously, where the animals became used to one another and also to the the herdsmen and their dogs. Almost all collective activities involved both the people and the animals and were of a peaceful character. The herdsmen helped the reindeer in their search for food, by finding new pasture ground hidden deep beneath the snow.

This picture of a peaceful and harmonious community was rudely- and severily disturbed by the introduction of the snowmobile. The herding of reindeer was turned into an entirely different process. The duration of contact between people and animals grew shorter and shorter, from months and weeks to days and hours; also the character of such contact became drastically- and intrinsically altered. The reindeer were hounded and pursued, oftentimes over great distances, in order to collect the herd. The social system of herding was turned into groups of individual, severily frightened, animals, forced to run into a specified direction. In consequence the reindeer were forced to gradually alter their natural living habits; a tendency to escape the tensions and disturbances imposed by the machine became apparent. Toward the end of 1971, only ten years after the introduction of the snowmobile, the full extent

of the most important aspects of the reindeer calamity had become visible:

1. The number of reindeer in use by the Skolts, fell from approx. 2600 in 1961, to 1700 in the spring of 1971.
2. In 1971, one-third of the total reindeer herd was owned by only one family that had been clever enough to exploit the snowmobile in the most efficient manner.
3. Two-thirds of the total Skolt-Lap population could no longer maintain any reindeer at all. The herds had become too small to be of any economic importance.
4. The greater part of the male population is no longer active as herdsman. In 1960 there were a total of 41 men active as ski-herdsmen, while in 1971 there remained a total of 14 snowmobile herdsmen, 19 men worked for wages in some other field of activity, or had become unemployed, 4 died and another 4 had to withdraw from any form of activity due to ill-health.
5. The herds can no longer be put out to pasture during the winterseason and, for this reason, the calving process is no longer under control of the Lap people. Most families, as a result of the running wild of the reindeer, have lost access to reindeer transportation possibilities. Transport now has to be hired from the owners of smowmobiles or automobiles.

To summarize, it may be stated that the Skolt-Laps, within a period of only 10 years, have turned from a selfsufficient community to a dependent group. A society composed of selfsufficient, free humans, living in relative harmony with one another and with the natural environment has changed into a population of unequal people sustained and driven mainly by economic values.
One would perhaps logically suppose that the obviously catastrophic effects resulting from the introduction of the snowmobile, would serve as adequate inducement for the Skolt people to return to the traditional methods for herding the reindeer. This, however, is not the case, since a small number of Skolts has apparently gained considerable advantage from the new situation. It is evident that not only the economic relationship, involving ownership of motorized transport, durable consumer goods, in short, the financial possibilities, have altered drastically but also the balance of power. This is due to the fact that the herding of reindeer has now become a free enterprise production system, exploited and dominated exclusively by a few leading families. An entirely new phenomenon has become manifest, where healthy

Skolts, ready, willing and able to work have become unemployable as a consequence of the technological innovation process and are, therefore, without money and without status in the new economic system. A herdsman on skis is now considered as being out of date. The young herdsmen want to own a snowmobile; they want to belong to modern times. And with this, the vicious circle comes to a close.

Prior to 1961 the Skolts' traditional selfsufficient technology was happily married to society and had been for a long time. A satisfactory degree of harmony existed between man, animal and environment. The introduction of the snowmobile led to an entirely different kind of relation between the two partners, technology and society. The final consequence was an indissoluble dependence on technology, external energy, and, of course, a monetary form of economy.

The tragic aspect of all this is that it cannot have been the intention of the inventor of the snowmobile, Mr.Bombardier to create such absolute havoc with the Skolt society. Back in the thirties his daughter who had fallen ill, died while being taken to hospital in a horse-drawn sled: this was the reason why Bombardier had wanted to develop a snowmobile that could be used under even the most severe of winter conditions. His sleds were the first to be imported into Lapland from Canada. Here again the burning question arises whether or not the engineer-designer is responsible for calamities such as befell the Skolt Lap people.

In Pelto's publications we find a summary of the drastically altered role-patterns caused by the mechanization of the Skolt community. He states that most of the skills that had been of importance in the past had been developed through generations of experience. The older herdsmen were, for that reason, far more capable on a great many points than were the young people. These skills were primarily in the fields of traditional tradecraft. Western technology has made the craft of herdsman practically superfluous. The continued existence of vestiges of this cultural heritage today is due chiefly to folkloristic- and touristic reasons. The craft of herdsmanship, which had maintained the Skolt-Laps as an independent community is lost. In its place a small outlet for consumergoods has been established north of the pole-circle and the force of western technology has proved its domination. The Skolts, with a sense of impotence have to stand by and see their sons and daughters move far away to the cities.

Of the 50 Skolt-Lap families, established in the area, where the antropolo-

gical study was conducted, in 1949, their children's pattern of settlement is as follows:

	moved away permanently	remained in the community	total
sons	28	58	86
daughters	45	33	78
total	73	91	164
%	45	55	100

Fig. 2: Settlement pattern of Skolt-Lap progeny

The potent power of Western society that is capable of turning an entire culture into folklore, rendering skills, crafts and craftsmanship entirely superfluous and, in this manner changing a selfsufficient community into an utterly dependent group of people stands in sharp contrast to the Lap people's own powerlessness to halt this process of catastrophic change. The reasonable conclusion drawn by those that conducted the study is that the introduction of technological qualities capable of converting production processes based on local resources (in this case, the herding of reindeer) to processes that are dependent on resources from outside the local community, is certain to have dramatic consequences for the social- and cultural patterns of the people so afflicted. The replacement of the reindeer-sled by the snowmobile should, therefore, not be regarded simply as being a technical innovation, but rather as something responsible for a complete and irreversible conversion for an entire community of people. The introduction of the snowmobile altered the existing relationship between the herdsmen and reindeer completely. As a consequence this necessitated an alteration in the traditional living habits of the herdsmen as established over the ages, but also the reindeer reacted drastically in their behavioural patterns to the presence of the machine. Even though the main causes of social changes may, in this particular instance, be attributed to the introduction of the snowmobile, it is, according to Pellto, reasonable to conclude that, generally, technical innovation, especially where

it creates demand for raw materials and products from sources external to the community, will lead to conditions of inequality and tension in previously selfsufficient communities. As in the case of the Skolt-Laps: spare parts and fuel for the snowmobile. It is this very demand for raw materials and fuel that characterizes western society.

5. The western world; the industrial state and its addiction

The preceding account reveals that technology can have no independent existence. The phenomenon of technology is deeply rooted in a particular society. Making a science of technique has led to its dehumanization in such a way that, for example, craftsmanship, as a personal expression of technique, has become degraded to peripheral value.

The altered labour-relations such as accompanied the industrial revolution have led to an advanced state of labour division. Within the relational structure between capital and labour, labour has gradually become a means to the making of profit instead of a means to the fulfilment of life. The tragic example demonstrated by the snowmobile revolution, shows clearly that, even were no one intentionally wishes to do so, the introduction of western techniques may well cause catastrophic alterations in the existing structure of a specific community.

In the following paragraphs we will investigate the addictive effect the industrial state is capable of producing.

According to Galbraith (1967) the industrial state may be defined as that state in which the industrial phenomenon occupies a central position in the processes of thought and activity, to such a degree where industry by the extent of its magnitude, its ramifications and influence becomes identified with the state-government apparatus.

For its existence, the industrial state is totally delivered up to mass-utilization of energy and raw materials. Such mass-utilization of natural resources has extensive consequences for the freedom and independence of the people that belong to the industrial state. In order to regulate an uninterupted supply of energy and raw materials, radical political- and economical dependency relations are required on a national level. Problems pertaining to selfsufficiency versus dependency, due to the addiction to energy and raw materials, are shifted to the social top. The term "addiction" defines this situation correctly, since the population has, in fact, very little influence

over its personal life and work. In other words, the industrial state makes special demands on its inhabitants. According to Galbraith, such demands become manifest in the distribution of welfare and well-being, the influencing of behaviour, the relations of power and armament.

- concerning welfare and well-being

  Only those people that voice a simple judgement where it concerns the industrial system are almost certain to be incorrect in their judgement. The system produces goods and provides services in enormous- and ever increasing quantities. There are a great many poor people living in the industrialized countries, especially in the USA... but these poor are effectively shut out of the industrial system; they have not been given jobs, oftentimes lacking the specific qualities required. The industrial system does not tolerate poverty or heavy physical labour, but only for those that are embraced by the system.

This facet of Galbraith'observations pertain to the system itself. But when we take a closer look outside of the system, it becomes evident that those countries that don't belong to it encompass the greater part of the worldpopulation by far, while those same countries utilize only a very small proportion of the total energy- and raw materials available in the world. It is, in fact, not even feasible for those countries to belong to the current industrial system, since this would not leave sufficient energy and raw materials to meet the demands of the industrial state. Obviously and essentially, the industrial system could not exist without the absolute neccesity for the existence of a destitute and distressed third world. For this reason the industrial state must be organized in such a manner that it can continue to exist without the possibility of interference.

- concerning the influencing of behaviour

  Advanced technology and efficient utilization of capital resources cannot permit becoming subject to the fluxuating ups- and downs of the market demand. This requires careful planning. The essential content of such planning is that the behaviour of the population is made predictable, that is: becomes subjugated to regulation. These regulations should not be readily discernable as being of an oppressing nature, they should not rule the body but rather the mind: no one bluntly commands us to buy an auto-

mobile .... we faithfully believe that we simply must have one.
Those people that come into contact with the industrial system are, according to Galbraith, continually exposed to mental influencing; a kind of full-time brainwashing. The object is to make the subjects firmly believe that they have to obtain the system's products. This, for example, may well make a mother believe firmly, that mothermilk is an inferior product as compared with synthetic, factory-produced babyfood.
Again according to Galbraith, the industrial system can exist only where the users of the products and the participants in the production process are continually imbibed with the idea that industrial welfare is the same as the wellbeing of people. One may well ask just how sick a world-society really is when the rich countries that form only one-fifth of the world population have no qualms in using two thirds of the available energy and raw materials and how sick a society that invests twenty times more money into the development and production of the most fantastic deadly weapons than it does in development aid to more than half of the worldpopulation that hardly has enough food to survive. Hasn't the disease reached the fatal stage in a society that condones the undermining and exploitation of the very means that makes survival possible, by promoting, with almost psychopathic persistance, a way of least resistance that will result in irrepairable- and irreversible damage to their culture and the natural environment alike.
Indeed, the point of no return would seem to become exceeded in a society where the public image of the leader in power is considered of greater importance than is the power of his character.
The Dutch philosopher Huizinga has described a number of aspects of this phenomenon, the syndrome of an illness that he has diagnosed as puerilism, defined as being a form of arrested early adolescence, resulting in severe immaturity in adults:

- Activities, wherein an adult participates as member in certain collective groups that lay claim to organizational qualities, yet that express these claims according to the norms of children in the pre-adolescent stage.

He lists a number of basic characteristics of this adolescent-culture:

- the easily satisfied, but never quenched thirst for trite- and trivial forms of amusement and diversion

- the thirst for coarse forms of sensation
- the need for ostentatious mass-exhibitionism
- the lively club spirit, together with its distinguishing marks,

Plus the phenomena arising from deeper levels:

- the lacking of a sense of humour
- becoming very emotional for slight causes
- immense exaggeration of praise and blame
- the easy accessibility for every type of illusion that flatters the love of self or the notion of professional status.

The chief causes underlying the coming into being of the adolescent culture are, according to Huizinga:

- the relaxation of moral standards
- the great degree of ease and comfort technology and organization have imparted to society.

These characteristics may be readily recognized in, for example, the manner in which the daily newspapers report the news, the fanatic behaviour of fans at football matches, the coming into being of collective groups, both old and new, such as the Evangelical Broadcast Societies, fascistic party fractions etc. Also in the manner that those for - and against - nuclear energy accuse one another of heretics and in the self-satisfied- and emphatically concerned manner in which politicians and industrial bosses express themselves, vastly exaggerating their serious state of mind, we can observe the deeper causes for the disappearance of the element of playfulness in our culture. Forms becoming fossilized, where their content no longer is allowed to change - and move in a playful manner.

According to Huizinga a real culture cannot exist without the element of playfulness:

> "Because in culture we assume certain self-limitations and self-control, a certain preparedness to not deem the inherent tendencies of the culture as the best and highest, but rather within voluntarily accepted limitation. Real civilization always demands "fair play" in every respect and fair play is, in fact, nothing but the equality of good faith."

But how can we seriously speak of the equality of good faith when industrial society maintains itself through the poverty of the greater majority of the world population? It seems that development-aid is gradually turned into a means for justification to maintain these conditions. The notorious maxim: "Wir haben es nicht gewusst" is not applicable in this instance. Bad faith appears to apply to the armament race and to the manner in which the western world sees fit to manage the interests of the victims of their own addiction to energy and raw materials; this holds true for both the super powers.
The industrial "culture" is a culture of adolescents. To change the industrial culture to a healthy society, the necessary ingredients would probably be: emancipation, becoming free of the addictive- and stupefying influences, a sense of solidarity and good faith as the main ingredient.

The addiction to "hard" technology; technology is the answer, but what was the question again?

This is a pronouncement made by the noted energy-expert Amory Lovins; the question is not posed, only the answer is given. Technology has become the end in itself. According to the popular idea, the energy problem may be formulated as follows: "How can the energy supply be enlarged to meet the predicted demands. This seems like a logical question when one considers statistical numbers alone, because of the nearly direct connection between the level of the gross national product and the consumption of energy per capita. The energy consumption and the gross national product in the Netherlands, for example, is twice that in Italy, while in Italy it is twice that in Argentine, where again it is twice of that in Columbia. In the United States, where the gross national product is 20% more per capita, the consumption of energy per capita is even 70% greater than it is in the Netherlands.

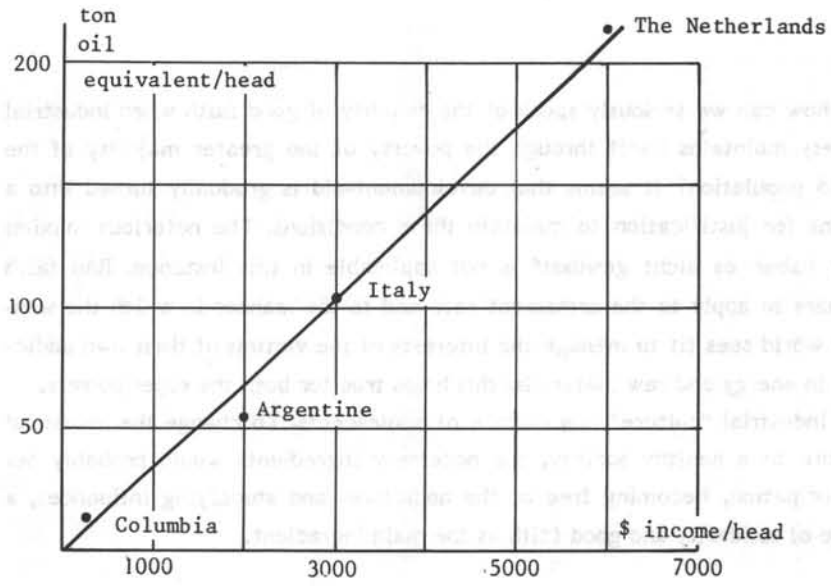


Fig. 3: Relation between energy consumption - and income per capita

Therefore, the energy problem seems simple: "Make sure to consume sufficient energy and everything will be alright with the national product, meaning income."

This notion may also be reversed: "Provided that your income is great enough, you can afford to consume a lot of energy". But, on the other hand, this is not a matter of money alone. At most, money represents one way of expressing the "value" of something, in units of measure. Today we have the possibility to realize a humane existence for everyone, but we fail to do so. And this is precisely where the technology of the industrial society has failed, where it concerns the great majority of the world population in any case.

Schumacher, in his book "Good Work" (1979), published after his death, has this to say:

1. Technology has disturbed certain organic relationships in such a manner that it causes the world population to progressively and irresistably grow to a level below that required for survival.
2. It undermines other organic relationships to a point where the possibilities to maintain a minimum survival level become non-existent, by the spreading of toxins and pollutants, unhealthy food etc.
3 The non-durable mineral resources, especially fuel and metals are depleted at a very rapid rate.

4. It reduces the qualities of morality and intelligence of humanity and, simultaneously, causes the development of an extraordinarily complex life-style that demands an increase of those very qualities of morality and intelligence.
5. It cultivates violence. Violence against nature itself and capable of being turned against our fellow human beings at any moment with weapons of a design and capability that makes non-violence an absolute prerequisite to survival.

To this definition of the problem, as stated by Schumacher, the interim answers would seem to be that none of these problems are capable of being resolved just as long as economy is the criterion whereby the intrinsic value of present-day science and technology is sought to be judged and measured. This point becomes clear when we compare the characteristics of the new industrial state with Schumachter's criteria:

Galbraith	Schumacher
Poverty must be the fate of those not (yet) included within the fold of industrial society.	Poverty is caused by the disturbance created by the industrial system in the structure of ecology.
Those that are part of industrial society, believe that they are in need of its products.	Those that are part of industrial society are, at present, victimized by the depletion of fuel- and metal resources and foodproducts harmful to health.
The power of the technostructure is based on the wholehearted dedication of all its participants, inclusive of its leaders.	The technostructure lowers the quality of morality and intelligence on the part of its participants.
The industrial state requires the armament-industry to maintain its systematic planning.	The industrial state breeds and stimulates violence that, in the end, will lead to annihilation of humanity

Fig. 4: The industrial state according to Galbraith and Schumacher.

Galbraith regards the industrial state as a system with norms and values that are worth striving after, from a viewpoint that looks within the system; in this manner he discloses its various weak elements, but considers these capable of elimination simply by becoming aware as to its disadvantages coupled with intelligent preparation for tasks within the system. Schumacher, on the other hand, observes and lays bare the consequences of the industrial system, within as well as outside of the system and, therefore, he perceives poverty, the effects on the dignity of men, the threat to the very existence of mankind and takes the position that it is neccesary to establish a form of economy that expresses itself in a manner "as if people matter" (Schumacher, 1973). But it is not enough to propose an economic system that at long last recognizes human interest, but rather an economy that is made subservient to only such ends as are pertinent to the fundamental needs of men and the preservation of the community of culture and the natural environment. "Hard" technology is most likely nothing more than an expression of the hard values and the economic point of departure concerning life and work: "Whatever is capable of generating money is beneficial". Where this kind of thinking leads to is readily perceived in the problem of energy. As stated before, there is a direct connection between national income and energy consumption. Any decrease in the consumption of energy in the industrial state of today, involves a simultaneous decrease in national income. And so, the industrial society is delivered up entirely to the consumption of energy.

It would be difficult to conceive of anything taking place in the modern household that does not require fossil fuel (oil, gas or coal). Our food is mechanically produced by machines operated by fossil fuels, with the possible exception where "free" raw materials are used as fuel, i.e. solar-, wind- and hydraulic energy.
Biocides and other extermination chemicals are produced nearly entirely out of fossil oil. Our food is transported by machines that are produced with oil and fueled with oil products to the cities where most of the readers of this book are living, while the book itself is produced by other machines, again fueled by oil or electricity out of oil or gas. Practically all of our food products are packed in plastics produced out of oil. Automobile, heating, television, telephone, refrigerator, washing machine, synthetic fibres, the baking of bricks to build our houses, the cooking of our food, everything, nearly without exception, is accomplished in strict dependence on oil or gas.

Electricity is one form of energy particularly suitable as an example to show the consequences of our addiction to hard technology. Electricity is typical for the industrialized countries. It is a luxury form of energy. It has to be produced without interruption, that is to say, the generators that finally produce electricity out of fuel must be continually kept operative in order to maintain the voltage tension on the power supply system.
Even where the utilization of electric power becomes temporarily reduced, the generators must keep operative and use up the oil or gas reserves in the storage tanks; conversely, as more electricity is demanded, additional machines have to be put into operation.

Everywhere in the home electricity is available in any quantity required. The few oil-lamps of the past are replaced with scores of light-bulbs, the washing done- and wrung out by hand replaced by the automatic washing machine and even the drying of the hair with a towel is now done with an electric hair dryer. In a typical western household we find scores of electrical appliances, many of which might well be termed as superfluous luxuries and not a few of these lacking in any effienciency or benefit to the user.
Here again we are faced with society's choices between alternatives. When the choice is made for electricity as the most important source of energy, this holds in that other, perhaps more intelligent choices, are not feasible any longer. Energy of a non-durable nature can be used up only once. Raw materials and energy pegged down in large regional electric power-plants are no longer available for divergence to small local power-plants. In addition to this, it is an established fact that large electric power-plants waste considerable quantities of energy; the large-scale production methods make it so. In a gas-fired large-scale plant approx. two-thirds of the energy is lost as waste-heat; in a coal-fired plant almost 80% of the energy is lost in waste and in waste-heat and it seems quite likely that nuclear power-plants, (with light-water reactors) show negative energy gains; that is to say, that the total balance of energy of the entire system, from the mining of raw materials, via the nuclear reactor to the storage of waste products costs more in terms of energy than is finally produced. (Storm van Leeuwen, 1980).

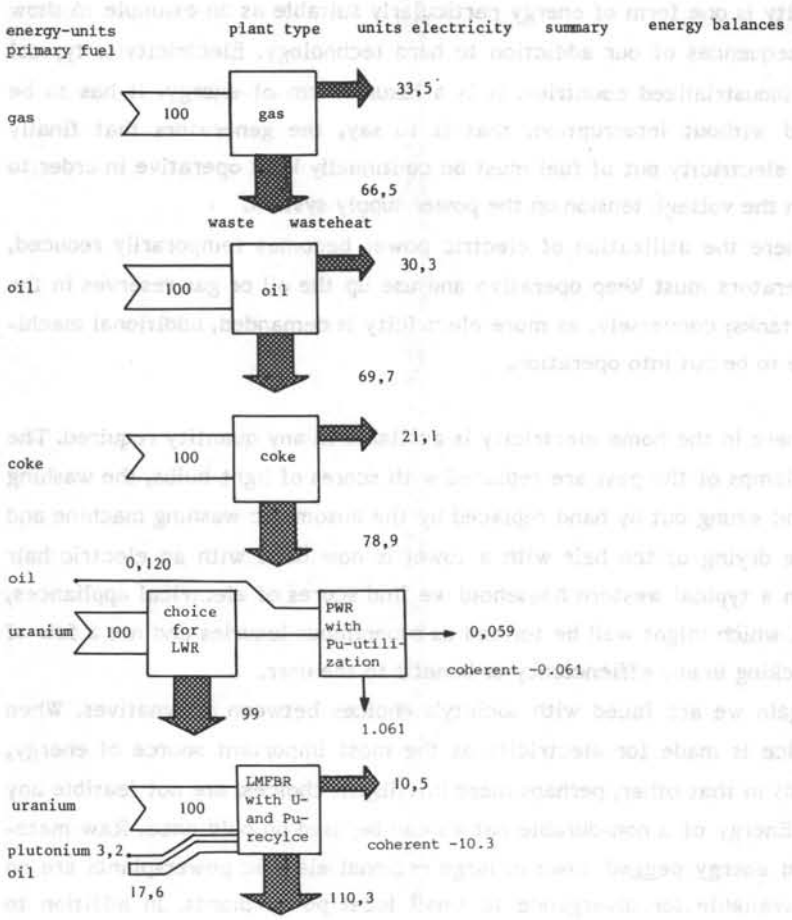


Fig. 5: Net yields in the production of electric power.

Summary of balances of energy for five channels of generation of electricity petroleum, natural gas, coal, pressurized water reactor (PWR) using plutonium (ore 0,01% uranium oxide) and liquid metal fast breeding reactor (LMFBR) on uranium- and plutonium recycle. The preference in connection with the pressurized water reactor is due to the fact that in the light-water reactor (LWR) 1% of the natural uranium is fissionable.

Only a few people question the necessity of proceeding with the increase of the number of electrical power-plants and those that, after a great deal of careful consideration do so, are quickly put down by the pro-industrial state

energy experts. These latter experts, however, in a Dutch government report, management of energy, dealing with the aspect of safety where it concerns the reactor alone, utilize this report to convince the policy-makers and themselves that everything is well with the safety of the use of nuclear energy for the production of electricity. The Harrisburg panic has clearly shown that reactor safety leaves much to be desired.

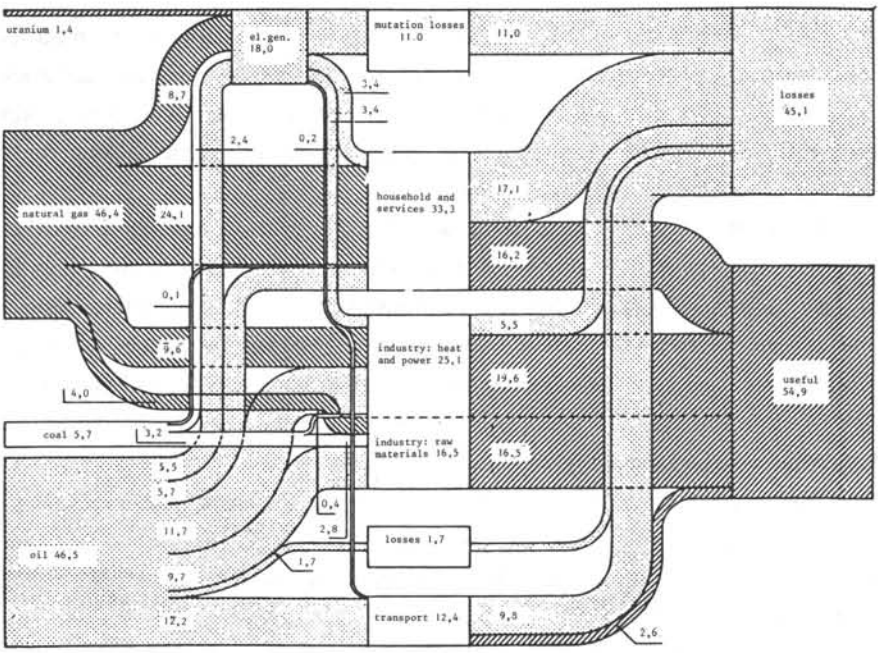


Fig. 6: Energy consumption in the Netherlands (AER)

A serious degree of blindness and deafness appears to exist where it concerns the addiction of the industrial state to the colossal waste of energy and raw materials and the failure to appreciate the economical- and ecological impossibility to continue such a state of affairs indefinitely.
What is required is a forecast scenario for the kicking-off of the addicted industrial state. A scenario, wherein not only the safety of a factory or reactor is taken into consideration, but rather the safety of an entire system and wherein the meeting of basic living requirements of the common man and woman, the continued existence of the natural environment and the preservation of humane content of cultural values, takes the highest priority and becomes the standard by which the quality of technology and organization may be measured.

It has been clearly shown that the introduction- and evolution of the motorized sled with the Skolt Lap people has resulted in a nearly complete destruction of their culture, in a time span of only 10 years; western technology, akin to some potent toxin, is quick-acting indeed, when ingested, causing rapid deterioration of the communal tissues.
Perhaps it is also possible to bring about such rapid changes in a positive sense, which again is a matter of alternatives of choice. It is tempting to choose for the superficial comforts of products afforded by hard technology- this is evident from the rate of absorption of western technology by other cultures and this same temptation holds true within the industrial countries. Even in times of economic recession we refuse to take a closer look at precisely what may be inherently wrong with the system itself.
The "necessary" economic measures are imposed in particular on the less fortunate in society; the retired, the young, the unemployed,the handicapped and the poor in the third world. It would appear as though the existing world system is based on "the right of the strongest".
While the consumption of electricity is about the same for industry as it is for households, the former, due to its position of economy and power pays far less. The model chosen for the production (organization) of today's technology seems, correspondingly, based on that very same principle of right of - and for - the strongest. Western technology is "stronger" than the natural environment and the indigenous cultures that are dying slowly - each in accordance with their own inherent degree of strength - but certainly.
Technology was the answer, but what was the question again? The question is,

if - taking into consideration the problems called into being by western technology - it would not be sensible and feasible to apply the knowledge currently available to humanity in a totally different fashion and with better results. The industrial state has as starting point processes and products as ends in themselves, while the truly intelligent end can only be measured in terms of quality of the human condition, whereby processes and products may possibly serve as one of the means to this end.

6. The third world - poverty as a symptom of a disease

It is, for most inhabitants of the industrialized countries, practically impossible to imagine what the essence of real poverty is, even when exposed to direct contact with it, whether in the Sahel or in a village on Sri Lanka; because we are in a position to return to our own country. It is true that the face and the smell of real poverty are familiar to us all and capable of inducing strong emotions, as demonstrated, from time to time during the television-broadcast money- and aid collection drives for Biafra, Sahel and, very recently, for Ethiopia. To be subjected to real poverty is probably the single most humiliating violation of the values of human dignity.

Technology permits mankind to visit the moon, land a rocket on Mars, while, at the very same time, hundreds of millions of people on our own planet are forced to exist under conditions of abject poverty. One out of three people on this earth are not in a position to live under conditions fit for a human being, or for an animal for that matter.

They are undernourished or starving, unemployed, inadequately housed or sheltered and unhealthy by any standard.

They have been forgotten by a development of which they should have been the focal point, the very goal to which any reasonable development owns its existential rights. The sad fact is, however,that the process of development has not only passed them by but has crushed them in the process.

Worldorganizations, such as the Worldbank and the International Labour Organization (ILO) have come to the same conclusion: Two-third of the third world population is extremely poor: two-fifth of these exist below the subsistence minimum.

Fully 40% of the work force in the development countries is unemployed. This is incredible indeed.

It further appears, that irrespective of which part of the world or country, it is the women that suffer most severily from the bitter poverty, not only from biological causes, but, oftentimes, from straightforward discrimination. In India, for example, 3 to 4 times as many girls are suffering from kwashiokor, an illness caused by malnutrition, than do boys and this in spite of the fact that boys receive hospital treatment with greater frequency.

The mother herself is compelled to co-operate with this discrimination. In Bangladesh the rate of mortality for girls below the age of five, is 30 to50% higher than it is for boys: this is practically a "necessity" since the mother is for her status- and future dependent upon her sons, requiring for that reason the better nourishment.

It is well known, that during the period that a woman breastfeeds or is pregnant, she requires supplemental nourishment. Studies conducted in Africa, India, Thailand and Guatemala have clearly shown that an insufficient weight-increase in women during pregnancy is closely linked to poverty and under-nourishment. This step from poverty to the special circumstances peculiar to women has, on my part, not been inspired by motives of fashionable feminism. Quite to the contrary: In the third world the social- political- and economic-technical significance of women is even greater than it is in the industrialized countries. The traditional woman, in those countries, plays a classical double role: taking care of the family and producing children. On top of this, she oftentimes cultivates the land. In this manner, the women serve to maintain the family, as the cornerstone of society and as source of income for that same family.

In spite of all this, she has no extra rights: quite to the contrary, even in highly industrialized countries such as the United States, women of over 65 years of age, living alone, form a group were loneliness and old age keep even tred with hunger. (Kathleen Newland, 1979).

Though it appears that women experience the phenomenon of poverty more keenly, poverty has a symbolism of its own. Poverty is oftentimes viewed as being a consequence of lazyness and of a lack of initiative, instead of being a by-product of the western system of thought and activity. Yet it are those very thoughts and activities, the ways and means of the western world, that support and maintain the ruthless exploitation of the third world, to a point where today crudely estimated, the northern hemisphere is rich, while the southern hemisphere lives in abject poverty.

The northern hemisphere supports a culture that treats the entire world as

belonging to its own territory and that behaves as though the available supply of natural resources is without limit; a culture of waste and excessive abundance.

Right from the very beginning, as part of the colonizing process of the third world, only one overriding message was imbibed: "The culture of abundance is the only right one". From the historic viewpoint alone, this message makes little sense. The industrial culture has only just recently come into being, while the culture of scarcity is far older. In these "scarcity" cultures, such as were the Skolt-lap people, prior to the introduction of the snowmobile, a distinction is made between short-term goods or products such as are utilized for food and clothing and long-term permanent goods or resources that are seen as capital necessary for survival, such as trees and most of the animals, that may only be utilized when absolutely necessary and then only where repair, recovery or repletion is possible. In these types of culture, such long-term permanent resources were not considered as being part of the economy, since their value is inestimable (Schumacher, 1979). Poverty in the third world, in terms of being a symptom of an illness, produced and supported in some considerable degree by the industrial civilization, may perhaps also be viewed as being a mirror-image reflecting the spiritual poverty of the west.

> "We are locked up in a crisis of this contemporary society, that has rejected its two great teachers: the first, the magnificent system of living nature; the civilization of the cities is completely out of touch with that teacher. And the second teacher that has been rejected was the traditional knowledge that is the inheritance of humanity, complete with its traditional values, replaced by an extraordinary structure, titled objective science". (Schumacher, 1979).

The most dangerous aspect of the spritual poverty of the west lies probably in its denial- and rejection of ecology in the widest sense of that word, i.e. the community of cultures with the natural environment. The denial- and rejection of such real values of culture implies, at the same time, the negation of the past and by assuming such a presumptious viewpoint we also assign ourselves the moral right to exploit the natural environment as well as the non-western cultures.

Jean-Paul Sartre had this to say:

> "You know very well that we are exploiters. You know very well that we have taken the gold and the metals and, thereafter, the oil from the "new continents" and that we have carried it along to the motherland. And not

without magnificent results: palaces, cathedrals, tremendous industrial cities; and then, when we were threatened by crisis we were capable of softening, deflecting it, thanks to the colonial markets. Europe, gorged on riches, granted all its inhabitants the "jure", the right, to the status of human: a human with us amounts to the equivalent of an accomplice, because all of us have profited from the colonial exploitation". (Fanon '78).

The victims of colonial exploitation are the poor, whose position is characterized by an ever increasing rate of slipping away in the direction of marginality existing at the very edge of society, useful only in terms of voting cattle and to fill in as numbers for the benefit of population statistics. It is just these poor that, in the preparation of a profit- and loss account of technique and tradecraft, experience the disappearance of the craft as a serious loss, since the craft contained within its structure not only their traditional values but also the means for a high degree of selfsufficiency within their own culture. The western technique leaves no, or very little room for such means and values, not only because it is far too complex or too expensive, but also because it has a different cultural content, being a product of western culture. Western technology increases the degree of dependence, because it is geared to do just that. The history of technology, that is to say, the written version, is, mostly, ethnocentric in content, because its authors, western scientists, take as starting point that western science- and technology are basically good. For this reason, it is likely that the recording of the history of technology leaves out certain pertinent facts, leaving the impression that the only developments of value, inclusive of technology, are rooted in the west. Even where, on occasion, it is admitted that other ways or means of production may have existed elsewhere or in the past, these are treated as being interesting but of minor importance otherwise (Alvarez, 1980).

The study of the snowmobile revolution provides an argument for the proposition, that industrial technology creates a society based on classes, where many poor must necessarily exist to make possible- and maintain the existence of the few that are rich, whether in the Bronx in New York City or in the third world.

Poor people, poor areas, poor countries, poor continents - all have to contribute equally to the maintenance and reinforcement of the industrial state. It is, however, difficult to prove this proposition; at best we can draw our

reasonable conclusion from the phenomena that are manifest everywhere. For example, Japan could well serve as evidence that the aforementioned industrial development model has been appraised correctly. Recently and even now, Japan went through a period of tremendous economic growth, yet it has very little raw materials available from the countries' own resources. An industrial state, based on the western model, can only exist if vast quantities of raw materials and products are transported back and forth over great distances. In order to maintain this flow continuously, spiritual-, economical- and political dependencies are virtually prerequisite and it follows naturally, that the powerful industrial states keep the countries that supply the raw materials well under control. Again, it is not necessary to differentiate between the free entrepeneur-capitalism of the west or the state-capitalism of the east-block countries. Our primary interest is not with the interaction, the dialectics, between production-relations and production-forces as is the case with Marx, who made a systematic analysis of such conditions; we are not talking about the organization of labour and the technical changes connected with it, but about the standards and values that are the determinant factors in the origination and maintenance of dependency-relations in the industrial state (Pieterson, 1981).

According to Harrison (1979), nature itself also promotes inequality and povery. The traditional systems based on alms, supportive aid or reciprocal assistance in the past, served to satisfy, to some degree, the inequalitites within a culture as were the result, in part at least, of influences from the natural environment. Harrison mentions four causes for impoverishment:

- geographical: where the main cause is from natural processes
- sociological: where poverty develops as a consequence of the basic rule of society
- economical : as a result of market-relations
- political : rooted in abuse of power by the state

Naturally, these causes manifest in different ways, in some situations appearing together. Obviously, the removal of one cause (for example, drought as caused by poor irrigation) does not necessarily result in the simultaneous removal of another contributing cause for the same problem (for example, oppression of the population by a military government).

- Geographical impoverishment may be caused by climatological changes, as is the case in the Sahel, where the rainbelt appears to have moved further south, or by natural disasters. It might perhaps be feasible, with the aid of today's technology, to alleviate the causes or effects of such natural disasters to some degree, however, there will always be areas in the world that are so unproductive as to make a reasonable level of existence nearly impossible. As a rule, geographical impoverishment results from the interaction of a population and technology with a sensitive natural environment. The many cases, where arable soil is destroyed as a result of deforrestation, are well documented. The solution to this type of impoverishment would be through population decrease, resulting in a reduction of pressure on the sensitive natural system or a renewal of techniques in a manner that permits the population to survive without a further destruction of the environment.
- Sociological impoverishment results from the interaction of environmental-elements (nature, technology and population) with the basic rules of the social system. In all instances where land is held in personal ownership and cultivated on an individual basis, inequality is the result, regardless of what the pressure of the population-volume may be. Crop failure may force the small farmer to sell his land; this causes an oversupply of hands on the labour market, with a consequent drop in wages. This is a simple process that, oftentimes, occurs in India for example. Again, the solution here would be to check the growth of the population and to improve technique in such a manner as would permit a family to live of a smaller piece of ground. Only where poverty is caused by the basic rules of the society, the system of landownership requires alteration, so that those people without any land are capable of getting some. It is clear that real progress is not to be found in individual ownership, but rather in systems of self-sufficiency such as co-operatives with adequate credit facilities in combined ownership of all participants (Stanislav, 1980).
- Economic impoverishment has much to do with the fact that a real free market probably does not exist. One party is always more clever than the other and the clever one naturally exploits this advantage, i.e. the party with greater powers of negotiation and seduction necessarily wins: the stronger, the wealthier, the best informed, the best organized.
  The law of supply-and-demand is, in the final analysis, no more than the law of the right of the strongest. Once again, the solution of the problem

would be to reduce the supply of labour, thus, a reduction in the population growth rate, and the creation of the type of agriculture and industry that is highly labour intensive, which means technological renewal. However, similar as in the case of sociological impoverishment, the condition of co-operative ownership has to be met. What remains is the problem of unfair competition. The access to capital, cheap credit, public services and markets is not a simple matter for the poor. They are in greater need of cheaper credit and more governmental aid than the rich. They require protected markets, reserved strictly for the small enterprise.

- Political impoverishment involves the utilization of state-force by certain groups in order to create- and maintain - inequality and to keep the poor at the minimum existential level. This is for example, the case in South America and South Africa where this form of oppression has assumed abominable proportions in many states. Swindle is a form of political oppression that can, to some degree, be combatted by the poor through participation in unions and similar political activities. Another form of political impoverishment is the utilization of funds belonging to the entire community for the benefit of the rich city-elite, in the guise of modernization or production-improvement. A third form is the coming into existence of a selfprotective elite of bureaucrats, as in the case of the eastblock countries or the leading industrialists in the west.

Whatever may be the causes for impoverishment, (geographical, sociological or political), the reduction of population-growth, adaptation of technology to the natural environment, production organizations with the right of self-determination, inclusive of adequate credit facilities and protection of the poor by the government, all appear to be prerequisite to real improvement.
Reduction in population-growth can come into existence where people know how to regulate the size of the family; where this is the case, the conditions should be such, that having many children is not necessary to insure survival of the parents during old age. The co-operative ownership of production organizations is, in principle, a possibility in many countries. In actual practice, however, this is quite impossible for the poor. Protection of the poor by the government should be the main function of the government. Unfortunately, there is a vast difference between the letter of the law and the interpretation of these laws; as a rule, the protection of personal property appears to be the government's main preoccupation, instead of protecting the possibilities for

the poor to establish some degree of selfsufficiency. In our world of today poverty is a condition that continually renews itself. The poor, their children, poor countries are, independently, not capable of breaking through the condition of inequality, because inequality seems to be a process that is self-maintained. The real break-through can only come into being if there is a striving for a development that permits those that are lacking in choices and opportunities in every society to independently fulfill their fundamental needs.

7. Development-models: development is the answer, but what is the question again

Many a model has been conceived for the development of men and society. Development-models are regulated, coherent ideas, concerning how a society should look and the manner in which this may be accomplished. Examples of development-models are capitalism, socialism, communism, feodalism. The latter model reveals its manner of execution most clearly, because the fact that only a few people decide what the others must do, cannot easily be hidden or disguised. Usually, these development-models find their justification in the improvement of the fate of the population, but, in actual practice, it amounts to a reconsolidation of the powers of the leaders. This holds true for state-capitalism in the eastblock countries, for the bankers and industrial leaders in free enterprise capitalism in the westblock and for the feodal systems as, oftentimes, exist in the satelite countries of the third world. The public is only given such information as is needed to reaffirm the ruling system. Pravda, in principle, has the reaffirming function in Russia, as does The Telegraph, the leading newspaper, in the Netherlands.

Within the blocks of power in the northern hemisphere, technology appears to have much the same function. There is community of interest between technology and society. Craft and craftsmanship, the expression of a trade on an individual level does not fit into the system very well up to now.

In the third world, the northern power-blocks are waging open battle for domination of their particular development-model; models that may be verbalized or formulated differently but cannot be distinguished from one another in their effects on the population. An excellent summary concerning this battle for supremacy of a development-model is given by Bertholet (1975).

The Netherlands, for example, belongs to the industrialized countries that derive their development-model from capitalism or, as Bertholet calls it: the

modernization model. In this model, the individual occupies the central position. Individual performance is to be rewarded materially. Free enterprise production is the dominant factor within the economic system, while the government plays a supporting part. In principle, anybody is capable of becoming rich.

> "The prerequisite conditions for the proper functioning of this model are an unlimited impulse towards more, better, further and richer, all this coupled to the type of innovative mind that is needed to visualize all that, plus, most importantly, the accumulation of capital formation that is needed to practically realize the model" (Bertholet, 1975).

The socialistic model affords "the people" the central position. Here, personal performance is only of interest inasfar as it is of service to the people. Enterprise is state-enterprise. The government assumes the leading position and no one is permitted to become rich (!) In actual practice, however, the socialistic party leaders enjoy the very same priviliges as do their free enterprise counterparts in the industrial state. But how about the worker and his family? The question arises if there is really an essential difference between the position of a worker in the east-block or in the west. True, the worker in the east-block has fewer things; an automobile in those parts is still considered a luxury. But when we look at those things and factors that determine the content of human life: personal freedom, independence in the working sphere, the opportunities for self-determination within the production-organization the possibilities for personal growth and unfolding. It would seem as though neither development-model shows any real perspective for the common people, but only for the elite. In both cases, the development-model appears to support only the maintenance of the system instead of the people. Again and again, all over the world, attempts are being made to initiate development-models that situate the common people, forming the basis- and backbone of society, centrally. Most of these attempts are bound to fail. We remember the Prague spring-uprising as a typical example of an attempt to democratize communism which was quickly put down, with considerable loss of blood, by Russia. On the other hand, the Yugoslavian experiment, at this moment probably one of the most important ones, is still going on (Ravesteijn, 1983). In South- and Central America we observe how attempts, such as that of Allende in Chile, to escape the clutches of the capitalistic system are violently put down with the aid- and intervention of the United States. Neither the communistic nor the capitalistic elite have any qualms

whatever to intervene with a war or a bit of murder to safeguard their interests. In this connection is the becoming free of Nicaragua an important event, since it seems to have succeeded so far. Why is the third world so important to the power-blocks' development-strategy? They are in direct need of sources of cheap labour- and raw materials and they seek stable outlets for their arms-industry. They are in need of states dedicated to them in order to enhance their power. Both of the power-blocks have as starting point the assumption that their development-model is the only right one.

After the second world-war the United States worked with the modernization-model. The motto was: "Do as we do and everything will go well with you!" The Marshall-plan was intended to turn Western Europe into a sort of mini-USA and in this they have pretty well succeeded, even though Western-Europe (fortunately?) still lags behind the United States where it concerns modernization.

It was assumed that this model would also be applicable in the development countries. The old colonies of the West would go through a similar development as in the industrialized states. This, however, turned out differently. The cities became industrialized, but the countryside, where the majority of the people lived, remained far behind. Thereafter, as a possible remedy, a variation: the "trickle down" theory was designed. What was assumed to be needed was an increase in development-centers, primarily in the cities, in the third world and from these centers the developments would slowly trickle down to the countryside. This didn't work out according to plan either. Next came the development of explanatory theories. Johan Galtung of Norway came up with his structural theory of imperialism (Galtung, 1971) that explains how centre-countries like Russia and the United States determine just how things should be run in peripheral countries (the third world) with the aid of dependence relations. And the same process hold true within the development countries (or any country for that matter) between the rich and the poor.

Conditions in South American countries indicate clearly that development and underdevelopment are, as it were, the two sides of the same coin (Frank, 1971), because Europe could only achieve economic development through the means of gold- and silver robbery, slave trade and cheap raw materials. For this reason the development of centre-countries goes hand in hand with underdevelopment of peripheral countries. Such a state of interdependence goes for a number of aspects: monetary, technical, economical, military and

informative. All these means are used to the end of maintaining or enlarging the power of the centre.

Naturally, the development countries themselves have understood this problem well enough; gradually, a considerable quantity of relevant literature is originating in the development countries. An adequate summary of these publications has been prepared by Theunis (1982).

Developmental models, designed for the third world, irrespective of their classification, prove themselves, in practice, to amount to little more than the establishment of interests of benefit to the industrial states. Once it had become clear that the modernization-model did not function according to plan, because there was little or no trickling down of development to the countryside where it was most needed, from the industrialized centres located in or near the cities in the third world countries, the trickle-down theory was abandoned. Thereafter, the more progressive organizations for development-co-operation in the west evolved the emancipation-participation idea, that has developed up till now with forms of activity that are primarily directed at the poorest as goal-group (an ideal not entirely free of the missionary element: our "goal").

Here the forms of activity have to do primarily with making free (emancipation), participation in sociological processes on a basis of equality and spiritual- and material improvement of position. The projects pursued by these progressive organizations involve the establishment of a greater degree of self-reliant independence of the goal-groups at the basis of society. The idea is that these groups should finally be capable of functioning independently. This means that the groups have to become organized to do so and with this they are in need of help. Some of the relief-organizations have, in this connection, given a great deal of thought to the manner in which these ideas may best be realized (Novib, 1980). When the circumstances allow groups at the basis to become aware collectively of the need to free- and organize themselves, this, indeed, oftentimes happens. Experience has shown that spiritual- and partial political autonomy do occur, but that economic independence, that can only be established by a striving for selfsufficiency with technical provisions, is, in practice seldom encountered.

Independence becomes a threat to the top of the system just as soon as economic independence, using selfsufficient technical means, is established. This fact may perhaps be one reason why the economic independence of communes in China has been drastically curtailed.

In this respect also, both world-systems appear, where it concerns their effect, to resemble one another closely; i.e. the creation of economic dependence through technical means. This would also explain why practically all technical-scientific research- and development is carried out in the northern hemisphere, instead of passing it on to the third world, since knowledge means economic power.

In spite of this, the public attention of the developmental idea remains focused on poverty. The Dutch minister of development-co-operation, de Koning, during the eleventh special session of the United Nations in New York City on August 29, 1980, had this to say:

> "We are deeply convinced that prejudism, where it concerns our own greatly privileged society, should not distract our efforts from waging a worldwide battle against poverty".

That is nicely put indeed and it also fits in nicely with the position that the Netherlands occupies in the chorus of countries giving foreign aid; but let us see what the current situation is in connection with development.

- In the first place, during the past 10 years the power relations in the world have shifted. No longer does the third world accept outright the various tenets dictated by the first- and second worlds. The key-words we all recognize are: the oilcrisis, Vietnam, the New International Economic order and the Islamitic revolution; these are notions that reflect happenings and processes that indicate that the third world is no longer entirely prepared to eat out of the hand of the industrialized countries.

- Secondly, there is the criticism that the western scientist has, concerning his own science and technology, reaching even the most prejudiced proponents of the status quo. We are, all of us, convinced that never before has there been such a vast quantity of technology in our lifes and that, in spite (or perhaps, because) of this industrial society is getting more ill by the day, both spiritually and physically.
  Alienation and pollution are the basic elements of the system-structure of industrial technology. It is important to note that the relation between environmental pollution and public health has been clearly established. Familiar names that indicate events: Seveso in Italy, Harrisburg in the USA and, also, in the Netherlands, Lekkerkerk. Our industrial society is getting sicker by the day: According to Galtung (1978) there is an annual increase

of 4% to 9% in the so-called social or civilization diseases, such as: criminality and the rate of mortality in the industrialized countries.

8. Critical science and critical technology; fighting the windmills

Critical science is meant to imply that the scientist takes a critical look at the social consequences of scientific activities. Critical science has, in fact, already become a new scientific field in itself. In the Netherlands, for example, nearly every university has its various science- and -society groups; there is even a periodical titled "Science and Society" supporting these groups.
The engineer, possibly as a result of his education, is somewhat more reserved than are other scientists. For this reason, the engineer in the field of critical science and technology has only recently become converted to this still rather small group of scientists. Still, it is just this very group, having the courage to hold up a mirror of judgement, to themselves and others, reflecting the consequences of their own scientific achievements, that may well be of great importance.

Not only has there been a tremendous increase in the quantity of scientific activity, as indicated by the vast number of scientific periodicals currently published: around the year 1800 about 100, 1850 - 1000, around 1900 - 10.000, 1950 - 100.000 and by the year 2000 and estimated 1000.000 (Rip, 1976). At the same time science has, to a certain extent,broken free from her previous state of isolation and this is a significant beneficial development. Certain phenomena, typical of in-breeding, that for many centuries have accompanied science, are sociological risks.
Ziman, a theoretical physicist, asserts, in his book "Public Knowledge" that science amounts to more than the published knowledge of scientific literature. Anyone is capable of observing something, express a supposition concerning the observed and have it put into print to be read by others. Such facts and theories that, after critical study or manipulation by other pertinent specialists are accepted, may, according to Ziman (1974) be called science. He distinguishes, in a general sense, the following definitions of science:

- science is mankind's mastery over his environment
  This is a rather pedantic definition, that points to the things we are capable of making and that tells more about men's technical activities than about

science.

More significant, nothing at all is said concerning the manner in which knowledge that inspires such technical activities, is acquired. It defines only the fruits of the tree of science, telling nothing about its nature.

- Science is the study of the material world

This is an incomplete definition, since it excludes such sciences as are concerned with the non-material. A questionable definition, for reason that matters of a moral or spiritual nature are also of great importance as subject for scientific study.

- Science is the experimental method

This is an attractive definition, because it recognizes the importance of the experiment; however, this definition is equally incomplete, since it describes only the manner of activities but not its content. He denies that specifically the scientists oftentimes try to discover in nature precisely that what they expect to find.

The three aforementioned definitions have in common that they are incomplete, because they neglect the fact that behind every choice for a particular manner of working and for a particular material subject we always find the viewpoint of the scientist, concerning what is thought to be acceptable, of interest or necessary.

- Science arrives at truth by logical conclusions drawn from experimental observation

This is a definition that will be appreciated by those of a philosophic turn of mind. The importance of presuppositions is recognized; however, these should be build-in into an orderly system of facts and observations. The weakness of this definition lies in its being to black-or-white, rendering a subject either "true or untrue", but in the reality of everyday (which includes scientific everyday) there is much of a grey- and,more often, dull shade to be perceived.

- Science is public knowledge

This is one of Ziman's definitions, that is more significant in that it acknowledges that scientific knowledge should be public property, but in

reality his public amounts to those belonging to the scientific community: the experts, deciding amongst themselves whether or not they will acknowledge someone's expertise. Ziman states further "Scientific research is a social activity".

This is very nicely put; however, this form of sociality is very restricted indeed. Still, it is not difficult to agree with him where it concerns theoretical physics. Making sums add-up or doing some nice research is not the problem since this involves only patience and training and, thereafter, one can be accepted into the cast of a particular scientific dicipline. What is of more immediate importance, is the effect that a particular scientific or technical activity may have. The critical scientist or engineer recognizes the importance of the relations between science, technology and society. A critical engineer wonders not only what will happen to his design, but also for whom and to what purpose his design will be put. He also questions himself as to the system of thought that underlies his formal education and this poses the greatest central problem that faces the critical scientist and engineer: his own formal education barely leaves him the possibility for real reflection, for reason that the mirror of scientific reality, in all branches of science and technique, knows only its own face. It is obvious that the critical scientist refers to: society, environmental pollution, the dangers of nuclear- and conventional armament, increasing degenerative tendencies, civilization-diseases and poverty.

Unfortunately, these are the very facets, whether factual or not, that established science does not permit to enter into their domain; and so we observe that critical scientists and engineers, capable of being pioneers for society, are pushed to the margin, to the fringes of "real" science.

But what are the characteristics of this "real" science? In the first place, in terms of daily-language usage, "real" and "western" are interchangeble. Professor Reddy of India states that technology contains a culture's genetic code. According to his viewpoint, technology is, therefore not the sum total of techniques (proficiencies, adaptations and tools) and know-how alone, but first and foremost the insight into why we have to work in precisely "this" way and manner and no other; the "know-why".

According to Galtung's formulation: when a certain technique is developed, distributed or transmitted, a structure is being built regardless of whether the technique is for production, distribution of consumption. Galtung further

claims that technique is never politically neutral.
Technique always contains a code and the same goes for the science that has spawned it. But what is this code and in what manner can we perceive it? For this perception we only have to take a good look around us.

Western science and technology is predominantly:
- expensive, that is to say; capital-intensive
- complex, i.e. research-intensive
- wasteful, i.e. raw material- and energy intensive
- labour suppressing, i.e. organization-intensive
- labour rejecting, i.e. labour-extensive

What is, in fact, the significance of this manifestation, seemingly based on a code that is preponderantly economic in nature?
Western science and technology are being developed in such a manner that necessitates an ever growing number of specialists for the industrial state in the fields of monetary affairs, research and leadership of (bureaucratic) organizations. Western science and technology can subsist only where there is adequate money, research know-how and (organization) technology. The technology of the West, by the very reason of its economic code, can subsist only under conditions of extreme inequality; this holds true within the bounderies of a country, between the leaders and labour or between one country and another as is the case with an industrialized country versus a third world country.
This inequality, a direct effect of code and form of manifestation of industrial technology, expresses itself in the various dependencies of the capital market, banks, (such as the Worldbank) of scientific experts, of raw material supplies (from the third world countries), of organizational experts and also of the state where, for example, it concerns the arrangement for provisions in connections with surplus labour.
Inequality is, however, also a basic tenet of the economic- and social code. The social code is geared to the cultivation of dependence, starting with the raising of the children and continued with the educational system. Paolo Freire (1972) states: "The process of bringing-up and education can never be neutral; it is either an instrument for setting mankind free or for mankind's enslavement and breaking-in for oppression". Western science creates dependency. Once we have established our technology, a permanent dependency

becomes established simultaneously for more knowledge, more skills, more technology and more spare parts; a highly addictive dependency.
Galtung uses the term "verticality" as a characteristic of the social code, indicating that the creation of seperate orders or classes is the dominant function of the social organization structure. Both in its conduct and its expression, western technology promotes a state of alienation between people. By only using a fractional part of its humane qualities, that is to say: its expertise, western society and technique alienates mankind from itself and from others (Walravens, 1977). A consequence of this alienation is that it calls a self-reinforcing process into being. The expert-elite, utilizing the principle of inequality and dependence, requires but little exertion in order to influence the people within the system of the industrial state, for reason that both the structure as well as the people will primarily accept "renewal" and "change" just as long as this connects with the established relations of inequality and dependence. Seen in this light, the battle for the introduction of science and technology capable of real renewal, is a battle for power. A battle where socialism does not provide any solution either, for reasons that when the means of production pass over into the hands of the community, only the first step is made. The breaking of the power-of-expertise of science and technique is also required.
This will create the possibility for becoming free of inequality and dependence. The cultural code is perhaps the single most threatening aspect of western science and technology, because this code, as it is transmitted through western intellectuals and academics, is of a level of superiority, a sort of "emitted of God himself" insight concerning the development-model demanded for a society:
A society is considered civilized (read: modern) when the transition from rural community with underdeveloped means of agriculture, to a modern city industrial society has been completed. This transition is accomplished in a free-market-economy with the enterprises in the hands of individuals, supported and made possible by technical science.

The future does not look very bright; this also holds true for the critical scientist and engineer. In the Report to the President of the United States concerning the state of the world in the year 2000 (Barney, 1980), it is stated that:

"The solution of problems concerning people, raw materials and environ-

ment are complex and time-consuming. These problems are firmly and unbreakably bonded to the most perplexing and persistant problems of world-poverty, injustice and social strife."

As a solution to these problems, that are described in detail in this report,it is stated:

"generous and just co-operation with other nations, particularly in the field of trade, investment and support .....".

The report neglects completely the prerequisite necessity to affect changes in the institutions and prejudices that form the basis of these problems, since, in the final analysis, it is these prejudices and the manner in which they express themselves, that promote and maintain poverty, injustice and the degradation of culture and environment. Just this degeneration and loss of the living-community, in the wider sense of the word, is the real threat.

The devastating influence of industrial technology on the eco-systems is familiar to us all, as is the criticism of a social-, economical-, biological-, cultural- and other nature. The message that is disseminated within our system by the established order is: it is true that there is inequality and a dependency on us, the experts, but that is as it should be. Have faith, everything will be alright. That is an encouraging message; unfortunately, the mirror of reality shows us, via television, an entirely different picture. The official vision of the future is obviously in complete opposition to reality. The central problem for the critical scientist is, therefore, not to demonstrate that things are not going too well. Everybody who has eyes can observe this daily. What can be done, however, is the presentation of well founded visions of the future, showing the world that things should - and can - be done in a different way.

9. Forecasting of technology: an ostrich policy?

Basically, there are two ways in which an exploration of the future of technique may be carried out. We can ask the question: "How does technical science develop itself and for what purpose may it be used". This may be called technocratic thinking; in this instance the plan would be ruled by technique.

It is also possible to ask: "How should a society look and which form of technique may be used for support"; this would than be called sociocratic thinking. In this case the plan would be governed by the community. (Van der Graaf,

1984).

The Scientific Advisory Board for Government policy (WRR) in the Netherlands has both perceived and foreseen these two ways. The way of technocracy is rather easy to fulfil; it simply means "more of the same"; a continuation of what went on before, but essentially nothing new. To explore the future technologically, basically involves a process of evaluation of possibilities for new technologies or for technologies as yet to be developed (Beek, 1979). This is a limited but otherwise pleasant definition of technology forecasting, since it does not require a vision of mankind and society. Any good technician with a reasonable insight into techniques and calculating methods is capable of arriving at a variety of nice technical predictions. A number of working-methods have been developed for this purpose, all based on an intelligent, mathematical projection of lines from the past. This is a convenient method for a company to determine how the production process of automobiles or instruments should be arranged in the future, but it reveals nothing whatever concerning the necessity to manufacture just those products and none other and even less about the consequences for mankind and the environment.

Even though it would appear as though the exploration of the future using technique is of little importance in this framework, it is, nevertheless, the same with this as it is with development-models that are based on western (technical) science. The know-how concerning the manner in which the work is carried out is quite as important as are the codes, the starting points, on the basis of which the techniques are being developed and executed. Ultimately, it is evident that, apart from the problem of fluctuations with the passing of time (that can easily be smoothed out using calculating methods) the demand for the exploration of the future of techniques, is little more than a desire to know the outside limits (Beek, 1979), specifically the technical duration of life (how long will a product last) and economical duration of life (when will it become too expensive to use).

It is obvious, therefore, that the exploration of the future by companies is primarily in connection with technical-, economical- and market problems.

> "When an enterprise is considered as being an economic organism, technical data in themselves have no significance: such data require interpretation and explanation against an economic background... In nearly every instance, the outcome of technological exploration and the decisions to be based on these, have to be translated into investment decisions and the time when

such decisions must be put into operation" (Rathenau, 1979).
The investment decisions made by the entrepreneur are based upon the aims of the industrial state and vice versa; in both cases the prime interest is economics. The interests, such as mentioned in the report concerning the state of the world in the year 2000, are of a different order however (Barney, 1980). The report states that if the current developments will continue, the world, anno 2000, will be overpopulated even more, polluted, more instable and more vulnerable than is the case today. The world population against the figures of 1975, will have grown by more than 50%; 90% of this growth will take place in the poorest countries. The development countries will experience a relatively greater economic growth than the industrialized countries; however, 2% of 30.000 Dutch guilders is only 600 guilders and that is a low rate of growth for a Dutch income, while for many millions of people 600 guilders amounts to their annual income. The absolute gap between poor and rich increases steadily.
In de period between 1970 and 2000, food-production will increase by 90%, meaning a world increase of 15% per capita, but the greater part of that increase will land up in the already prosperous countries. We only need to take a look around. The Dutch are growing fatter still, but in the poor areas, such as South Asia, the Middle East and Africa the food situation will sooner get worse than better and sink, in fact, even lower than the already existing unacceptable minimum required to sustain human life. Furthermore, prices will double within that period of only 30 years.
Up to the year 2000, the area of arable land will increase with only 4%, so that the great increase in food-production will have to result from a higher productivity of the existing arable ground.

In order to affect such an increase in food-production does not only require a great deal of oil and gas, which is gradually becoming more expensive and, therefore, out of reach for development countries, in the production of fertilizer, insecticides, irrigation and propulsion of machines; but also for the production of the required machines and other means, oil is needed. Furthermore, it is most likely that a more intensive use of arable ground will heighten the vulnerability of the biological systems.
Matters do not look too well for the oil production either. The wealthy countries will probably manage to obtain sufficient quantities of oil, but the development countries will have ever greater difficulty in meeting their

demand for oil. And oil resources are becoming depleted.
The poorest 25% of humanity, dependent on wood as fuel, will have a demand for fuel, in the year 2000, that exceeds available supplies by 25%.
Coal-, oil-, natural gas-, tarsand- and uranium resources are unequally divided and its mining will involve serious financial- and environmental problems. The current situation, where 1/5 of the world population consumes 2/3 of all the energy, will continue to exist.
The demand for drinking water will double in the period between 1970 and 2000, as a result of the population increase alone. However, to meet the demands reasonable for existence, more drinking water should be produced, but as a consequence of extensive deforrestation, the production of water will also become a difficult matter in the development countries. Again, the very poorest will fall victim, because the production of water will gradually become more expensive as a result of pollution, decreasing available quantity and the reduction in possibilities to control the production of water. Of the total world-forrest, sometimes called the lungs of the earth, only 60% will remain in the year 2000. The rest is forever lost as fuel or for industrial purposes. Annually, 18 to 20 million hectares of forrest-area are lost; that amounts to 5 or 6 times the total surface area of the Netherlands.
The loss of arable ground, stimulated by intensive agricultural methods and the loss of jungle and rain-forrest promotes the gradual advancing of the deserts. Annually, an area of ground twice that of the Netherlands is turned into parched earch and it is to be anticipated that this process will be gradually speeded up.
By the year 2050 air pollution may well have changed the worldclimate appreciably. Acid rains, caused by an increased use of coal and, also, oil and gas, threaten forrests, lakes, soil and crop.
Radioactive waste and other dangerous materials will threaten safety and public health in an increasing number of countries. Many species of plant- and animal life will become extinct with the disappearance of their living environment; perhaps as much as 20% of the total of all living plant- and animal species may become extinct, particularly in the tropical forrest areas.
This then is the total picture of an exploration of the future that leaves little room for hope, if the current policies are left unchanged. These unaltered policies are made visible in the exploration of the future on behalf of the United States.

The critical scientist-movement is tolerated at the universities; however, scientific policy is hardly effected by their findings. As a result of co-operation-programs of various governments, the United Nations and private organizations, development workers are being sent out, but their findings also have no real effect on government policies. It is easily understood why this is so: when poverty, exploitation of mankind and environment and the armament-race are required for the maintenance of the industrial state, it is not to be expected that an exploration of the future will yield more than a reporting of the consequences of the existing policies. Any private enterprise would do the same where it concerns explorations of the future: just as long as he remains within the restrictions of the industrial system, the predictions will be attainable.

All this clearly indicates the necessity for exploration of the future of an entirely different kind:

Exploration of the future, not to serve the short-term interest of the industrial state or the adjustment of mankind and his environment to technical development as dictated by industry but future exploration where:

> "technique has to adapt itself to what people, in a process of mutual influence that is based on equality, find to be of importance. Problems are not considered to be capable of solution by technique alone, neither is this considered feasible by detailed regulation and planning on the part of the government, but by a change in the living-style of people, motivated by an awareness of the responsibilities for the total of the community". (Ter Borg-Neervoort 1981).

Modelstudies, such as those made by Forrester and Meadows on behalf of the Club of Rome, have penetrated right into many a living room (Meadows, 1972). Less is known concerning the further effects of these studies, namely the research into the possibilities to establish conditions of regional equilibrium (Mesarovic, Pestel, 1974). But the essential message of these reports is no longer resisted: Our spaceship Earth has its limitations; it can produce a limited quantity of food, because there is only a limited quantity of arable ground. Also, pollution has its limitations and, with it, the volume and type of industrial activity.

The natural resources on which industrial- and food production depend are limited and this limitation is the determinant factor where it concerns the number of people that are to able live a humane existence.

This type of global study is of importance since it indicates what the situation

is and what is likely to occur, within certain limits, if existing policies remain unaltered and such predictions form the limit of their importance. Interesting studies: how tragic that things are going from bad to worse in the third world. The forced marriage between technology and society does not, in fact, leave any room for a real alternative. An exploration of the future, that takes into consideration the experiences of the past, the history of technique so to speak, has, however, not as yet been made. Such an exploration sould set goals that would permit people to develop for themselves the possibilities to strive, within their own region, for a reasonable degree of selfsufficiency. But this kind of exploration is not yet being made; not for reason that it would prove impossible to do so, but probably solely because it would be considered undesirable by many in the industrialized countries. Being poor in our society is nothing as compared to being a paria in India and it seems a fact of life that man is simply not inclined to take a step backwards on behalf of his fellow human being or of his progeny. As long as such facts of life exist, technology forecasting will remain a hobby for industrialists and government officials who will continue to convince us just what renewals and innovations are needed in order to waste our resources to the bitter end, but as efficiently as is possible.

10. Innovation; the fairytale of the emperor's new clothes

Innovation, a word straight out of a fairytale. But what precisely is the meaning of this word, oftentimes heard on television or read in the newspapers. Is it a matter of putting a new bright wrapper around a bonbon gone stale? Is it a case of renewal intended to pep up an industrial system that has run its course? Are we talking about renewal that will yield sensible employment opportunity or about renewal found important by the bankers, the industrialists themselves, the technocrats and the bureaucrats, i.e. does the emperor require new clothes; new, so that his nakedness may be revealed all the clearer?

In 1979 the Ministery of Science Policy of the Netherlands published an Innovation-directive; this describes innovation as follows:

> "Technological innovations are concrete, identifiable technical-economimal phenomena that have, as an integral part of the definition, their succesful introduction on the market. Innovation is the development- and succesful introduction of new, improved goods, production- and distribution-processes. Technological innovation concentrates in particular on the renewal and adjustment of the technical aspects of products, services, the utilization of

raw materials and manufacturing- and distribution processes. In general, innovation includes changes in organization, market renewal and improved forms of management. (Dutch State Publication 1980).

According to this publication, innovation is not to be regarded from the scientific- and technological viewpoint alone.

"Cultural-, social- and organizational circumstances may be determinant factors for the nature of innovations".

Even though the publication recognizes the importance of the interaction between social- and technical developments and gives some attention to these factors, still the problem of renewal is, in this publication, approached on a strictly technical basis. Events, such as occur in society, are viewed as a consequence of innovation rather than the other way around, but still this is a rather risky way of looking at matters.

According to Crouwel, (1981): "The design-process is such that all facets that have a function in the development of a new product are being optimized. The ultimate intention is to market a product that is socially-, culturally-, esthetically-, technically- and economically balanced. The process of design is, for this reason, the business of many".

This approach also, though more comprehensive, is risky, since it is primarily interested in the producer. The new change of clothes for the emperor undoubtedly makes for a nice spectacle indeed, however, it is in the end the people, the consumer, that have to pay for it, for example, in the form of unemployment and pollution of the environment.

"The well-organized production interests of the industrial system stand in opposition to the interests that are, more or less, weakly organized: the interests of those drawing a pension, children, housewives, students, the unemployed, the sick, those on social welfare and those that rent facilities, but also the consumers, those making use of recreational facilities and people that utilize nature- and environmental qualities", (Jänicke, 1981).

Renewal, in the sense implied by the Dutch Government innovation Directive or even in the broader sense, stated by Crouwel, deserves our critical attention indeed; because innovation is there, but little is done to improve the problems of unemployment and pollution.

It would be well to take a good look at the relation between technical innovation and sociological processes. Clearly, the degree in which- and the time when -innovations start playing a part is primarily determined by the producers.

sociological part	producer	consumer
	- production - design - interest of groups	- consumption - item - interest in preservation and protection
share in spending of time by population	- approx. 10% - decreasing	- approx. 90% - increasing
characteristics of power	- high degree of organization - strong social influence - strongly specialized - professional interests - organized handling of conflicts - extensive financial resources - strong parliamentary representation	- low degree of organization - little social influence - scattered - human needs - amateurish handling of conflicts - scanty financial resources - weak parliamentary representation

Fig. 7: Producer and consumer in the industrial state. (Jänicke, 1981).

Gradually, however, a current has come into being in the industrial society that has realized that it is necessary to delegate more power to the consumer. Proponents for a more sociocratic innovation, state optimistically that the basic-groups should develop greater initiative, while the sociocratic pessimist retords that the common people are not in a position for doing so. The latter viewpoint would seem more correct, since science and technology

have been made inaccesible to ordinary people. But what if the scientist, particularly the engineer, were to be taught how to transmit information and if they were to be made aware as to the degree of prejudice contained in their educational system, perhaps then sociocratic innovation may well be possible.

The question is whether or not it is indeed possible that the nature- and the direction of technical innovation within the structure of current sociological relations, can originate from aims that are determined by the basis level of society.

Character and direction of technical changes

What are the sociological processes that dominate these changes? (University of Technology, Twente-Holland, 1977).
In the first place, it is the optimism-pessimism debate that occupies an important position, also in the field of public information. The optimist camp is united under the banner: "They'll come up with something" (Government of the Netherlands - Informationservice for Science Policy 1981).
The most fantastic predictions are being made. Railroad traffic on the moon; on earth trains will reach speeds of 350 miles/hr. Nuclear power stations in large numbers will take care of electricity production. The weather will be "man-made". In short, mankind will live in an automized environment, at home as well as on the job. Science and technique will be the great blessing for future life.
The pessimists hold two main lines of vision on the future: We will all be annihilated in an unavoidable nuclear war or we will become extinct, as a consequence of over-population and pollution.

Pessimism and optimism both are viewpoints that should be critically approached, by ourselves as well as by others. Both can equally be traps, that can have disastrous consequences, since the optimistic viewpoint (install 10.000 nuclear missiles in western europe and "the russians" will not dare touch us) is quite as serious a threat as is the pessimistic viewpoint (if "they" start a nuclear war, a few hundred of those missiles are enough to destroy all of europe).
Obviously, here we are talking about a reality; regardless of whether one is fore or against; those 10.000 missiles are already here and the question is what are we to do in order to avoid a war that will annihilate the human race.

The pessimistic- and optimistic viewpoints may be reduced to ideology, that is to say, deep rooted prejudices. Prejudices that reflect the viewpoint of the group in connection with the development of mankind and society. With the technocracy-optimists, it is the producer, the production-sector, the factor that directs men and society, while the technocracy-pessimist views this as a threat.
The sociocracy-optimists want all power at the basis; the sociocracy-pessimist also wants this; however, they consider men to be too lazy and uninte-

rested to hold such power.
It oftentimes appears as though technical innovation in the industrial state leads its own independent life. Neither optimism nor pessimism seem to have any great influence; what matters is creating space for sensible and feasible alternatives within the existing structures (van der Graaf, 1984).

During a symposium concerning technological innovation, held at the University of Technology - Twente - The Netherlands in 1977, the most important aspects of the aforementioned viewpoints were reviewed:

1. The worldpopulation will not increase at the predicted rate. The predicted number of 30, or even 40 to 50 billion world population at the end of the 21st century, will probably be "only" 15 billion (Barney 1980).
2. The world foodproblem is more a problem of demand than of supply. The poorest section of the worldpopulation can simply not afford to purchase available food. Viewed in this way, the provision of food is, for the time being, not a technical, but a social problem.
3. Where it concerns the raw materials supply, it would seem that the possibilities for replacement of materials that are scarce, by materials that are amply available, are enormous. This opens great opportunity for innovation.
4. Energy is a chapter by itself, not only for reason that the already mentioned consumption of energy and national-income have a direct connection, but also because the provision of energy is probably one of the most controversial subjects of technical innovation.
   One thing is certain: none of the industrialized countries has taken the subject of conservation of energy seriously, after the oil crisis of 1973.
   This is peculiar, for reason that energy-conserving technologies not only create small-scale employment opportunity but, at the same time, make a country less dependent on oil (-import), thereby enhancing economic independence. Regulations for the conservation of energy could, therefore, affect the starting phase of disconnecting energy consumption from national income. It is also certain that nuclear energy, though a highly controversial subject, for reason of its radiation effects and its connection with the atomic armament race, is still a heavy entry in the (government) budget of every industrialized country.
   The provision of energy does not have to impose restrictions on the (world)

economy, provided that the right sociological choices are made in connection with regulations for the conservation of energy and the application of energy obtained from durable sources, particularly directed towards an enlargement of the possibilities for selfsufficiency.

5. The situation with employment in today's society is, according to Kondratiev of Russia, a problem that is caused by changes in technology. He claims that there are waves with a duration of 50 years. If Kondratiev is correct in his observations, this would mean that the cost-savings through automation that free enterprise looks longingly forward to, is simply an indication of unemployment on a vast scale, that may well rival the years of the great depression, fifty years ago.

The problems of choice with innovation

The problems of choice with technical innovation are possibly determined by the correctness of the predictions concerning population-growth, food production, raw material replacement possibilities, the utilization of renewable sources of energy and structural unemployment. With sociological innovation and the techniques needed for such innovation, we are more concerned about the dominating direction of science and technique, that is to say:

- the centralization of management and research with the aid of organization-technology
- the rejection of labour through choice for large-scale automation of processes, consuming a great deal of raw materials and energy.
- economic thinking that has as central point the procurement of the highest profit from the deployment of advanced technology.

In the last analysis, probably the greatest single problem that we are facing with innovation is that because of this dominant direction, the available technical solutions, by their very content only serve to, time and time again, call up the very same problem. One might say that the cure is causing the illness.

Meaningful innovation is therefore difficult to practically realize:

- In the first place, it may be formulated, that a turning-about must occur coming out of society, from within, i.e. the scientific world, as well as from the outside, via politics; a turning-about that can create room to

develop small-scale technique and organization and, in this manner, cause processes to come into being that promote employment opportunity and protection for the environment.

- Secondly, it may be stated that economic theories to support this necessary change in policy, are severely lacking, or available only in principle (Daly, 1977).

  It seems that, within the existing economic theory-formation, it is difficult to appreciate-, develop- and disseminate alternative forms of technology. This is a great disadvantage for the third world, for they have an even greater need for development of their own labour-intensive small-scale technology, instead of purchased-off-the-shelf capital-intensive large-scale industrial technology.

Economy would misleadingly appear as an instrumental appendage for making a choice in innovation; in reality, however, economy is the instrument itself that determines the choice of technology, as will be discussed in the following paragraphs. The solution to the burning question: will society choose for innovation as a means to beneficial ecological ends or for narrow, economical profit ends; this choice will probably determine the future for men and environment.

11. Economy and ecology; money as an obstacle in the way of development

As Amery Lovins has already stated in his publication concerning energy production that is non-aggressive to the environment: Mankind is more important than are goods. Economic activities should only be the means, but never the end in itself (Lovins, 1979).

It seems that in the industrialized countries the dominant thought is concerned with "more" rather than with "better". All economic activity is based upon this kind of thinking and yet it would probably be as great, or even greater, a challenge to direct the efforts of economic activity towards the utilization of raw materials and energy in such a way that less waste would occur, resulting in savings. But why doesn't this happen? What sort of people really desire our economic system? The demands made by the economic system on its participants has already been discussed, but what about the demands made on homo economicus or, as Fromm calls it: "men in the capitalistic society" (Fromm, 1972).

"Capitalism has a need for people that, efficiently and without friction, work together in large groups, that are willing to consume more and whose preferences and tastes are standardized and easily influenced and predictable. It needs people, that feel free and independent, not subject to authority, principle or conscience, but still prepared to obey commands to do what is expected of them and fit into the social machine without any friction".

The economist knows how to exploit this picture of humanity. He adjusts the theories to the norm- and value system of society and in this manner creates a self-contained process, in which the economic system and the industrial state reinforce one another. The economist bases his theory on his picture of mankind, so that it is possible to divide people into markets/groups of consumers with standardized needs. In order to fulfil these needs for standard products, a smooth adaptation to large industrial organizations is necessary. Production and consumption form an unbreakable bond; this then is the mental disease of democracy and capitalism and the subtitle of Fromm's aforementioned book.

To convince an economist that he, in fact, is working against nature, he should first become saturated with the unnatural content of the economic practice:

- the tendency to express everything quantitatively (preferentially in terms of currency)
- the tendency to view men as a factor of labour (only to be used if it cannot be done otherwise)
- the tendency to assign to everything to do with interhuman traffic an exchange value (which causes us to view everything, including human beings, as merchandise)

To highlight the absurdity and unnaturalness of this basis stance, Fromm states as follows:

- <u>the quantitative expression of facts and events</u>

  "The modern enterprise is supported basically by the paper of its accounting system. The concrete- and direct observations of the craftsman are no longer sufficient. Raw materials, machines and wages can be, similar to the product, expressed and compared in terms of monetary values, ready to be

assimilated into the accounting system. All economic facts and events have to be strictly expressable in quantities and only the accounting balance with its precise comparisons of economic processes in numbers, can show the manager inhowfar he is involved in profit making, that is to say, "sensible activity".

This transformation of the concrete into the abstract has, however, developed too far beyond the accounting and the quantitative expression of economic activities within the production process. The modern businessman does not calculate only in monetary millions, but also in terms of millions of clients, thousands of share-holders and thousands of workers. All these people have thereby become reduced to as many parts and sub-parts of a gigantic machine, capable of supervision and control and with results that can be made accountable."

- The tendency to view men as a factor of labour (only to be used if it cannot be done otherwise)

  Characteristic of capitalistic production is the measure in which it has developed itself. Even though economy in the middle ages was familiar with the division of labour, such as, for example, the agricultural sector and the tradecraft, there existed little or no division within each separate sector. Within the modern industrial enterprise, the worker is, in no instance, in contact with the product in its totality. He only fills an extremely specialized function, so much so that it may be stated that the modern industrial worker functions much like a machine, for which no other machine has been invented as yet and in who's place mechanization would, for the moment, be more expensive than his manual activity.

- The tendency to view everything as merchandise:

  All things are experienced as being merchandise, the embodiment of an exchange-value, not only in activities pertaining to buying and selling, but also in relation to them, when the economical situation is ended. Even after the purchase, an item never loses its property of being merchandise in this respect.... For example, automobiles are being resold after one or two years, long before their useful value has become exhausted or even appreciably reduced... Mankind itself is also experienced as the embodiment of a quantitative exchange-value. When we are taking about the man that is worth a million, we don't mean the human as a concrete person, but rather an abstraction, that is expressed in numbers.

Even the best of economists get caught in the trap of overestimation of the

economy. Hueting, a well known Dutch environmental-economist, in his dissertation, puts it this way: "The crucial question: Of what value is nature to us, cannot be answered throught he facilities of the instruments available to us". (Hueting, 1974). The dominating part that the economy plays in our daily lives, does not necessarily signify that nature, culture, friendship and solidarity have to be made capable of measurement in economical terms. It is bad enough that a cow or a pig is viewed simply as a producer of meat. The fact, that the meat is gradually becoming contaminated and polluted is evaluated by the economist as a reduction in value. The common man can appreciate it as a degeneration of the environment. In the way that all losses to the environment, such as: polluted water- and air, deforrestation and soil contamination, can, in fact, only be found back in the cleaning-up and purification taxes as income, but never in terms of losses to the quality of life, as an expense to the national balance.

Where it concerns the vitally important aspects of life, economy deserts us totally.

There is sufficient food available, but poor people do not have enough money to purchase it, so they are lacking in sufficient food. Plus: "Unaltered continuation of production growth is almost certain to lead to ecological or climatological disasters" (Hueting, 1974).

Still, most economists do not doubt the theory, that necessitates the continuation of production growth; quite to the contrary, they influence society in a direction of more production, thus, less environment as a consequence of the sort of technology that is being used.

The fact that there is a growing degree of activity directed against this production-technology on the part of the people, doesn't worry the economist greatly. The current economic theory remains valid. A few economists, it seems, do realize this problem: "... The innovation impulse, for the commercial sectors a matter of survival, requires support by a co-ordinated social climate that favours innovation. A society wherein a majority of the adult population is involved with production processes and wherein the battle for existence can be felt, would seem to call into being such a co-ordinating ethos.But in a society where large groups of people, such as unemployed and those employed in the social welfare field, are screened-off from the direct battle for existence, by the fact of inactivity, strong rival mentalities (in conflict with one another) develop. It is questionable if a stable and coherent society is conceivable, wherein the rivalry is led into such channels as permit

industrial innovation to have a chance and sufficient working dicipline can be achieved to participate internationally" (Van der Zwan, 1981).
Workers, be diciplined. Social workers, unemployed and those that don't like working, know your place. Work, hand in hand, and all will be well again. It would certainly be right to offer resistance against this. The professional segment of the population is not the guilty party in the unemployment problem, but rather the responsibility of the leaders of the industrial state and its economic advisors. Our population is not lazy nor afraid of work, but alienated and made sick by the manner in which they have been used in the production organizations. The social workers are not too lazy to work, if normal work would be available, but the industrial climate creates such a state of illness that the cult of psychotherapy and relief work are absolutely necessary to aid the people that have become mentally ill. The industrial state, together with its economic system, are the cause of unemployment, pollution, stress and a disease-creating environment.

The classical form of economy is in point of fact also "productivistic" (Hueting, 1974). He assumes that mankind will be called-on to ever growing productivity. It follows that public relief services, such as the indispensable service of the housewife, are not considered as actual production.
Production growth and growth in prosperity in the classical economy, go hand in hand. In our society, growth in production, as a rule, also goes hand in hand with detrimental side effects for men and environment. We have long passed the point of simply providing for the fundamental requirements; the goal is currently to market and sell as great a volume of goods and products as is possible. In western society it would indeed be feasible to have an increase in prosperity resulting from a decrease in production, provided that, for example, leasure time and a clean environment would be acknowledged as a form of prosperity. In other words, the material level of needs could be reduced and the spiritual level raised. The requirements for existence can be assigned a lower priority than the social- and growth requirements. In the development countries, on the other hand, the accent should be on technology to satisfy the requirements for existence.
The economic theory does call attention to these problems, for example in the prosperity theory, however, the belief in growth with its economy especially directed towards productivity, gains ground again. It appears that an ecological form of economy, one that takes into consideration, and protects,

mankind, the environment and culture, instead of exploiting and destroying it, is not as yet feasible. Could it be that the phenomenon "money" is the major offender?

Where barter is involved, everyone exchanges products that are not needed, for products that are. The product itself is involved on both sides of the exchange. Even when a product that, in the past, was rare and scarce, such as salt or spices, becomes a more widely used means of barter or payment, the product is still noticeably present. The transition from "rare" product to means of payment is a small step, as is the step to the making of coins. What is also understandable, that to guarantee the value of paper money as means of payment it appears to be necessary to keep in some place its countervalue in something more durable and rarer than paper, such as gold. But what is more difficult to comprehend is the use of papermoney without the setting up of countervalues. Today it is quite possible to live solely via means of bank transfer facilities, without ever seeing, or being in contact with, actual money. The moving back and forth of vast amounts of money on the stock-markets of the world, money belonging to others, and getting rich (or poor) in this way seems to be the end of an ever climbing series of alienations. The common people know well enough what they can, or cannot, do with their income, but money as an economic phenomenon is for most a mystery. For most people their capital consists of their life, nature that they can use, the culture in which they live, their friends, children, sweetheart, the place where they live and work. For an owner of capital this is an entirely different matter: "his" ground, "his" houses, "his" factory.

It is perhaps, worth the trouble to imagine a life independent of money and private possessions, even though it is most probably impossible and also undesirable to ban money out or our life; however, to for a moment imagine so, would reveal clearly the direct connection between labour and existence.

It would be an attractive proposition to conceive of a new theory that would contain all beneficial elements of the current economy, such as the control of the international flows of money and the mutual relation of the value of the different types of money.

The two essential changes that are necessary in the aims of the economic theory are probably:

- The economy needs to put mankind centrally; that is to say, men's existential-, social- and developmental requirements and, more specifically, for those that form the basis of a society. Neither the free-enterprise capita-

lism of the West, nor the state-capitalism of the Eastblock have succeeded in doing so to any sufficient degree.

- Furthermore, the economy needs to put centrally also the living-capital that is an integral part of the community, i.e. the ecology of environment and culture. Again, neither of the two great worldsystems have succeeded in doing so, to the contrary, we have only to look, smell, hear and feel around us to understand the true state of affairs.

The striving after selfsufficiency by, for example, a development country, on the basis of renewable sources of energy is in some cases technically not only within reach, but would also be of great benefit to men and its environment. Unfortunately, if the investments made are not earned back in a relatively short period of time, the project is halted. This, in fact, is an absurd situation. Selfsufficiency is also very important for the protection of the natural environment. It prevents the dragging back and forth of people and raw materials, that is of such great importance to capitalism. Furthermore, selfsufficiency is probably the only possibility to create a healthy working climate. Just as long as the means of production are not in the hands of the people, it is possible for a few people to dictate what the economy of a society shall be.

The economic basis of our society has necessitated a strong degree of labour splitting and expertise. Scientists, economists and engineers could also be trained to make selfdevelopment for the people possible. Expertise should in the first place serve to benefit society and only in the second place serve economic interest. Why is it, that money is an obstacle to development? In what manner would it be possible for people to calculate the usefulness of their work other than in terms of money?

Labour and material are parts of a process. What does, in fact, happen when a person performs work? Material becomes altered, labour is added to it so as to create something that either the worker or someone else would rather have than the material in its unworked state. What, in fact, happens, generally speaking, besides the conversion of energy and the addition of something intangible, like artisticity or creativity which are qualities, that become more apparent if the product is fashioned by craftsmanship?

With a solar-cell, for example, the rays of the sun can be converted into electricity. As a result of a great deal of research we have succeeded in

making these solar cells from materials developed from high temperature chemical processes. The usefulness of such a cell can be calculated in terms of money, but it can also be determined simply by saying: How long does it take before the energy/heat that is put into it, is earned back in terms of electricity? That is a most important question; probably more important than the question; how much profit will it make. A second way of evaluating the social usefulness of a process, is to base it on the final objective in connection with the satisfaction of needs. In order to cook food, it is not only more pleasant to burn fuel directly, instead of the application of electrical hot plates, but at the same time more efficient, since electricity is produced in such a manner that 2/3 of the fuel is lost in waste heat. Ultimately, a much smaller part of the energy is utilized for cooking than would be the case with direct fuel burning.

An economy, that is based on renewable sources of energy, low intake of raw materials and production of as little waste/heat as is possible, while at the same time relating everything to be final goal: the satisfaction of fundamental needs, would certainly serve to promote a healthy society.

The money-economy of today does nor properly suffice, because it leads to the consumption of fuels and raw materials and the consequent production of great quantities of waste/heat.

Currently, it may be safely concluded, that an economy that has the earning of money as its primary objective, is not capable of protecting mankind and its environment.

12. Limitations to growth and limitations to science; gigantic cities and basic groups

Limitations to science

Unity and its antithesis, between the development of technology and the development of society, is the red thread that runs through the first chapter. The basic thought was that the development of technology based on science has gained excessive influence over society, while society has gradually lost its hold on this development, with its character of modernization and quantitative growth, instead of the development of growth in qualitative terms. The confidence in science is quite understandable. Science searches for recurrence and regularity and makes predictions. It is true, that some specific

scientific activity may be better suited to making predictions than another. It becomes easier to the degree that the science subject is more homogeneous. The engineer works with mathematical-, physical- and chemical processes. The making of buildings and appliances is based on the homogenity of materials as described by the field of study connected with material strength.
Oftentimes the engineer is apt to view the social sciences as being less scientific, because he doesn't realize that people and society are the least homogeneous of subjects. It would be scientifically correct to state that it is more difficult to be a good social scientist than it is to be a good engineer., The aforementioned criticism on the failure of the economist needs to be softened, since the economist is also involved with mankind and society. The viewing of regularities in a retroactive way is much simpler than the making of reliable predictions. That goes for every social scientist and also for the economist. By making statements concerning society on the basis of seeking for regularities, a natural scientist is stepping on treacherous ground.
In what way is this so?

- In the first place, the natural scientist or engineer is not of the habit to be involved with values. A statement often made is: "natural science is not capable of occupying itself with questions pertaining to values, since such questions are beyond - and outside - the field of natural science." But it is not only the facts and the manner of work; the judgements that form the basis of the scientific manner of working are probably of greater importance than the manner of working itself. The demand to function free of value on the part of the (technical) scientist leaves him with the possibility to build value-judgements into his work, without any control.

- The second self-imposed voluntary limitation of most scientists is the rigid division between science and the arts. Science occupies itself with regularity and recurrence, while art deals with diversification and the unique. This is a fact that hasn't done us any good. The artistic craft,that still contains within itself a unification of art and science, is disappearing very rapidly, amongst others due to the influence of the conceit with which the scientist and the engineer look at it.
Undoubtedly, this limitation, selfimposed by natural science in order to study regularity and recurrence, has laid the basis for the industrial state with its enormous production potential. But it may well be that the nearly

complete disappearance of the aspect of art out of technique is the cause of the many soulless products that have, in our time, come into existence. In the past, during the times of craftsmanship, "expertise" implied knowledge and craft, creativity and artisticity. Today, expertise means knowledge of (a small part of) science or technique. Contemporary science may well benefit considerably by a more frequent admission of art, of the unique and the diverse, into the creation-process of science and technique. It is quite possible that scientists, such as Einstein, that have brought about a scientific revolution, were, in essence, both scientist and artist.

- The third limitation of science and technology occurs where it concerns trans-scientific problems, such as fall just outside the field of science; i.e. problems that have to do with rare events or disasters.
  Questions such as: "What exactly will happen when a hydrogenbom of x megaton would explode over a heavy industrialized area?", or: "What is the effect of gloss-producing chemicals as used on apples on the health of the consumer?" might perhaps be answered by scientific analysis. But some questions concerning the consequences of extremely small quantities of extremely toxic substances or of distasters due to entirely unanticipated events, can not be answered quite so easily.
  It is characteristic that in the debate "fore or against nuclear energy" the scientists are, in fact, stepping into the field that belongs to trans-science, without admitting that they lack expertise in this field. Predictions concerning the coming into being of a police-state and the dangers resulting from the storage of nuclear-waste products, probably fit into this category. In this instance, the maxim: "In case of doubt, abstain" holds true, especially where alternatives are available that prevent a production process, together with its by-products, to enter to this field. That is the message of the so-called "green" parties in the industrialized countries.

Scientists would do well to recognize and indicate their own limitations:

a. For the sake of clearness it would be better to insert values into the scientific process, in an aware fashion, than doing so via non-verbalized judgements and opinions.
b. The unique and the diverse of artistic thought are also capable of forming the basis of a scientific process.
c. At the point where science reaches its limitations, society should not be

left with the faulty impression: "they'll find something for that yet". Alternatives that are beneficial for mankind and its environment are to be preferred in every instance; i.e.: The substitution of sociological moments of choice by speudo-scientific expertise-compulsion is very risky indeed and should be strongly advised against.

It is, however, not only the scientist that is the guilty party, but also those that deliver themselves into the hands of science. It is love of ease, to assign to the limitations of science the limitations of growth; in fact, "love-of-ease" in this context is synonymus to voluntary slavery.

Limitations to growth and voluntary slavery

In the year 1577 there was published, in the Netherlands, a dissertation concerning voluntary slavery. The author had this to say:

"The primary reasons that people prefer to be subservient, is because they are born and raised like slaves" and: "it seems incredible how a people, from the moment that they are subjugated, suddenly seem to fall into a state of deep forgetfulness of freedom, so that it becomes impossible to awaken them in order to regain freedom.

Their subservience is entered into so easily and so voluntarily, that - if one were to observe them - one would say that they have not lost their freedom, but, rather, that they have deserved their slavery." (de la Boétie, republ. 1980).

Those thoughts, expressed more than 400 years ago, appear of immediate application to the industrial society:

"It is indeed in the nature of the great mass of people, the majority of which inhabit the cities, to stand in distrust in relation to those that may love them and unsuspecting in relation to those that are out to cheat them. Don't think for a moment that there is even a single bird in all of existence that can be caught easier on a stick daubed with glue, or a single fish easier caught on a hook inside the tastiest bait, than can the great mass of people, that can be seduced and made into slaves, driven by greed and the temptation of even the slightest taste of honey surrogate. It is nothing short of miraculous, that they are immediately prepared to be taken in, by practically anything; just to tickle them very slightly is already sufficient.

The theatre, games, comedies, performances, strange animals, medals, paintings and many other stupefying items, were for the people in ancient

times the bait for slavery and bondage, the price for their liberty and the instrument of tyranny. These means, these practices, these temptations were used by the tyrants of old to make their subjects fall asleep under the yoke of slavery".

Has anything really changed in the meantime? Certainly; today, television offers the entire package mentioned by Mr. de la Boétie, right inside the home. But that does not involve real change. Real change lies in that the oppression does not longer clearly originate from a single tyrant, but rather from a tyrannical elite, a technocracy, a bureaucracy. The traditional tyrant has become increasingly rare and that is probably the difference with 400 years ago.

In the year 1516, sixty years earlier, the great literary piece "Utopia" was published. It describes an island, inhabited by a perfectly organized and happy people. The book is sometimes considered to be the source, out of which communism came into being. Thomas More describes an ideal society; completely democratic, with a six-hour working day. Money is non-existent, but there is enough of everything to be had, for free, by everybody, at the store. There is no private property and the chief aim of the economy is to provide everybody with as much freedom from physical exertion as the requirements of the community allow, in order to develop the mind -a quest that, in Utopia, is viewed as the secret of a happy life. Hospitals are such pleasant places to stay, that everyone would rather be ill in a hospital than healthy at home. The population is divided into groups of thirty households each, that every year choose a district chief. Every city has two hundred of such chiefs and they, in turn, elect the mayor.

There is plenty of gold, but it is only employed for ordinary articles of use. There are also plenty of jewels, but these are only worn by the children. The only other function that gold and jewels have, is for the benefit of negotiations of various kinds, with either friendly or hostile nations. Each inhabitant of Utopia is required to spend two years of life working in the fields. In short, not a paradise on earth, because working is still a necessity; however, it may be viewed as a healthy community. Technique plays a very minor part in More's book; more than 450 years ago he wrote as follows:

"In other places people are always talking about the interests of the people, but their sole interest is in private possessions... In other countries almost everyone knows, that one starves, if one doesn't take care of oneself... For

what kind of justice does one call this:

"People, such as aristocrates, the goldsmiths and money-lenders, that don't do any work or that do work that is of no importance, are rewarded for this laziness, or for their insignificant activities, with a life full of beauty and luxury... But the workingman... and the farmlabourer, that are continuously working like horses in jobs that are of such importance, that if they were to stop working, the country would come to a halt within 12 months - what happens to them? They get so little to eat and they suffer such bad times, that they would be better off if they were draft-horses" (More, reprint 1965).

Thomas More, obviously, has little sympathy for the social systems in the world. The rich are full of tricks in order to buy the work of the poor as cheaply as is possible; thereafter, these tricks are fixed firmly into laws.
It is in this way that a minority, led by their insatiable greed, take into possession - and for their private use- that what would have been amply sufficient for the entire population.

If science (and technology) were to acknowledge its own limitation, then perhaps the visible manifestations of the limitations to growth, such as we experience today, could dissolve into the background again. For to acknowledge the value of nature, the value of culture and to acknowledge the limitations to personal knowledge, would lead to a more reserved practicing of science, where thought, feeling and activity would form a unified whole. The limitations to growth have been reached mainly from a lack of understanding concerning the limitations of science, plus a lack of respect for culture and nature and, in addition, a lack of self-knowledge.

Gigantic cities, parasites of the countryside

Round the year 1900 the capital of Sri Lanka, formerly Ceylon, was still called the garden-city of Asia; but today Colombo is growing into a metropolis. By the year 2000 there will be approx. 60 cities in the world that have a popultion of 5 million or more; in total they will have approx. 650 million inhabitants. Around the year 1900 there were 1.6 billion people living on earth and about 1%, i.e. 16 million of those, lived in cities. By the year 2000 more than 15 percent of the world population, about 3 billion, will live in cities. The urbanization is a consequence of the migration of people from the rural

areas to the cities. This migration is easily understood. Almost everywhere the people of the countryside, especially those in the third world, are getting poorer, while the majority of the poor city-population still has a chance to find the means for the most elementary living requirements.

In the large cities of the development countries, 25 to 50 percent of the inhabitants are living in slum dwellings; still they have relatively better chances, where it concerns education and health care, than those in the countryside. In Lagos, Nigeria's capital, lives 3 percent of the population, but this small percentage has access to 20 percent of all medical doctors and almost 50 percent of all dentists. (Internationale Samenwerking 1980). The better educated people would also rather live in the city.

Why is it that the people of the countryside like to move to the cities? Or is this the only way? The urbanization happening in the third world today, has already been completed in the industrialized countries. The french economist Jean Fourastié describes, in his publication "Le grand espoir du vingtième Siècle" (The great hope of the twentiest century) how technical progress in the industrialized countries made it necessary for the segment of the population that were skilled to adjust, by changing their tradecraft as well as their place of habitation. Industrialization means migration of workers from the countryside to the cities (Fourastié) 1965.
He distinguishes between different sectors:

- the first sector : agriculture and mining; in short, the winning of raw materials
- the second sector : the making of raw materials into products
- the third sector : the public services

According to Fourastié, the winning of raw materials with machines causes labour to be pushed into industry; mechanization and automation of industry causes, in its turn, that this labour is than pushed on, to the sector of public services. In this manner the development of technique alters the composition of the skilled segment of the population.

- initially, 80 percent of the skilled population is employed in the winning of raw materials; 10 percent in industry and 10 percent in the public-services

sector.

- in the end, according to Fourastié, 10 percent will be employed in the winning of raw materials, 10 percent in industry and 80 percent in the public-services sector, all this via a transition phase that may take tens of years to complete.

This process may be shown as follows (Malotaux 1980):

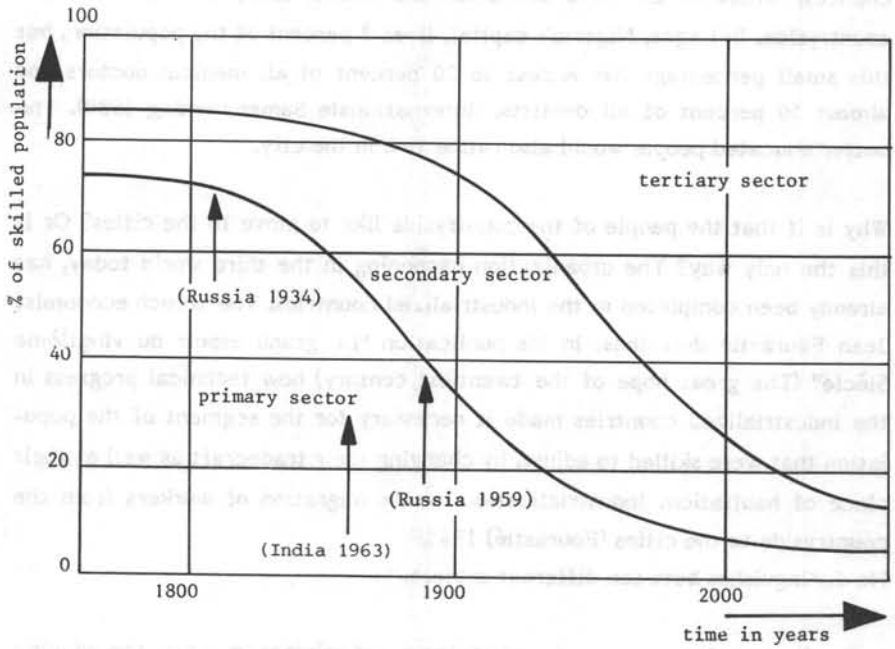


Fig. 8: composition of skilled population by increasing industrialization

Fourastié does not indicate what happens further with labour pushed out of the public services section by the still increasing degree of automation; this development had not become apparent in his time; however,the process described by Fourastié is, most likely, the basic reason for urbanization. The problems of urbanization are not trifling. The industrial metropolis is the greatest synthetic product ever built by men. The city and its inhabitants dominate all. Even the revolutionary mass-movements of the millions of small farmers, as is the case in South America, are, oftentimes, initiated- and lead by city people.

"It is the daily pressure of life in the city that turns the masses of people

into crowds and personnel... At the same time the city is a composite of all the poor ecological habits of our society.... Her economic style is the greatest burden leaning on the planetary environment.... The city is the power plant of parasitic energies; all decisions concerning the planet's future are being made by the city-intellect. The city comes into being by withdrawing people from the primary production of their existential requirements such as food, fuel and raw materials. Those who leave the soil must utilize the labour of others...." (Roszak, 1980).

This is no plea for the abolition of cities; however, it would seem to be correct to state that the city has become a place of waste. Still, the cities continue to grow as a result of the increasing poverty in the rural areas and vice versa and here we may perhaps find the key to the solution of this problem.

What needs to be done is to provide for the people in the rural areas the possibilities for a better life.
This is easily stated but difficult to carry out. At the Asiatic Institute for Technology in Bangkok, 66 professors and 500 engineers, from all over Asia, are combining their efforts to inhibit and reduce poverty in the rural areas of Asia. This Institute and similar institutes all over the world, such as the Centre for International Co-operation and Appropriate Technology connected with the Institute of Technology (T.H.) in Delft, The Netherlands, are working for technological innovation, such as inexpensive methods of construction - and materials, small hydropower plants, pumps operated by solar energy, production of biogas out of organic waste and simple drinking water supply systems.

These and other systems of benefit to mankind and its environment are necessary to reduce the population pressure on the cities and to reinstate the cities once again as centres capable of emitting the creative force in the fields of art, science and technology. Also for the cities themselves this type of systems are desireable and feasible.

Fox has described a project of urban agriculture in the United States, amongst others, through utilization of solar energy and windmills. There are a great many untapped resources and possibilities, to give our cities the crea-

tive power derived from people that are free, instead of the exhaustive suction power of the parasite. (Bemer, de Schutter, 1980).

Basic groups as growth-nucleous for development

Back in 1972 there was already a group of thirtythree scientists in England who, in a paper "Blueprint for survival" drew attention to the problems resulting from detrimental excessive cultivation of the eco-systems of this world. They propose a stable society without economic growth, with minimal disturbance of natural processes, aimed at conservation and stabilization of the population growth plus a decentralized social system that places responsibility in the hands of the people.

> "A small community is not only a form of organization wherein specific regulations will have an optimal effect, but rather, the entire manner in which a small community functions, has a stimulating influence on the individual and provides joy of life.
>
> It is perhaps so, that a human can only be entirely himself in a small community. It is typical that the disappearance of the small communities, the rise of centralized community councils and the growing sluggishness of the public authorities, go hand in hand with the becoming selfconscious of the individual,who feels increasingly threatened in a world wherein he is only a number". (The Ecologist, 1972).

That is not to say that the social controls in a small living- and working community cannot be experienced as oppressing.

Insecurity surrounds us on all sides. Our food is - and will be - contaminated. Surface water is contaminated to such a degree that it is difficult to produce good drinking water and even if the water is good, fluor has to be added, a point where even the experts are not in agreement. The safety of our houses is threatened by toxic waste products dumped before the houses were constructed, by traffic noise, by the neighbours and, often, by chemical stench from industry. Where it concerns our jobs, we are not certain whether or not we will be still be welcome tomorrow. In the bus or train at night we look fearfully about us. The intimacy of a friendship or love relation is threatened by the new moral:
"nothing is an obligation and everything goes". Development and material possessions are put on the same level. A real development that requires great

effort is compared with the easiest activities resulting from work obtained through an employment agency. There is something drastically wrong with our mental- and physical nourishment. Excessive nourishment functions as a safety valve for tensions and frustrations in our society. The package is more important than the contents and this also creates fear, for a person disguised in a nice package could very well be rotten and vice versa. The driven manner in which we "nourish" ourselves mentally and physically makes us ill, while our medical care reaches no further than expensive (group) therapy for the more affluent and some symptomatic treatment as used in the case of, for example, heart disease and cancer. According to Toffler, all countries that out of the first wave of development, i.e. the rural area society, based on agriculture, have arrived in the second wave of development, industrialization, have six ground-principles in their program (Toffler, 1980).

- Standardization
- Specialization
- Synchronization
- Concentration
- Maximization
- Centralization

These principles, so it seems, hold valid for the capitalistic, as well as for the socialistic wing of the industrial society and so comes into being the gap between the producer and the consumer and the ever increasing part played by the "market" that lies in between. According to Toffler these six ground-principles will change during the course of the "third wave of development":

> "The heroic epic of the building of markets has gone and a new phase is coming in its place, a phase wherein we only maintain, renew and modernize the pipelines. Without a doubt, we shall have to redesign important parts, in order to be able to accomodate the radically increased stream of information. The system (the pipelines of international contacts) shall in an increasing measure be dependent on electronics, biology and new social technologies.... The third wave will show the first transmarket-civilization..... From that point on there will be an endless variety of changes in civilization. New religions will come into being, as will works of art on a scale heretofore unimaginable and, fantastic scientific- and political institutions". (Toffler, 1980).

Toffler's world, though his books may be bestsellers, would seem like an insecure world; a world of pseudo-freedom and pseudo-prosperity. Toffler has not entered into the problems of poverty, overarmament and environmental destruction. All that will be solved; "they'll find something for that".

For the time being gigantic cities will determine what the face of the world will be. The limitation to growth will be reached very soon, without a doubt. The question remains if science and technology are willing to put themselves in service of the fullfilment of the existential requirements of common people, for the protection of the environment and for the maintenance of what is of value in the culture. The following chapter will describe which technology could be of aid to developments capable of promoting this.

CHAPTER II

APPROPRIATE TECHNOLOGY - ITS CONTENTS

1. Introduction, concerning needs and desires

In the previous chapter we showed the picture of how the fabric of technique and organization forms the visible part of society. Technical provisions and organizational regulations are a common occurence in that fabric. It was also shown that a program seems to exist in the form of a plan to arrange the fabric in precisely the way that it is now and no other way. Technique and organization form the visible substructure, while the thoughts and judgements as to how the society, at least according to the opinion of those that are influential, should be developed determine the superstructure, the invisible plan that arranges the fabric.

Appropriate technology, is essentially a new school concerning technique and organization. The aims of appropriate technology are not only to indicate the lines of development for a sociological structure, the fabric of technique and organization, but also for the program needed to produce that fabric.
The demands made on such a new teaching are quite extensive. It has to be applicable on the level of a group, a section, a village, but equally for country or area. It has to fit the facts as well as the emotions. It has to encompass the elements for a clear program as well as the elements of charactarizing techniques- and form of organization that can be adapted from that program.

For mankind and for the animals as well technique is a means to realize ends. It is known a fact, that animals also use techniques. In the utilization of technique, humans can be distinguished from - amongst others - the animals, by the measure in which they apply technique and the radicalness of that technique.

By developing a technique on the basis of science, man has coupled knowledge to skill; this, in fact, has only made his responsibility as administrator and as stuart greater. Unfortunately it does not look as though those that

have developed knowledge and skill understand this fact. Quite to the contrary - Marcuse in his publication 'The one-dimensional man' (Marcuse, 1974), has the following to say:

"Auschwitz continues to haunt us, not in the memory, but rather in the deeds of the people: the spaceflights, the rockets, the ballistic missiles... Beauty shows her ugly sides now that topsecret atomic factories and laboratory - "industrial parks" are being situated in pleasant surroundings and now that in the headquarters of the department for the Protection of the People it is possible to admire a "deluxe atomic shelter" with wall to wall thick carpeting, easy arm-chairs, television and scrabble, designed as a combination living room, for peace time use and as atomic shelter for a family, in case of war.

If the truly revolting aspect of these matters does not penetrate the awareness of the people and if these matters are accepted as a matter of course, the reason for this is that these accomplishments are:

a. entirely reasonable in the sense of the existing order and
b. a sign of human ingenuity and power that rises above the traditional limitations of the imagination.

Such revolting coexistence of beauty and reality is a refutation of the philosophic thoughts that places the poetic imagination in opposition to the scientific- and experimental reason.".

The science and technology of the highly industrialized society places the thinking, the acting and feeling of the individual in a large crucible. The efficiency of this system expresses itself in the blunting of the human quality. In this way it is possible to transform the real needs of people, seemingly, into desires that are artificially aroused and that serve only to maintain the existence of the system. The one-dimensional man is needed to transform sensible needs into senseless desires and in this advertisement plays a leading part.

The part played by sales promotion

According to Schumacher western economy is based on a systematic stimu-

lation of envy and desire. What manner of working has been developed for the stimulation of that desire? The famous depth-psychologist Jung, a disciple of Freud had this to say:

> "Attempts to influence public opinion by means of newspapers, radio, television and advertisement are based on two factors:
> - On the one side, they are based on techniques to reveal the general "opinion" or to reveal the "wishes" as expressed by collective mental attitudes.
> - On the other hand, they express the prejudices, projections and subconscious complexes (usually power-complexes) of those that manipulate public opinion". (Jung, 1973).

Experience has shown that people involved in advertising have an exceptional capability in the composition of a campaign of coherent sales-promoting activity.

Schumacher has this question:

> "How can someone find the strength to overcome in himself the violence of envy, desire, hate and lust?".

To put it is a different way: How can one find out what the advertisement people really have in mind and what fundamental deception is hidden in their message?

The same, in fact, holds true for science and technology. It is of greater interest to know why scientists and engineers are engaged in certain activities, than it is to know what they are doing. Most scientists and advertising people support, consciously or subconsciously and, oftentimes, in a cooperative manner, the existing order. The consumer sees only the final result, but knows very little or nothing at all, about the processes that have led to these results. The businesslike - and sober fashion in which science and technology are being sold, leave the impression that these have a connection with the requirements of society. The hard reality of the industrial society shows an entirely different picture: the open animosity between the top and the basis and the utilization of police, riot squads and army with ever growing frequecy against the common people that only

want fulfilment in terms of sensible work and life, fulfilment of their fundamental needs.

Stuarts and robbers

A robber is dependent upon a special sort of joy: the joy to chance upon a subject that can be robbed. After the robbery, this subject is of no further interest. Dependent upon the size of the loot the robber can carry on, up to the moment where again the mood to rob strikes him or when he has to rob for reason that the loot of a previous robbery has been spent.
The robber does not govern, he only consumes; he lives on someone else's expense. Western men, today's robber, lives for the greater part, at the expense of the environment and the third world, but that era will soon belong to the past. The contemporary robber-technique will have to make room for true stuartship.

> "For mankind, from the beginning, had the function of stuart. Adam named the animals. He was intended to be the highpriest of nature as it were. Stuartship does not mean domination, but rather governing." (Bouma, 1975).

A true stuart administrates nature in such a manner that it will be maintained and preserved and allowed to develop beneficially. The puzzles presented to the advertising people for a solution are akin to that of the robber's accomplice. The headman of the robbers knows the places that are best for robbing (markets and target groups). He passes these places on to his accomplices and those are permitted to solve the puzzle of the robbery. Scientists and engineers supply the tools to accomplish the actual robbery.

In this manner of working there is little difference between the acquisition, transport and sale of slaves by Dutch shipping owners and the destruction of tropical rain forests for the benefit of beautyfying our homes. The scientist or engineer who is willing to behave like a true stuart will have to look further than the puzzle presented to him. To solve these puzzles he is well equipped, as a result of his education (Kuhn, 1972.)
An intelligent administration of animate- and inanimate nature is the nucleus of the plan of work of Appropriate Technology; however, such

responsible stuartship is difficult to accomplish within the working method of a community of robbers. According to Kuhn it would appear:

> "that anyone that is part of a matured scientific community, is, similar to the protagonist in Orwell's book 1984, the victim of a history that is being written by the predominant powers".

If it is true that many scientist and engineers are hereby indicated as robbers, this is so in the context of this citation: robbers, for reason that they don't know any better. We are akin to ants that move across the two-dimensional sheet of paper of the substructure of technique and organization, without any awareness that there is room to play, room capable of being created by ourselves by becoming free of our own prejudices. New and vulnerable in the movement of Appropriate Technology is the awareness of the necessity to see liberation as a leading aim for "technical" science. Vulnerable also because the Appropriate Technology movement, for the time being, cannot make available a sufficient number of appropriate techniques such as might aid in the instruction of a self-governing structure of society.

Such techniques that enable mankind to have a greater degree of say-so concerning their own lives and work, can only come into being when a sufficient number of scientists and engineers have come to realize that they are capable of supporting the many liberation movements.

If it is true that the ('technical') scientist is indeed the victim of history especially, written by the dominating powers, then the coming into being of the necessity of Appropriate Technology as a conscious variation of the established technical science, will come early. That is to say, right from the moment that the technique based on science started development; as of that moment, the extremely rapid growth of industry also came into being.

2. History of Appropriate Technology; from Walden to MeMo

Natural science as culture medium for industrial technology

Natural science is the basis of today's technology. In The Netherlands, natural science has been consciously promoted and made to flower by the class of regents in the Golden Age. The philosophy of Descartes in those times formed the most important basis for natural science. Herein, the causes for all natural phenomena are reduced to mechanical processes.
The States of Holland had a need for the type of science that would serve navigation on the seas, for with trade that was based on navigation the greatest amount of money could be earned. In this way, astronomy, surveyance, mechanical engineering and natural science, based on mathematical knowledge, came to unfoldment (Pleijsier, 1970).
The close connection between natural science, technology and society, therefore, already had its start in the Golden Age. The technology of regents and the States of Holland, i.e. to their economical standards.
According to Doumas, the history of economics forcibly declares the history of technique as belonging to her field; the working methods - and subjects for research were imposed on technique by the economy, at a very rapid rate (Doumas, 1980).
Economic norms formed the leit-motiv - and program for society, that produced the visible fabric of organizational regulations and technical provisions of today. This fact became only clearly visible during the time when technical development and economic growth reinforced one another mutually: the industrial revolution.
Writers like Engels and Mill place the beginning of mutual reinforcement in the second half of the 18th century, while Marx places it already in the 17th century:

> "The separate moments of the capitalistic accumulation are becoming divided, more or less in chronological order, especially in Spain, Portugal, Holland, France and England. In England, towards the end of the 17th century, they are systematically put together in the colonial system, the state-debt system and the system of protection..... All, however, use the power of the state, the concentrated - and organized violence of society to artificially promote the process of change from the feudal to the

capitalistic manner of production and to shorten the transition phase..... The history of Dutch colonial domination, keeping in mind that Holland was the capitalistic model-nation of the 17th century, reveals a picture of treason, bribery, assassination and baseness that cannot be surpassed. Their system of stealing people in Celebes in order to get slaves is a typical example. The thieves of men were specially trained to this end. The thief, the interpreter and the salesman were the principal agents in this trade, while the native princes were the principal buyers. The young people that were stolen were locked up in secret prisons on Celebes until they were ripe for shipment on the slaveships".

In the first chapter we described how, during the industrial revolution, when the workers became aware concerning the altered principle in society, they resisted strenuously against the soullessness and powerlessness in their work.
It became apparent that the power of the state protected the rapid economic growth to, in this manner, safeguard the interest of the ruling class. The preparations that were, in principle, made through the facility of cleverly manipulated natural science gained influence in technique and organization in the new social structure of the industrial society.

From Walden to MeMo

Nowadays, in every industrialized state, there is a vast array of alternative movements, co-operations, green parties that, dependent upon their attitude towards the established order are treated either with a kind of condescending friendliness or with extreme vigilance.
The O.E.C.D. has, in three publications, made an excellent record concerning the history of Appropriate Technology. In the first book "Problems and promises of Appropriate Technology" (Jéquier, 1976) the contents of the field are defined. Thereafter, a sort of telephone directory, giving information about institutes all over the world was published. (Jéquier, 1977). Finally the O.E.C.D. made a quantitative analysis of the movement that showed rapid growth. Up to date, there are 680 organizations considered in the analysis, divided over 80 countries, of which 122 institutes are located in Western Europe and 8 in the Netherlands. The money spent on these movements increases from 620 million dollars in 1975 to 1075 million

dollars in 1977. There is a steady increase in the number of organizations, at the rate of several organizations per year, in the fifties and tens of organizations in the seventies (Jéquier 1983). The early elements of the Appropriate Technology movements in the Netherlands can be recognized in Walden. Walden was a production co-operative, which existed from 1889 to 1907. Frederik van Eeden, a Dutch writer started the co-operative. The Walden-co-operative has recently drawn attention again for reason that self-management of enterprise by its workers has again become a matter of interest. Walden was one of the first experiments in The Netherlands with emancipation of labour and self-management and, to some degree, it was also an experiment in self-sufficiency. The development of Frederik van Eeden's sociological ideas as portrayed in "Walden in dream and deed" (De Leij and Luger, 1980) is the leit-motiv of the following remarks and citations. Van Eeden is represented herein as being a man with ideals.

According to Van Eeden, the ideal situation only comes into being once a condition of equilibrium is attained, in which the parts of an organization, the individuals, are no longer dependent on one another, by an equality in thought and activity that can be reached.

The strategy of transition to a healthy society is, according to him,

- to live in a thriftier and less luxurious way
- to transform capital into means of production
- to unite with individuals of similar mind, jointly purchase ground and jointly work the soil.

Concerning co-operatives Van Eeden states, that in the degree they are becoming more selfsufficient they'll become more anticapitalistic, i.e. when the workers unite the factors of production and distribution and become producer and consumer at the same time. Toffler, in his paper of 1980, considers this as being something new and calls it the "prosumer".

There are three phases of development in the co-operative:

- the lowest state of development is the society of consumers that excludes the intermediate trade
- a higher stage is that where means of production- and operating capital are partially in the hands of the workers
- the highest stage includes the complete joint-ownership of the production means.

Perhaps the reader knows already: the Walden project became a failure.

The main cause was apparently that selfdetermination and selfmanagement only function properly if the participants are ready for it i.e. if they know themselves to be of equal rights and if they know themselves to be jointly responsible for the total. It would seem that a considerable degree of emancipation is a prerequisite condition for proper selfmanagement.
If this condition is not met, failure is certain to occur, as in the case of Walden and also through a lack of individual initiative, greed and low productivity, emancipation appears to be necessary in order to judge for one self the significance of participation in an experiment such as "Walden"[1].

MeMo

Seventyfive years after the rise and the fall of Walden, the initiative is taken to set up an organization "to promote the coming into being of alternative employment opportunity in small-scale enterprises beneficial to men- and his environment".
MeMo wants to aid people that are willing to work for themselves in a responsible manner. Responsible here has a dual meaning. Not only is it necessary that the enterprise is economically viable but also account has to be given concerning the social- and environmental interests, (MeMo, 1981).
Not only is this initiative of rare quality, but especially the idea that supports it. In the seventies a new sort of estate-agent function comes into being in The Netherlands. The agent of appropriate science and technology. This function comes into being out of the academic environment and in particular, out of the science-and-community movement, the so called: science-stores. The aim of the science-stores is to provide social (basis) groups such as the environmental groups, with free scientific support. The idea is, that groups in our society, lacking in opportunity, have equal possibility to realize their wishes with the aid of scientific support, as do those that are not lacking in opportunity.
It is a striking but understandable fact that, oftentimes, these wishes come into conflict with the interests of the existing economic situation. The detrimental effects of stench, research into the effects of soil-pollution,

1) This was also the title of Thoreau's book "Walden, or living in the woods" that inspired Frederik van Eeden, written in 1854. Thoreau lived for two years in a hut on Lake Walden in Massachussets).

the risks involved with the building of LPG (liquid propane gas) stations in inhabited areas are subjects concerning which these low opportunity groups wish to be informed at the science stores. In the extension of the critical science that expresses itself through the means of its science and community groups and in the estate agent's function of the science store, also outside the academic sphere a new sort of broker-in-knowledge is coming into being and, this time, out of the practice of a more appropriate technology. "The Little Earth" (De Kleine Aarde), a foundation in The Netherlands, is, in fact, a forerunner of this function of estate-agent. This foundation is, for example, also responsible for the initiative to start the MeMo foundation. It is an agricultural enterprise that produces and markets agricultural products on a basis of practices beneficial to mankind and its environment, but also via their own magazine "The Little Earth" that supports similar initiatives with information and courses. MeMo, in its MeMo guide (1980) gives a summary of about a thousand organizations that occupy themselves with enterprises in the Netherlands that are beneficial to man and its environment. In a question and answer session in the MeMo office in Amsterdam on June 15th 1981 one of the co-workers had this to say concerning the aims of MeMo:

> "It is important to us that the people that start a small enterprise manage it themselves and that the production process and the products are beneficial to man and its environment. Yearly, several hundred MeMo "enterprises" are started".

What in the times of "Walden" was considered to be a daring initiative of a head-in-the-clouds idealist has, in our times, become a new style of enterprise. MeMo is an expression of this new style for reason:

> "because ever more people are seeking for other ways of working. There is dissatisfaction with the manner in which in most organizations work and production is being done".

This statement was taken out of a leaflet "Katernen 2000" (1981), also distributed by MeMo, in which instructions are provided for the setting up of a small enterprise. In the same leaflet there is also an account concerning the Association of Companies on a Co-operative Basis (ABC), that was started in 1950 and that currently counts thirtythree co-operative enterprises with sixhundred members and about nineteenhundred employees. This association estimates that in 1980 there were a total of 200 enterprises that have self-management. The Foundation Selfmanagement, that pu-

blishes a monthly called "Selfmanagement" (Zelfbestuur) founded in 1982 by the aforementioned association, has as task the promotion of the coming into being- and development of enterprises with a form of selfmanagement. But MeMo goes beyond this. MeMo started in 1976 and it combines self-management with works that are beneficial to man and its environment. MeMo also maintains a guarantee-fund and an investment-fund out of which credit can be given to small companies that are just starting. The aims of the MeMo-movement are as follows:

- "the promotion of the coming into being and development of productive units/-groups/projects/co-operative enterprises, that employ means of production that are beneficial to man and its environment and that, in that manner, function to inspire-and renew society exclusively on the material level, with preference and primarily in the fields of agriculture and gardening, nutrition, clothing and home-construction, including repair and renovation.....; public services, amongst others, in the form of repair and renovation enterprises; the promotion of the re-utilization of used raw materials.....
- The laying of contacts and the promotion of co-operation between people and institutions that are working, or are willing to work in the aforementioned fields of endeavour...." (Document of Foundation MeMo 1976).

Within the movement developed the need for insight concerning the relation between the aims of the foundation and the reality of the MeMo enterprises. In an analysis of the research report that was done in connection with this it is stated that economic recession has a stimulating effect on the small-scale selfsufficient enterprise (C. van Alphen, 1983).

The growth of the number of co-operatives and MeMo enterprises can, therefore, not be viewed as strictly a fringe-phenomenon. Quite to the contrary, this sort of enterprise serves a function as forerunner in relation to the traditional enterprises. To promote a more prosperous growth, however, there is more- and specifically aimed support required from the educational- and research institutes and the government, specifically the Ministry of Economic Affairs.

Employment, without the loss of social welfare benefits and the granting of government aid for the beginning entrepeneurs in this sector, together with a stimulating policy of the regional government, in co-operation with the

Chamber of Commerce would appear to be needed.
The unions in particular could play a vital part by stimulating and supporting the initiatives of their members. Moreover, it is hoped that within the field of technical education a greater degree of understanding will come into being concerning the necessity for development of techniques that are beneficial to man and its environment (Walravens, Riedijk, 1984).

A bright economy

Is there an economic basis that permits the continued growth of the germination seeds as are to be found in the movement of Appropriate Technology? Paul Hawken describes the phenomenon of the coming into being of a new economic system (1983). In this "disintermediation" (short-circuiting) will play an important part. Disintermediation is a term that can be used, for example, to indicate the removal of their money from banks- and investment-institutions by investors in order to go around the established institutions because they are seeking higher yields by investing the money themselves.
Disintermediation also means the intention to shorten the lines of connection between people, between users and suppliers of products and services. For example, when energy was still inexpensive and the economy growing, it was, in fact, cheaper to buy food than it was to raise it yourself. But the rapid increases in oil prices are passed-on and calculated into our energy-"rich" food, so that it becomes an interesting matter to raise one's own. A "short-circuit"-economy comes into being, not only as a consequence of the increasing energy - and raw materials scarcity, but also because of the high cost of our "detour"-food.

Naturally, disintermediation doesn't occur solely in the form of a "bright" economy, for reason that another possible reaction may be the "shady" economy or, as it is called by prof. Arnold Heertje of The Netherlands, the shady circuit, since the latter also involves the economic short-circuit but of a more criminal character. Both "bright" and "shady" economy are probably phenomena with a common cause: the failure of the economic detour system to give sound impulse to people and groups in society. Impulses capable of improving this system could, for example be the striving for

ends beneficial to society and the taking of such measures as are needed to create a sound society.

The shady economy reaction links up with the pattern "the more I can earn, the better and I am wrong only if caught". The playing around with people, such as the dealing in illegal contract-labour, with the environment, such as in illegal dumping of toxic waste, also, playing around with information concerning activities that are socially- and economically unacceptable, such as the deceit involved with the american nuclear weapen policy (Fallow, 1981), are also manifestions of a shady economy. It is a reaction on the part of enterpreneurs and investors on what they consider to be too low a profit margin within the official economy, which is understandable.

The bright economy, on the other hand, seems a reaction of persons and groups on the steadily shrinking remuneration that the official economy gives to people that form the basis of society, for their efforts. This is also understandable, since the cost of living continues to rise, while the wages are not accordingly adjusted. The increasing scarcity of raw materials, stagnation of wages and rising cost of living are the phenomena that, for the time being, will continue to occur simultaneously. The official economy, thusfar, has attempted to curb these problems by the way of concentration of power, capital and raw materials.

The shady economy seeks the solution in the playing around with people and the environment; to do so is not a difficult matter in times of high- and increasing unemployment and a stagnation in the economy.

The bright economy also seeks to detour the official economy, but attempts to do so in a more humane fashion, small-scale enterprise, thriftiness and intelligence.

It is easy to deny the magnitude of the bright economy, even though its extent is very considerable; in the United States, for example, it is estimated to be between 300 and 500 billion dollars, which is more than the net national product of France. In Italy, the informal economy is estimated at 30% of the national income and the estimation for Russia is 20%. A social-cultural report published in the Netherlands in 1982 reveals that, in the Netherlands, a total 7320 x 1000 man-years of informal labour has been performed and 4584 man-years of formal labour. Even when the rate of pay for informal labour is estimated at only about 10 guilders (about $ 3.00) per hour, it is evident that, at the current rate, informal labour, continuing to grow, will surpass the value of formal labour, that is stagnating, in a few years.

An estimation, at a national income of 330 billion guilders (about 100

billion dollars), the informal sector will amount to 30% of the total national income.

The denial of the bright economy is easily understood; it is not due necessarily to a lack of publication channels, such as the "MeMo-paper", "The Little Earth-paper" and the "Twelve Crafts-paper" (De Twaalf Ambachten), but rather because it simply has to be denied by those against economic change and who's existence is being threatened. In this way, the saving of energy by the electricity producers must be considered as unimportant and, also in this way, it must be prevented that the renewable sources of energy, such as wind-energy, will get the same developmental chances as do the large-scale monopolizing energy systems. This is accomplished by various fiscal-, organizational- and economical obstacles (Potma, 1985).

And just as long as the average consumer continues to pay along for the energy-costs of the large consumer, (because he has to pay two to three times as much per kilowatt-hour), the electricity producer can maintain: wind- and solar energy are very nice but of no economic interest.

But the growth of the bright economy cannot be denied, even though this cannot immediately be seen from the numbers, because the middle- and small-scale enterprise has grown a few percent during the last ten years in employment opportunity, while the large-scale enterprise has diminished by several percent. While the total employment opportunity in large-scale industry has diminished, for example, with Philips, in the Netherlands between 1974 and 1982 from 410.000 to 330.000 and with Unilever, also in the Netherlands, from 355.000 to 280.000, new job opportunities come into being with small-scale enterprises. In the United States the small enterprises produce twenty times as many innovations per dollar than do the large ones and this situation is probably not much different in The Netherlands.

The consumer also contributes to this situation. The advertisements and products of the large companies are no longer blindly accepted. Nowadays "large" is identified with indifferent. The rising energy price stimulates the consumer to saving, the high food prices to self sufficiency and the high cost of services to working for oneself. In short, the longer the production detour, the sooner the consumer will seek for a short circuit of that detour. This involves the replacement of labour and materials/energy by information, through better design, a better method of production and a more direct way of selling.

The complexity of the industrial state is also given form by a bureaucratic network of rules and regulations, that can be gone around by disintermedia-

tion. The conception of "bright"-economy signifies a new approach to economy that is beneficial to mankind, an approach that pushes the significance of money in daily life to the background and where, side by side with the notion of profit or capital interest, it is taken into consideration that mankind owes its life to nature. This means that, in that case, the natural laws must be indicative of what is economically possible and acceptable (Rifkin, 1980).

By pushing back the significance of money; skill, natural products, assistence and information will start playing a greater part than before. By the pushing back of mediating organizations mankind will have more to say concerning their own lives and work. The producer and the consumer that have been pulled apart by these mediating organizations approach one another until they are, if necessary, united in one single person.

	old strive for:	new strive for:
norms values	- growth security - high income, based on energy consumption - quantity - consumption	- development/change - sufficient income, based on conservation - quality - durability
organization	- from chain to chain and from chain to industry - aimed at anonimous markets - staffed with individual specialist	- intelligent and flexible enterprise remaining small - aimed at groups of people/ individual clients - staffed with people of broad development, working together
technique	- repeatable activities - uniformity - mass production - production efficiency - detour production - little information, much waste and much energy	- interchangeable activities - pluriformity - serial production - product applicability - self sufficiency production - much information, little waste and little energy

Fig. 9 The characteristics of new- and old economic thinking.

The MeMo-movement strives to establish a number of criteria for this bright economy. These criteria are established in a voluntary manner by people willing to create their own work, beneficial to man and its environment, expressed from within and out of their own free will. Going on strike simply indicates that the workers are not boss in their own home:

> "If they were, the idea of a strike would simply not arise. They would determine their wages themselves on the basis of their rights as owners. They cannot get any more wages out of the enterprise than they have put into it by their labour; the logic of this can also be understood without the mental capacity of a state functionary as intermediary. The workers must feel and know that they themselves are the owners of their enterprise; when this is the case they will apply themselves with their intelligence, solidarity and awareness to see to it that no trash is being produced and they will take care that a maximal performance will be attained with available means and also that everything will be done to continually improve technique and labour productivity. In short, they will do everything that was previously done by the private owners, but they will do it voluntarily because the business has become "their own business"." (Havemann, 1971).

Selfdetermination and selfsufficiency

A theory from which the contents of a bright economy can be deducted will have the previously described factor of selfdetermination as one of the basic principles. But a second principle, the tendency of which is also present in the Memo-movement and in Walden is of equal importance in the establishment of a bright economy. This is the principle that is becoming visible towards the end of the industrial age: The finity of the non-renewable sources of energy and raw materials. The "soft" ways of energy that were discussed in par. 4 of the previous chapter indicate the road along which a new economic order will have to move along.

The first murders, connected with the depletion of petroleum resources, took place in the United States in 1979. The alternative for panic and the spilling of blood is not an easy one. It is, in fact, the most difficult alternative that any culture has had to acknowledge since the beginning of the history of mankind. It took many thousands of years to accomplish the

transition from a hunters/nomads civilization to the agricultural society. It took hundreds of years to change from an agricultural working method to the industrial processes. However, in both these instances there was sufficient time to adjust to the radical changes prerequisite to the new economic relationships.

Today, we are forced to make the transition from the Industrial Age, based on the utilization on non-renewable sources of energy to a new age that, as was the case in the long ago past, will have to be based on renewable sources of energy and this transition will have to be completed within the next few generations. In proportion to the depletion of the available supply of non-renewable energy, regardless of whether this is petroleum or uranium, will the dissolution of the existing economic structure take place. The cracks in that structure are already visible and there is not enough non-renewable fuel left to carry out the necessary repairs. This then is the hard truth of the matter, that all of us, but in particular the economists, will have to face up to.

In the long run, the Solar Age we are just now entering into, will prove as different from the industrial civilization as were the middle ages from our own current age. The third world countries that have already developed a western economic system and, as such, is based on large quantities of finite sources of energy shall soon discover that they are no longer capable to provide a sufficient quantity of energy required to keep their economic machine running. This is particularly and foremost true for countries such as, for example, Brazil and Nigeria. (Rifkin, 1980).

It is the western countries that through the transmission of their own technology, effectively prevent the development of selfsufficiency, amongst others based on solar energy, in most of the third world countries and this in spite of the fact that solar energy in the third world is far more readily available than is the case in the industrialized countries of the west.

The humane aspect of the MeMo enterprises includes the principle of selfdetermination. The people themselves determine what is to happen within the organization wherein they are employed; oftentimes, the enterprise is in collective ownership of the workers. The humane aspect of MeMo enterprise has to do with the principle of selfsufficiency, because technology makes us ever more dependent upon nature even while simultaneously alienating us from that nature:

We have become more dependent, because we have demanded ever increasing quantities of energy from nature in order to support our own cultural patterns and our own personal living styles... the gigantic flow of energy into the modern industrial society, has created a gigantic chaos in the world where all of us must live. The more streamlined we manage to make our technology, the faster the available energy will be consumed, the faster will the process of conversion proceed and the greater will be the chaos. (Rifkin, 1980).

Selfsufficiency breaks the vicious circle of trying to solve the problems with yet more technology. It leaves mankind with the possibility to determine for oneself just how far to go with causing damage to the living environment, without the pressure of having to create a product that makes him dependent on international markets.

The transition of the economy based on mass production to the economy based on selfsufficiency is not caused by a decrease in the demand for products, but rather by a decrease in the supply of inexpensive energy. Therefore, the new economy will not simply replace the old one, but gradually take it over as part of a development towards selfmanagement and selfsufficiency. The industrial age is coming to its end and merges into the age of information, an age that demands adjustment to expensive energy and raw materials and with cheaper labour.

The time that humanity could afford to cut butter with a chainsaw has gone, as has been stated by Amory Lovins when he discussed the social usefulness of nuclear energy.

The relationship between labour and energy has drastically changed. The costs for the production of energy are ever increasing for reason that it takes more labour to produce a given quantity of energy. Towards the end of this century, the relation between the hourly wage of a worker and the real costs of a barrel of petroleum will be about equal to the relation as it stood at the beginning of this century, i.e. approx. 4,8 hours labour/barrel. This factor, between 1970 and 1973, was 0,6 hour labour/barrel. The relation between labour and energy, between 1900 and 1970, has decreased by a factor 8 and thereafter, since 1970 and up till 1980 it has increased by a factor 35.

The secret of a succesful new economy lies in the acknowledgement of

these altered relations. The time of economics of scale is past. A cultural revolution of a kind will break through in the field of enterprise. There'll be a higher quality of labour and more information put into the products of the future by people that know how to function autonomously with energy-conserving techniques that are beneficial to the environment. It is not the money, the capital that will be the determinant factor for the success of this new type of entrepreneur, but rather his understanding concerning the alteration in the relationships between a mankind striving for autonomy, the urgent need for protection of the natural environment and the attractiveness of a product with much information and little energy content and consumption.

The Memo enterprises form a essential impulse towards a society that is beneficial to men- and its environment and where the central question will be answered, a question that every culture in history must answer "how should mankind behave itself in the world". According to Rifkin, the law of entropy provides the complete answer to this question:

- "The maintenance and fortification of life in all its forms demands the availability of energy. The more energy available, the greater the prospects for the possibilities of life in the future" (The law of the conservation of energy).
- "However, the second law also reveals that the available supply of energy in the world is being exhausted at every opportunity. The more energy each and every one of us utilizes today, the less there will be left for those people that come after us. We, therefore, have a moral obligation to waste as little energy as is possible; only in this manner can we express our true love of life and the continuous development of all that is living".

Walden and MeMo were born of urgent necessity to set out in a different direction. Appropriate Technology can support such efforts of development. In principle this would seem an easy task: Technology needs to be adjusted to mankind and its environment, but still.

3. Simple is not an easy matter. A comparison of several trends within the field of Appropriate Technology

In 1979, Van Bronckhorst at the University of Technology in Eindhoven, The Netherlands, gave a parting speech to close off his career as professor and chairman of the faculty of Appropriate Technology. His speech was an attempt to summarize all that had happened to his field of endeavour and what was happening at the moment and he concluded with the question: "What precisely may be considered Appropriate Technology and why should it be a specialized field of endeavour?"

> "During the course of recent years much has been said and written concerning Appropriate Technology, giving evidence of great diversification. On the one hand some consider it of great importance while others deny such importance entirely. Appropriate Technology is, in the first place, a field of study that is moving very fast, with a great many people involved. A recently published book by the OECD in which all persons, groups, institutes etc. are included makes mention of more than 1000 instances involved; this number was reached in about ten years. When, back in 1970, I entered into this field of endeavour I found only a few isolated people who, armed with a small book "Small is beautiful" carried the gospel of a new economy, E.F. Schumacher's message. A message with an economy as if people matter". (van Bronckhorst 1979).

According to van Bronckhorst there is an increasing degree of experience that expresses itself in vast quantities of books, articles, magazines but also in a number of controversial issues. He claims that four of these issues are as follows:

- The question if Appropriate Technology is capable to yield a significant contribution to the field of small-scale, labour-intensive production methods.
- The crucial question if Apropriate Technology is capable of promoting employment opportunities at minimal costs.
- The possibilities to, with the aid of Appropriate Technology, establish self-reliance on the part of persons, areas or countries.
- The possibility to, with the aid of Appropriate Technology fulfil basic requirements/needs.

Actually these four questions deal with one and the same problem.

Schumacher, one of the founders of the Appropriate Technology movement has said "Appropriate Technology is, in fact, a question".
It is the posing of a problem, a problem having to do with the arrangements of our existence. Kranzberg puts it the other way around:
"The question for which technology is the answer, is, in reality, a question having to do with values and living styles". (Kranzberg, 1981).
Rifkin has another answer on what precisely technology is.

> "Remove all mysticism surrounding technique and what remains, naked and vulnerable, is a converter. Every form of technology ever conceived by men is nothing more than a converter of energy out of nature's resources. During the process of conversion energy flows through culture and the human system".

Technique and technology

Thus far we have established four opinions concerning technology:
Rifkin: Technology is the conversion of energy, i.e., a conversion-process.
Van Bronckhorst : Appropriate Technology is a process of learning.
Schumacher : Appropriate Technology is a question.
Kranzberg : Technology is an answer.
As has been stated in the first chapter "Technology and society", technology contains a visible part consisting of techniques and technique-producing institutes and an invisible part, the ideology, which is the governing principle of the visible part. Rifkin discusses primarily technique. Kranzberg makes a clear division between the ideology, i.e. the code of technology which, to him, is the question and the visible technology, which is the answer to that question. To Bronckhorst technology only becomes appropriate if its coming into being is supported by a process of learning.
Schumacher appears to be particularly aware of the fact, that whatever form is given to technique and organization it should be determined by questions posed by society and only from this basis can Appropriate Technology come into being.
In this publication the starting point of technology is that it consists out of a super-structure, its code and invisible part and a substructure, technique and organization, its social structure and visible part. Technique and organization are an everyday occurrence in the fabric of society. The code, the dominating ideology, is the program out of which that fabric comes into

being.

The factor that turns technology into Appropriate Technology is that both the code as well as the technique and organization are aimed at selfreliance and on the satisfying and fulfilment of the fundamental needs of the people and through the people themselves, from the basis of society. The coming together of the various currents in Appropriate Technology, discussed by Bronckhorst in his parting speech consists in my opinion, out of two elements:

1. Centripetal force of Appropriate Technology: "Mankind itself", as against the centrifugal force of Industrial Technology (large-scale activity and international markets").
2. The breaking through that petrification that characterizes contemporary technology, probably caused by the petrification of its code.

In the following paragraphs a number of currents in Appropriate Technology will be compared.

We may differentiate between three different types of currents in Appropriate Technology.

- A current that involves the superstructure, norms, values, ideals and ideologies.
- A current that involves the substructure which can be divided into a field of interest that finds the organizational regulations which form the organization of society as being the criterium and a field of interest that views technical provisions as a means to change.

Naturally, these currents do not occur in separate pure forms. For example, the current that is involved with the code, norms, values and living styles can be found particularly with the so-called critical scientists; however, the scientists are not concerned solely with this, but also with the direction of the research at the universities, institutes of technology and other research institutions.

Technique as a means to change is found particularly in the world of the engineer, but also with economists, like Schumacher. The organization of society can be viewed as a political problem. An author like Dickson views, for example, the production of alternative technology in the first place as a

political/organizational matter. From the aforementioned it may already have been deducted that technique, organization and ideology are closely interwoven. For this reason it would be difficult to imagine that a technique of craftsmanship could be produced in a large bureaucratic organization.
It is also impossible to imagine the management of a nuclear power plant in a democratic fashion.
The ideology of the members belonging to environmental protection movements cannot be combined with the technique and organization of an oil refinery.
In the following paragraphs three examples of currents within the Appropriate Technology Movement will be discussed.

I Intermediate technology: the current of mankind and technique

Ernst Schumacher is one of the Godfathers of the Appropriate Technology movement. He was born in Germany and left that country in Hitler's time. He is an economist. During the war he worked as a farmhand and in the evenings he wrote concerning monetary problems. He became a member of the control commission in charge of the reconstruction of Germany and wrote lead-articles for "The Times". In addition, he worked for twenty years as economic advisor for the British Statemines, where he effected a high degree of decentralization. Professor Schumacher has become famous by his book "Small is beautiful", that moves him into the field of development of the Third World. The "Intermediate Technology Development Group" in London, founded by him, puts his ideas into successful practice. Even though Schumacher is an economist by profession, his book, nevertheless, has more the character of a philosophic dissertation concerning technology. Schumacher's basic idea is that mankind should not eat into its living-capital. Nature is the basis of life for humanity. Eating into nature is equivalent to eating into the living-capital of humanity. To solve this problem of eating into our living-capital, we have to develop a life-style that is based on durability. The unbridled growth that, according to modern economy, is both desirable and feasible has, according to Schumacher, two limitations:

The quantity of available raw materials and the limited capacity

of the environment to maintain itself under conditions of continual depletion.

By the systematic stimulation of envy and desire it is, according to Schumacher, possible to influence mankind to such a degree that his intellectual capacities become degenerated to a point where he can no longer understand his dependence on nature.

The leading principle of humanity should be the insight into the necessity of durability.

That durability should indicate to science and technology the new direction towards the soft, the non-violent, the beautiful. For this, working methods and tools are required, that are:

- cheap enough to be within everybody's reach,
- suitable for utilization on a small scale,
- meet with the human demands of creativity.

These are the basic thoughts behind Schumacher's "economy". Schumacher has also stated that the "goods" that form an inescapable condition for economic activity, are not a part of the modern economic theory. Those are: air, water, the natural resources; in fact,the total frame of animate- and inanimate nature.

The economy of Schumacher stands in opposition to the modern economy, that is a result of thinking in terms of money, while, according to Schumacher, thought based on the principles of durability and non-violence would yield a better economy. In such an economy labour would serve to develop the capabilities of mankind, necessary to insure a dignified existence. Mechanization is only beneficial inasfar as it enlarges these capabilities.

The aim of economic activity is not to obtain goods, but rather to obtain a humane existence. According to Schumacher, modern economy passes-by entirely the needs of the poor, while these are the very people that are in need of development.

The ideology of the superstructure is, again according to Schumacher, today defined by intellectually developed people from the following six major thoughts:

- Evolution: The higher develops, as it were, continually out of the lower.
- Competition: The strong overcomes the weak.

- Economy: The activities of people are aimed at economic interests.
- Inhibitions: The desires of people are caused by the unfulfilled desires of their youth.
- Relativism: Absolute truth does not exist; there is only the here-and-now.
- Positivism: Valuable knowledge can only be acquired from observable facts.

These six modern basic thoughts deny, in fact, any higher state of mind or being. The presence of a centre in men, a self or a higher ordening principle cannot be found in the modern basic thought.

In this entirely materialistic conception of our existence, agriculture serves only as a means of food production, however, agriculture also serves as a means for establishing contact with nature and the humanization of the environment out of the principles of health, beauty and durability. In our current system the question is not what is permissible in relation to people and the environment, but rather on what we want to spent our money.

The most significant characteristic of modern industry is that it requires a great deal of money, intelligence and materials, without having any noticeable beneficial long-term effects. Schumacher cites as an example the United States that with 5,2% of the world population, consume 26,8% of all available energy (1980). What is supposed to be the most efficient country in the world, is, in fact, irresponsibly inefficient. The real question is, therefore, if, in practice, we are capable of developing a technology that is really of aid in solving the problems of life, technology with a humane countenance. It is not a matter of mass-production, but of production for the masses, with the utilization of the best of modern knowledge and experience. Schumacher has termed this "intermediate technology", exalted far above the tenets of primitive technology, but, at the same time, far simpler, cheaper and freer than is the supertechnology of the rich.

According to Schumacher, the most important development-philosophy of the past twenty years was: "What is best for the rich, must also be the best for the poor", however, development does not start with goods, but rather with people, with education, organization and discipline. People are the first and the last source of all prosperity.

Therefore, development aid should in the first place be aimed at the

instilling of selfconfidence and independence and on knowledge and methods of work that promote selfsufficiency. Only if the standard of living in the rural areas can be increased will it be possible to fight the calamity of unemployment and mass urbanization. This can be accomplished by the development of a countryside-industrial culture. Motivation, knowledge, capital and market outlet have to be the sources of this culture.

The decisions that have to be taken for this culture must be based upon the judgments of mature people, non-electronic brains, that are capable of viewing a matter in its totality and in this there has to be an adequate equilibirum between its central order and its peripheral liberty.

The private possession of means of production is a restriction imposed on liberty, because it causes matters to be viewed in a narrow- and egocentric manner. Private ownership on a larger scale places the owner in a position to be a parasite on the labour of others.

Schumacher's school of intermediate technology is, in essence, a total teaching, with a superstructure that he has derived from the tenets of Buddhism. In his design for the sub-structure however, Schumacher places the accent on the technical provisions.

The making of connections with organizational regulations is present only in a rudimentary form. But it is not without a reason that Schumacher is called the father of the Appropriate Technology movement, since it was he that has placed the most important problems of western science and technology in the framework of economy and technique. His intermediate technology developmentgroup in the United Kingdom is, therefore, one of the most important institutes of Appropriate Technology in the world.

II Alternative technology; a current directed at mankind and organization

Another well-known author in the field of Appropriate Technology is David Dickson, who wrote "Alternative technology and the politics of technical change" (Dickson, 1974). The object of this book, according to Dickson, is to discuss the social function of technology. Dickson has the viewpoint that technology plays a political part in society. A part that is ultimately connected with power and the exercise of social control. It is Dickson's aim that production is performed in a non-suppressing and non-misleading manner, so that the natural environment does not become depleted. His starting point is that this can be accomplished within the framework of an alternative society. His conviction is that the roots of the problem with modern technology can be found in the design as well as in the utilization of technology. The solution for these problems can only be found by a radical turning about of the technological- and industrial principles of society. Dickson also defines as cohesive elements in the Appropriate Technology movement, the minimal utilization of non-renewable raw materials, the minimal modification of the environment, regional or local selfsufficiency, the putting an end to the alienation and exploitation of mankind. Therefore, technology should in the first place be designed to fulfil human needs. Problems such as could conceivably arise, should be taken into consideration prior to the design of technology rather than afterwards. The traditional interpretation of the aims of technological innovation, however, is to enhance the efficiency of industrial production.

Industrialization is put on a level with modernization, modernization with progress and progress with a better and healthier life for everyone.

This ideology hides the true face of the political abusive advantage taken of fellow human beings and the natural environment through the development of modern technology.

The guiding principle is, according to Dickson, the political impartiality of technology. Technology is only a free-of-values instrument that can be employed in either a good or bad way. Still, industrialization produces a technology that is a direct image of the ruling ideolo-

gy, the (pre) judgements of the leaders of the industrial state, namely the selfevident necessity for domination of the masses by these leaders and their scientific advisors and, accordingly, the social control over all other human experience.
Contemporary industrialization, according to Dickson, may be compared to magic: Perhaps "technique" does not always work, but that was probably due to human error in connection with the contacts with the supernatural. An error that will be corrected next time around.
The production method that, since the industrial revolution, has developed in an image of the original production relationships: the class relationships in industrial capitalism. In this connection innovation is not only of importance for the enlargement of the efficiency of the production, but equally so for the maintenance of the relationships of authority and the subjugation- and fragmentation of labour.
Dickson views the history of technology as a historic alteration in domination of mankind by nature to a domination of mankind and nature by mankind. However, the dominant viewpoint is currently that there is only the situation of a mutually dependent relationship between technological- and economic development, without any political content.
But technology can also be viewed in social- and political terms. From that viewpoint, technology is the expression of values and principles of the ruling social class expressed in the economic need to submit the labour class and to govern the supply of natural resources.

Alternative technology

Technological transition should therefore, according to Dickson, be seen as a political process, that reinforces, maintains, enlarges and protects the interest of the ruling class. This means that the development of a non-alienating, non-depleting technology demands more than the superficial change in relationships of possessions of machines. According to Dickson what is needed is a complete reform of our political and technological consciousness. From this viewpoint of alternative sociological development, new instruments, machines and techniques should be developed.
Essential for this Appropriate Technology is the coherent viewpoint

on values and style of life (the superstructure) and its connection with the technological substructure. The characteristics of this technology are as follows:

- To work with it gives satisfaction
- The producer, as well as the community for which the products are intended, are in control of the technology.
- It prevents depletion of the natural resources.
- It inflicts only negligable damage to the environment.
- It is aimed at low profits and slight riscs.

For the design of, what Dickson terms the technology of the future, three conditions must be met.

1. The absence of accuracy. There are no ready-made generally valid design formulations.
2. The going together of technical-, social-, political- and ecological conditions.
3. The need to no longer take economy as the primary norm that sets the value of human endeavour and the utilization of the natural resources.

The technology of the future knows four sources of energy:

solar-energy
wind-energy
hydraulic power
biogas

in conjunction with the employment of animals and human labour. Dickson is critical concerning intermediate technology, Schumacher's idea. Oftentimes this is liable to degenerate to a point where it serves to reinforce the ideology of industrialization, because, according to Dickson, technological renewal is viewed by Schumacher a being a neutral process.
Again according to Dickson, intermediate technology carries within its content the danger of small-scale capitalism, with the very same inevitable negative consequences as does the current industrial technology.

A technology that is truly appropriate can only come into being through a demand originating with the people by which and for which it is to be utilized; at least inasfar as they know and understand their own political-and economic power. Technology is the language through which social activity is expressed and technology as a social institution plays a direct political part in society.

The message of the industrial state is that in order to reach a politically neutral- and businesslike solution, it is necessary and sufficient to approach a problem in a technical-scientific manner.

It is not the development of technology for the benefit of humanity that is important for the industrial state, but rather the belief that science is necessary and that the way in which science and technique are currently employed is the correct way.

Like Schumacher, Dickson also has a vision, though somewhat less abstract, concerning the superstructure of society, but he puts the accent on the substructure of political-organizational regulations in society. In this he is very much aware that selfdetermination by itself is not sufficient. Complex, advanced technology cannot be of satisfactory application in this connection, since in order to utilize such technology in an efficient manner it is necessary to rely on a non-democratic organization of technical specialists. Like Schumacher, Dickson indicates various points of connection as to what should be changed, particularly in the political-organizational substructure and in the superstructure of values, judgements and life-style, however, like Schumacher, he pays little attention to the coherence and interaction such as exists between the substructure and the superstructure.

III Currents primarily aimed at the technical provisions of the social substructure

The United Nations family is also involved with Appropriate Technology. The department of Technology and Employment opportunity of the International Labour Organization (ILO) and the United Nations Development Organization (UNIDO) have published books concerning Appropriate Technology. The ILO proposes a world-program for Appropriate Technology (Bhalla, 1979). According to Jéquier the

Appropriate Technology Movement has outgrown the first generation, that was characterized by the coming into being of small groups of socially-moved people who experimented with windmills and small stoves capable of burning almost anything as fuel.
The second generation is the coming into being of institutes, the official recognition of Appropriate Science as a faculty and also the coming into being of more efficient lines of communication between the renewal-system of Appropriate Technology and the money- and investment system. Ultimately, so asssumes Jéquier, there will be a national and an international Appropriate Technology policy, aimed at the fulfilment of basic living requirements of the poor in the third world, i.e. the third generation.
Jéquir places the Appropriate Technology Movement in two great families:

- the family of the industrialized countries, concerned with environmental problems, scarcity of raw materials and the technology of the industrial state.
- the family of the development countries, concerned with problems of poverty, social inequality, employment opportunity and basic living requirements.

Even though he summarizes a number of important ingredients belonging to a vision on Appropriate Technology, his most significant observation is probably that appropriate- and industrial technology are not opposites but rather that they supplement one another mutually.
Frances Stewart, author of the book "Underdevelopment and Technology" (1977) that describes the slight possibilities for the future of Appropriate Technology from the viewpoint of an economist, contributes to the aforementioned program concerning Appropriate Technology of the International Labour Organization. She considers that a serious obstacle in the further development of Appropriate Technology is the lack of easily accessible information in this field.
The thing that Stewart and Jéquier have in common is that they, in fact, acknowledge primarily the technical aspects of Appropriate Technology, but that they touch on the connection between tech-

nique and organization only slightly, not to mention the code that provides modern technology with its various insights. The same holds true for the United Nations Organizations for Industrial Development (UNIDO) which does not rise above the level of the technical-organizational substructure of society in its various statements concerning industrial technology. According to UNIDO, the term "appropriate" applies generally to: labourintensive, small- scaled and connected to the traditional techniques that are present (UNIDO, 1979).

Tinbergen, in these UNIDO publications, indicates a number of research subjects for Appropriate Technology, such as:

- self-provision of food, preferably with natural fertilizer
- production of biogas and protein on the village level
- selfconstruction of housing
- labourintensive industrialization

Tinbergen, like the others, does not progress beyond propositions for the technical-organizational substructure, as was also the case in his well-known frame-work for a New International Economic Order. What unites the United Nations family is its restriction of speculations concerning Appropriate Technology to the substructure of society, which can be easily understood.

It cannot be expected of the United Nations that they undermine the power of the industrial countries. By not discussing the code that is the basis of the system that dominates the world, the danger of its negative affectation is reduced.

At the same time it indicates that it is assumed that Appropriate Technology has to be, or can be fitted into the existing system. This is incorrect. Appropriate Technology does not strive only for a different substructure of coherent, self-governing organizations and selfproviding techniques, but it is, in particular, the code that is utilized, that is the determining factor in the possibility to develop Appropriate Technology in a society. When viewed in this context, it is easily understood that the basic strategy-of-needs of the International Labour Organization mentions only technical means, such as food, housing and medical care and pays no attention to other basic needs such as mental freedom.

Also at the many technical universities it is felt that Appropriate

Technology-institutes can be afforded. As is the case with the Institute of Technology at Delft, The Netherlands. "Simple is not easy" is the title of the paper on policy published by the Centre for Appropriate Technology (CAT) at the Institute of Technology at Delft (TH Delft, 1979). (This centre is now called Centre for International Co-operation Appropriate Technology, CICAT).

What the title of this paper indicates is that the design and implementation of simple technology is not a simple matter.

> "Whereas in technique we are concerned with either a "good"or "bad" design, where good and bad are indications of optimum functions that are dependent on:
>
> (a) the level of technical knowledge and the available means and
>
> (b) the social requirements.
>
> With (a) we are concerned with the internal characteristics of efficiency and with (b) we are concerned with the external characteristics of the efficiency." (Rademaker, 1981).

Even Appropriate Technology, in most of its descriptions, is primarily directed at the substructure, that is to say, especially on the internal characteristics of technical- (organizational) efficiency. Efficiency in the sense of satisfying social needs is not being strived after in the current reality of Appropriate Technology. In my opinion this is due to two essentially different causes.

One is a pure technical cause, namely the fact that it is very difficult indeed to, based on todays technical-scientific knowledge, come up with a design that is at the same time simple and efficient and a more basic cause having to do with the manner in which the engineer, as a creator of technique, is being educated, i.e. the way in which he thinks. Wouter van Dieren terms this "tunnel-vision", which is characterized by the assumption that it is possible to isolate one part of a system while at the same time perceiving it as the total. But the entire system has its own laws and after a while the forgotten parts, in their turn, come to demand their rights, a phenomenon that is termed "negative effects" by the field of economy and "feedback" in the field of systems (Van Dieren, 1981).

In traditional science- and technique the consequence of tunnelvision is that technical application is viewed as being isolated from the

influence of such application on culture and environment. An engineer trained in the traditional manner, even if he were capable of freeing himself from tunnelvision, is still left with the problem of the institutions, the organization of the society. Van Dieren (agreeing with Dickson) states as follows:

> "Alternatives may be technically conceivable and sometimes more attractive economically, institutionally speaking they are, for the time being, not feasible. These institutions consist of laws, regulations, commisions, advisory boards, departments of policy and credit systems that are not hanging loose in the air but that are inseparably connected to the traditional, non-alternative technique".

Where, out of pure technical consideration, it already proves difficult to create an efficient piece of Appropriate Technology-apparatus (plus the fact that only little money is being spent on Appropriate Technology), in addition, it is the thinking of the engineer that leaves him practically incapable to work efficiently on Appropriate Technology. And by the prevention of the social change, that inspires the movement of Appropriate Technology, those that manage to free themselves of tunnelvision, run with their heads against the wall erected by the traditional social structure that prevents them from realizing their ideas.

Since this chapter deals with the essential content of Appropriate Technology, it would be well to make a few remarks concerning its criticisms such as are set forth in the following paragraphs. This criticism on Appropriate Technology deserves special consideration, since in our world criticism has taken on the character of control. Just as long as something fits into the existing order, it receives positive criticism; if not, it is condemned and left powerless.

In his book "The one-dimensional man", Marcuse enters into some considerable detail concerning the paralyzing effects of criticism on society, together with the forms of control and encapsulation that are an intimate part of it:

> "Below the surface of the striking dynamics of this society hides a totally static system of life. The encapsulating influence of technical progress is proportional to its rate of growth in the established direction. The better technology appears to be capable of creating the conditions necessary for peace - this in spite of the political fetters that are imposed on it - the better mankind becomes physically and mentally equipped to oppose this alternative". (Marcuse, 1974).

The making free of tunnel-vision is one of the most important aims of Appropriate Technology; this is one of the reasons why Appropriate Technology may also be termed: "technology for emancipation".

In the following paragraph it will be considered into which framework the concept of Appropriate Technology may best be fitted.

4. Appropriate Technology as framing-concept: selfdetermination, selfprovision and selfdevelopment

From the chapter dealing with Technology and Society it would seem that, in order to know precisely what Appropriate Technology should be, it needs to be clarified first what is to be accomplished by it. The proof of technology is in its appropriateness. The term "appropriate technology" is of great significance for, as they say, "Nomen est Omen". A summary of the various names by itself would already be a good starting point for a definition of Appropriate Technology:

Soft, intermediate, radical, alternative, waste, ecological, democratic, peoples', humane, small-scale, simplistic, village, organic, peacable, labour-saving, rural, decentralizing and non-alienating technology. Most of these names were already being used prior to 1970.

Since the beginning of the seventies the term Appropriate Technology (aangepaste technologie, angepasste Technologie, technologie approprieé, technologia appropriada) is coming into common usage. The coming into being of a name indicates that Appropriate Technology is gradually becoming a world movement. The isolated elements to be found in the various names gradually find their place within the frame-concept "Appropriate Technology".

Witold Rybsczynsky titles his book, in which he discusses Appropriate

Technology critically, "Paper heroes", (1982), each with their own ideas that, oftentimes, do not reach further than the paper they are printed on. In this, he underestimates the power of the idea and the restrictions that are imposed by the code of our society, also on him. The phenomenon that Appropriate Technology is a world movement, provides an attraction to define Appropriate Technology as framing-concept in which other concepts can be included as a part of the total.

This can be accomplished not only by taking these specific viewpoints, such as technical, organizational or religious by individual writers or specific groups as a starting point, but especially by a communal mankind and society picture of the "Appropriate Technology movement", the superstructure in which persons and basic groups in a society themselves feel free to utilize technology in order to give expression to their living and working.

In the magazine for Intermediate Technology for Great Britain, John Davis discusses the way in which this may be accomplished:

> "Already for a long time I have expressed my conviction that in order to create a future that is capable of supporting life, the average energy consumption per head of the population must be reduced from the current consumption of 2,5 ton petroleum/head in the cold northern countries to 1 ton/head of the warm southern countries (half of the northern consumption is used for heating). This means that Western Europe has to reduce its consumption to 1/3 of the current level.
>
> I believe that it is technically possible to design systems that make these savings feasible, without demanding clear-cut sacrifices of the quality of our existence..... As compared to the alternative of a society with a high consumption of energy, it would make the practical difficulties for a low-energy future much smaller" (Davis, 1980).

Davis further states that the conservation of raw materials is one of the central subjects of Appropriate Technology. Appropriate Technology, that properly fits into a society based on conservation, a technology of "scarcity". The economy of this conservation-society, claimes Davis, provides high living standards, a minimal utilization of raw materials and energy (and, thus, a minimum of pollution) and a high degree of personal- and communal satisfaction, together with harmony with the environment.

All these are, in fact, aims and answers on questions of living styles and

values. This also holds true for his remarks concerning employment opportunity:

> "There are two fields that are clearly open to a net increase in employment opportunity and also in quality of labour. This is in the first place a moving away from the manufacture of products to repair, renovation, re-utilization and recycling and, secondly, the replacement of an agricultural system dependent on chemical products to organic forms of agriculture".

According to Davis the lack of interest for these possibilities of employment opportunity is due to the absence of a powerful lobby for this purpose. It would seem better to state that the importance of Appropriate Technology is not yet understood. In order to accomplish this it is necessary to establish, in the first place, a becoming aware in society, both at the top and at the basis, that it is the code that gives form to technology and that it is useful and necessary to, within the existing dominating technological system, create room for an entirely different technological system that is inner-directed, based on products for local, regional and national areas that are produced in self-governing organizations, based on a code protective to mankind and its environment.

Appropriate Technology inner-directed on the life and work of the people themselves and on solidarity with others, based on their own development, their own management and their own provision of living requirements. The code of Appropriate Technology is aimed at survival, while the code of Industrial Technology is aimed at wasteful consumption.

The becoming free of the consumption-thought that we can only become happy by wasteful consumption, i.e. de possession of more and more articles, is a part of the code of Appropriate Technology. Becoming free also of the fear that an existence in which it is necessary to relate to the environment thriftely and with respect, would not lead to a satisfactory existence. Ultimately, this could also lead to the solution of the Third World problem because it would then no longer be necessary to, for the benefit of prosperity in the industrialized countries, keep the Third World poor.

5. The component parts of Appropriate Technology-vision: technology for liberation

In the following paragraphs the component parts of an Appropriate Technology vision will be made mutually coherent, meaning that a model will be constructed. The weakness of any model, not excluding ours, it that it can never be more than an image of reality. Reality is always, fortunately, infinitely more complex than the model. Still it is both useful and necessary to have a model available because, if it is a useful model, it presents the possibility to make connections, gain insight into problems and give impulse towards solutions.

In the first place, the connections will be made between the requirements of people, the means to fulfil these requirements and the tools to produce these means. The basic assumptions will be that requirements, means and tools are inescapably tied to one another.

Needs, means, tools, - a trinity

Appropriate Technology has to be based on the real living requirements of people. A basic problem in Appropriate Technology is, therefore, the determination of these requirements; i.e. not by what the Appropriate Technology-engineer has thought up but by the requirements determined by appropriate research and dialogue with a specific basic group in its own environment.
This is easier said than done. However, a great deal of research in this field has already been accomplished that can be used for Appropriate Technology.
According to Maslow, there are five fundamental types of needs.
He distinguishes between physical-, security-, social aproval- and developmental needs (Maslow, Dutch translation 1972).

1. The physical requirements serve to maintain the organism, such as the requirements for the means of food, sleep and shelter.
2. The security requirements are concerned with a predictable condition of order, safety and security in connection with the satisfying of physical needs.

3. The social requirements are of a dual nature: the need to belong to something, a family, an organization, a society, a company and the need for affection, friendship and love.
4. The need for approval, which is also split into two parts: the need for respect- and esteem of others for personal qualities and performance and the need for selfrespect, selfreliance and independence.
5. The highest need is that of selfrealization: the need to become who you are, the need for self-actualization.

For the work in Appropriate Technology the previously mentioned simpler scheme of requirements of Alderfer, (deducted from Maslow's model), is useful. He distinguishes:

- Extistential requirements necessary for the maintenance and safety of life.
- Relation requirements are applicable for all human relations.
- Growths requirements are rooted in the wish to change, to develop oneself.

In the above, it is assumed that in order to secure a humane existence the order in which these requirements are arranged is of no consequence, but rather the balanced distribution of the requirements. In Appropriate Technology it is essential to know what the requirements of the basic-group are and the measure in which they are met. This order of requirements from 1 to 5 is, according to Maslow, of great importance: the higher requirement comes into being on the basis of the fulfilment of the lower requirements. As one of Maslow's students tried to show, this order of requirements is most likely valid everywhere (Aronoff, 1967). Needs are always met with something: with food, with medicines, with a house, a telephone, a means of transport or with a book. The translation of needs to means can naturally not be valid universally, since such a translation is strongly dependent on culture and environment. The translation of needs to means, in conjunction with the basic-group, is necessary in order to know what Appropriate Technology must make or aid in making, must organize and discuss. In the practice of project work, the demand is oftentimes for means and the problem is how to gauge the underlying requirements that possibly could or must be translated in a different way, in terms of useful means. This is especially important when the means requested are not available and can be replaced by an available alternative. In view of the aforementioned it

would be sensible to distinguish between needs, means and tools; more so, since the risk of loosing track of the underlying requirements would perhaps result in a purely technical approach in terms of tools and means. For example, fuel for the preparation of food is in many development countries a serious problem. Biogas might well be an excellent possibility, however, it may not be culturally acceptable since this gas for cooking is derived from human- and animal waste. This means, that not only the means "energy for preparation of food", but also the tool in the broad sense of the word (the production process, the tool that is used to produce the means, the organization), is of importance and that the translation of needs to means and from means to tools needs to be accomplished in a careful manner in connection with social-cultural and technical-environmental circumstances. Furthermore, needs play a significant part in the process of change. The process of change itself can, in fact, be an obstacle in the way for the need of security. When change occurs certain things disappear that pose the question of which needs were met by the disappearing item. A careful determination of need is therefore an essential step in the process of Appropriate Technology.

The fear of change is possibly one of the central problems where it concerns beneficial change. As was mentioned previously: change is an obstacle in the way of the need for security. This will be disussed in the following chapter under the paragraph: a strategy for change, the attainable ideal. Ways of change are of great importance to the realistic introduction of Appropriate Technology, because Appropriate Technology would have its influence in many areas of society. Van der Graaf(1980) gives a summary of the various pathways to change. These ways to change are an important factor in Appropriate Technology because society will have to drastically change on several points in order to be able to introduce Appropriate Technology. Van der Graaf mentioned three ways of change in the organization of society:

- The experimental intellectual way
- Training for change through personal growth
- The utilization of power

The experimental/intellectual method has as starting point that there is a harmony of interest of all those involved. The negative consequence of the snow-mobile revolution was an example of the fact that few people are

inclined to give up power once they have got it.

Training for change is aimed at the change in behaviour, particularly as applied to groups. The development of organization is a method to bring an organization and its participants to a greater degree of maturity. Development of organization is aimed at co-management. Here also the relations of power oftentimes stand in the way of real change. The exercise of power is based on the imposition of the will on others by way of reward, punishment, regulations, the setting of examples and expertise: the exercise of power is, in fact, the simplest manner of work.

The ways of change by means of selfdevelopment would seem best for the superstructure of society in combination with an experimental intellectual way of change that leads to the fulfilment of needs that is in harmony with the environment for the technical-organizational substructure.

Means and tools belong to the field of technology. The means used by Appropriate Technology are selfdevelopment, selfdetermination and self-sufficiency. The tools to produce these means are emancipation, organizational regulations and technical provisions. This can be schematically shown as follows:

needs	means	tools	
development	selfdevelopment	emancipation	superstructure
relation	selfdetermination	organizational regulations	
existence	selfsufficiency	technical provisions	substructure

Fig. 10: Relation between key-concepts in Appropriate Technology

- Selfsufficiency is described as the means to fulfil existential needs with technical provisions that are being manufactured nearby the basic group in the section, village or region.
  This, however, is neither completely possible nor desirable in all cases, for reason that mutual dependency between economically equal partners may be very useful. Techniques of selfsufficiency are aimed at making maximal utilization of locally or regionally available raw materials and skills. The ultimate goal is the enlargement of economic independence through fulfilment of existential needs.
  The term "self" in this instance relates to the utilization of locally or regionally available raw materials in the natural environment as well as to personal and group skills.

- Selfdetermination means that people, in particular the local and regional groups such as ethnic-, national- and geographic groups, keep their own organization and have ownership of the means of production.
  Selfdetermination does not mean that there would be no division of labour or grades; it means that the groups involved choose their leaders if necessary, determine the organization and decide concerning the policy that the leaders have to carry out. The ultimate objective of selfgoverning organizations is to have political independence through satisfaction and fulfilment of the need for relations. "Self", in this context, means the co-operation within the group: the company, the society, the union, such as can be found within the cultural reality in the village, area or country, (Harper, 1972).
  With organization-regulations aimed at selfdetermination and technical provisions aimed at selfsufficiency, form is given to the social substructure, the fabric of technique and organization. It is assumed that emancipation, liberation and the consequent coming into being of the possibility for selfdevelopment will give substance to the program, the code for the substructure.
- Selfdevelopment, in this context, means the process of emancipation that is found back in many of the liberation movements over the entire world, such as the farmers in South America, the Basks in Spain, feminism, etc. but also in the development of the individual to a person. This means that people become aware of their own skills and needs and of the restrictions imposed by the living community of culture and environment. The aim of

selfdevelopment is a fulfilment of the need to develop in relation to "the other" and "the different". By the term "individual" we mean a human capable of saying "I", while with the term "person" we indicate an individual that is aware of its own being and has developed the interrelated concept of his own felt needs.
Out of the development of the individual to the self-aware person, from persons to liberated groups and from groups to communities that stand in solidarity with one another, comes into being the basis of a society-structure that is directed at selfreliance.

The Appropiate Technology movement, an impulse to the formation of theories.

In an excellent article that summarizes the movement of Appropriate Technology and its literature, a review, Malcolm Hollick (1982) shows the coherence and the incongruities of this movement.
The movement envisions a society that is decentral and places the accent on the small communities rather than on cities. Every community is relatively selfsufficient, utilizes local resources to produce the greater part of its food and energy. Goods are, for the greater part, manufactured in small workshops while organizations are selfgoverned. Tools and instruments are simple and small-scaled, so that they can be easily understood, used and maintained. The techniques are relatively inexpensive and labour intensive. Production is aimed at the satisfaction of needs and a stable economy in order to minimize the utilization of non-renewable sources of energy- and raw materials. Work and recreation are in close proximity, in the sense that work in itself provides the satisfaction such as could not be obtained from the collecting of goods.
The protection of the culture has high priority in the Appropriate Technology movement. Hollick claims that every technological renewal means a change and gives as example the previously described snowmobile-revolution. He puts as primary demand that innovation should take place in such a manner that it can be absorbed by the culture as a basis for development.
Hollick raises himself above the daily prejudices against decentralization and selfreliance but he indicates at the same time that selfsufficiency involves hard work and that in a world urbanized to a high degree, decentralization can, at best, take place only very slowly.

Concerning the possibilities of creating the type of work that is less alienating, he states that the selection of non-alienating technology would be more difficult than the rejection of alienating technology.

In the summary of his article Hollick states: "Perhaps the time has arrived to attempt developing a theory of Appropriate Technology..... Such a theory would have to be constructed on the basis of a deep understanding of human needs - individual as well as social - capable of encompassing cultural variation in its broadest sense. It should contain a sufficiency of precise characteristics in order to determine the appropriateness of a technology, but must serve to prevent that the state can decide concerning the appropriateness of needs" (Hollick, 1982). Precisely this is the intention of the theory of Appropriate Technology developed in book.

The previously mentioned study by Ravensteijn has provisionally resulted in a summarizing publication titled: "Theoretical aspects of Appropriate Technology". This study shows a partial confirmation of the theoretical basic points developed up to now:

> "To put it stronger: there is an indication that the great significance assigned to selfsufficiency is generated by a situation in which selfdetermination and selfdevelopment are the powers that give it form" (Ravensteijn, 1985).

Ravensteijn, in his course-handbook makes mention of the demands that must be made on a useful theory. It should be applicable on different levels: in the village, in the countryside, on the national level, for one person or for a family.

It should include, apart from statical elements, the framework, also dynamic elements, the methods for change. In addition, a theory of Appropriate Technology should contain both subjective aspects, such as norms, values, ideas pertaining to the "ideal" society, and objective aspects, such as the measurement of the economic value or the degree of diffusion of an Appropriate Technology.

Now that the most important component parts for the formation of a theory are available, the time seems ripe to start paying attention to these parts. The answers, supplied from the viewpoint of science and from the viewpoint of a technology developed on a scientific basis, are, oftentimes,

answers on questions that relate to the conception as to what society should be like.
Previously we had applied the term code to define this concept, for reason that it seems impossible to decipher the essence of science and technology by superficial observation and also because the code appears to be the key to mastery of the relation between society and technology.
If other developments than those of today should be pursued with technology, the current code needs to be deciphered and than, at the same time, a different code can be developed, aimed at satisfaction of basic requirements. This is one reason why the formation of a theory is important and, possibly, necessary, while the second reason is a logical consequence of the first. Once a different code has been developed, how can best be proceeded to produce within the current social system, in industrial- and development countries based on this code, this program, a fabric of technical provisions and organizational regulations that will lead to the desired developments.

That part of the theory formation deals with concepts, the definition of those concepts, the relation between those concepts (hypothesis) a working method (how to make such appropriate technology) and how to judge such working methods (is that what is produced what we wanted). Concepts, definitions and working methods can be circumscribed, hypotheses can be tested; it is possible to verify the claims. The same does not hold true for the code, the program, the aims that are to be realized in society with technology. We shall now proceed to further define the framework concerning the remarks made thusfar about the code and the contents of Appropriate Technology.

6. A vision of Appropriate Technology: elements and definition- the soft way out of addiction and waste

Again a poetic title and, to be sure, the utilization of a language that is poetic and understandable for non-initiates is rather unusual in the current scientific tradition. The portly language of the scientist, saturated with difficult concepts has an impact similar to that of the white coat of the doctor; it creates awe for the official functionary.
The scientist that steps out of his ivory tower in order to mix with the "common people" is in danger of not being taken seriously any longer by his

basic-group (in the language of the trade: "scientific forum") but also by society,because he is taking of his "white coat". It is a fact of life, sadly enough, that science is being identified more with those in power than with those at the basis of society. This is an emancipation problem that every scientist should dare face up to.

The tendency to pass off the responsibility to them that by their function and expertise are placed above us in society is probably the single most important obstacle on the easy way out of addiction. Addiction to political-, economical- and mental power of the leaders, but equally, addiction to the passing on of personal responsibility of the non-leaders to the leaders.
But the continuation of the current one-sided way does, most likely, yield insufficient future prospectives; this is a problem that is generally acknowledged. This one-sided road may be indicated in terms of: "the belief in the possibility of a continuing growth based on cheap energy, in spite of the limitations, that are becoming ever clearer".

- The growth proceeds parallel with the consumption of non-renewable materials and the production of an ever growing quantity of waste (heat), as a byproduct of, in particular, industrial processes.
- The limitations are found in the restricted supply of non-renewable materials and the capacity of the environment to recover and absorb the waste (Harper, 1972).

Appropriate Technology acknowledges these problems and attempts to indicate means for change. The choice that is made in Appropriate Technology is not for the current system in which the classic economical forces are considered to be capable of reacting adequately on the growth/restriction problems by means of short-term planning.
Appropriate Technology considers the current system no longer capable to rectify the growth/limitation problems with the same type of science and technology; in fact, Appropriate Technology states that contemporary science and technology and especially its code, will, ultimately, endanger the continued existence of humanity. Appropriate Technology also states that means of change in science and technology are both necessary and feasible.

These means of change in growth/limitation problems are found in the field of potential between mankind and science and technology and society.
The limitations to growth are determined by the limitations of our planet. Therefore, short-term planning will have to be the result of long-term thinking concerning a secure continued existence of humanity, in harmony with the living-community.

The tragic part of the situation is at the moment such, that the relations of power and the connected economic dependencies within, and between, states and powerblocks would seem to make it impossible to realize a secure continuation of existence. This would be true even if there would be insight into the fact that the development of Appropriate Technologies is unavoidable:

> "When the supply of raw materials becomes reduced, the impulse to cultivate reserves as fast as is possible becomes stronger. This is an excellent investment: it will cause prices to increase. The arguments of the protectors of the environment, who have an entirely different aim, are hereby effectively neutralized".

There is also the matter of environmental pollution:

> "Who are the people that are going to get the profits? It is those that are continuing production without setting aside sufficient funds for the management of pollution"
> "It is possible to make international agreements, but those can probably only be realized when the selfdestructive nature of a situation is acknowledged and dramatically drastic disasters will enable governments to "do something" when so forced by far-reaching changes and public opinion" (Harper, 1972).

Accidents or near disasters, as in the case of the nuclear powerplant in Harrisburg, are, apparently, not quite dramatic enough.
At the moment, economists do not view symptom-opposing processes, that are either protective or exhaustive to the environment, as expenses, but they are being entered as an increase in gross national income. Reports, such as the previously mentioned "Global 2000" report to the president of the United States are, apparently, horrible enough to realize that taxes on

the environment and symptom-opposing processes should be counted as an expense.

The tendency to, from the viewpoint of Appropriate Technology, speak about a battle between good and evil is difficult to suppress. The addiction to waste, the raping of the earth and the armament race stand in opposition to voluntary restraint, intelligent management of the capital belonging to the living community and the powers of conviction on the part of the stuart.

The question, whether or not there is a soft way out of addiction can be answered in the affirmative. Affirmative, when the addict realizes that he is destroying himself. When he does not do so, there is no way out.

The question as to the awareness of the consequences of a choice for the present way of living and values, precedes the question as to the values and ways of living that are chosen by the current power-mongers, such as bankers, industrialists, politicians and scientists. The invested interest of the power-mongers detracts nothing from the fact, that these people are also capable of liberating themselves. The ways to attain awareness lie within each man. The instructions given by president Reagan, to add new weapons to the enormous destructive supply of atomic weapons, may be viewed as an act of courage for the protection of Western Europe against the communistic power-bloc. It can equally be viewed as a significant step on the part of an addict to power in the direction of selfdestruction.

Appropriate Technology proposes a choice in the direction of a soft way to liberation and harmony, as a development out of the current choice for a hard way to addiction and selfdestruction. It is selfevident that the comparison between both extremes are of a black-white character:

		Hard way	Soft way
	Characteristics	Addiction and destruction	Liberation and harmony
SUPERSTRUCTURE	Development	Underdevelopment of many addiction to the power of few aimed at growth Collection of items and accumulation of capital	Selfdevelopment of many from becoming aware to making free for many aimed at development Fulfilment of living requirements and protection of living capital
SUBSTRUCTURE	Organization	Subordination of many in the techno-structure (uniform businesslike one-way relations)	Selfdetermination by many in the socio-structure (pluriform humane cooperative relations)
	Technique	Oversufficiency of few exhaustion of nature for the benefit of mass-production for world markets	Selfsufficiency by many protection of nature by the production of living requirements for local basic groups

Fig. 11: A comparison of two extreme development models.

This vision signifies that the hard way and the soft way are mutually exclusive. During a transitional period they can and will co-exist; however, ultimately, mankind, in order to survive, must choose for a transition of the hard way to the soft way. The development aim of Appropriate Technology is the going along this soft way. How do the people on that way look and what type of society do they form?

Mankind, emancipated and aimed at greater harmony

For the establishment of an attitude of life that is conducive to a process of making free and is consciously beneficial to man and its environment, accessibility- and usefulness of knowledge is of vital importance, since such knowledge would serve to achieve an understanding for the necessity of this. Knowledge, in the form of science and technology such as has been developed during the last few hundred years may perhaps not be of adequate value for the stimulation of freedom of thinking (for example, the previously discussed heavy initiation ritual of the scientists). Nor does it serve the development of harmony with the environment (for example, overarmament and environmental destruction as by-products of our technical provisions).

To the technical scientist, specialized by his education, to function in a way that is beneficial to man and his environment, means that he knows how to transmit its essence to the consumers, in such a way that the consumers may judge its applicability.

The knowledge of every specialist will have to be made accessible to the "ordinary" people in society in such a way that the groups involved can decide for themselves concerning its relative usefulness in the creation of technical provisions, as well as in the making of organizational regulations. The specifications for quality to be stipulated for the knowledge of specialists can not solely be determined by the current traditional concepts of efficiency, since these indicate only if money is put to economic usefulness and also in its extension, in terms of labour, energy and raw materials.

The reasonable criterion should be to evaluate the effects of the aimed-for process on people and on the environment and no quantitative concepts are as yet available to accomplish such evaluations. At best, the principle of "in case of doubt, abstain" should be applied.

Cost-price is, in any case, too limited a concept: the cost-price of operating an automobile, per mile, does not reveal anything at all concerning traffic accidents and fatalities, environmental pollution and the problems for mankind and its environment in the disposal of what remains of the automobile.

For this reason, the thinking of specialists, of scientists and of engineers will also have to be aimed at totals instead of parts; at total systems,

ranging from the mining of raw materials right up to the disposal of waste. The funnel-thinking of the specialists will have to be supplemented with network-thinking, in conjunction with basic groups.
This is, in fact, a plea to connect the strongly developed intellectual thinking of industrial society, with the feeling-requirements for a healthy relation with fellow human beings.
By the going together of thinking, feeling and acting, a basis comes into being for a process of thinking with the hart and feeling with the intelligence that is capable of directing the daily activities at a healthy, harmonious society.

Society, pluriform and co-ordinative

When accessible knowledge concerning systems, in the form of networks, is available, the structure of society must be capable to stimulate its application. The form of structures, and the relation between people in those structures, should make this possible. These can be made visible in a simple model.

	subordination	co-ordination
uniform	feudal	socialistic
pluriform	capitalistic	emancipating

Fig. 12: Connection between organizational form and human relations in a society structure (inspired by Galtung, 1980).

In a feudal, oppressing society, there is a uniform authoritarian structure, such as is, for example, the case with military governments as in Chili. Capitalistic society is characterized by great pluriformity and a factual subjugation of humanity in the technostructure. The bureaucracy of socialistic states is uniform, and, theoretically, its people are co-ordinated, such as is the case in, for example, the German Democratic Republic. Emancipating social structures are only to be found in principle, such as in Nicaragua and Yugoslavia. These, in fact, have to be constructed right from the bottom, regardless of the ruling system. This signifies, amongst others, that central provisions, regardless of whether these are uniform, subordinant, or both, have to, in an emancipating social system, be judged in such a way that only the strictly necessary central technical-organizational provisions are being maintained. Examples of this are the infrastructural provisions such as roads, train-connections, telecommunication networks, but also co-operative banks.

Also the networks of knowledge, such as can be made with higher education and with computer systems, belong to this category. The summum bonum in the structure of society is its legislation, that regulates the relationships between people, organizations and the environment and that has to guarantee the preservation of the living community. This is accomplished by the making of regulations for the management of nature aimed at technical provisions, as well as by the giving of guarantees for selfdetermining forms of management within the cultural framework of country or region. A connection can be made with the key concepts of Appropriate Technology as follows:

Mankind		Appropriate Technology		Society	
person	needs	means	tools	society	limitation
thinking	development	selfdevelop-ment	emancipation	legisla-tion	ecology
feeling	relation	selfdetermi-nation	organization	manage-ment	culture
willing	existence	selfsuffi-ciency	technique	admini-stration	nature

Fig. 13: Mankind, Appropriate Technology and Society

This model is not only very schematic, but also hypothetic to a high degree. It is important to see technology in the first place as an instrument utilized by man to form his society and vice versa and further, to perceive that the limitations, on the part of mankind, are set by the degree in which his thinking, feeling and willing form a total, as well as on the part of society to the degree in which the value of the capital of life is acknowledged, in terms of legislation, government and administration.
The primary intention of this model is to place Appropriate Technology in such a frame that connections can be made capable of promoting developments beneficial to mankind and its environment. Such coherent connections may be read horizontally as well as vertically. A pluriform, co-ordinating structure of society, consisting of emancipated people, becomes a balanced total of man and society in this model: the model then becomes a cylinder.

Concerning the structure - an ecological state-housekeeping

A different segment of a vision on Appropriate Technology is an observation of the structure of social productive force. In the faculty of Industrial Management of the Institute of Technology, Delft, The Netherlands, social production is being compared to a pipeline-system between raw materials and end-products or between possibilities and requirements. (Malotaux, 1980).
An integrated company is involved in the entire chain of processing, from raw material to end-product; for example, a blast furnace industry, that mines-, transports- and processes ore to some end-product, such as rails. A differentiated industry specializes in a manipulation such as, for example, a packaging industry. A specialized industry manages one, or a few, products; for example, bearings and a parallellized industry carries more products, such as, for example, a chain of supermarkets.
This picture of fat (parallellized), thin (specialized), short (differentiated) and long (integrated) pipes, in all possible connections, is adequately useful to describe the society structure, technically and organizationally.
There was a far-reaching tendency towards integration (forward, to finished products and retograde, to raw materials) and parallellization; in short, the coming into being of thicker- and longer pipelines, such as the transnational enterprise: the "economics of scale" pictorially expressed. The

coming into being of ever thicker- and longer "pipes" also signifies the disappearance or absorption of small enterprises in the grand total of the multinational. The small enterprise is being sucked into the pipe of the large enterprise.

That would present no problem, just as long as everything went well, however, large enterprises may well go the way of the dinosaur: once they were great and powerful, but also very vulnerable, as a result of their very size. Furthermore, to the degree that an economy is becoming increasingly poor, it is just the multinationals that have the possibility to treat vulnerable man and his environment in a less careful way.
The approach of Appropriate Technology is to strive for a balanced ecology of the social generative force. Not only short and thin, i.e. very small enterprises, or long and thick, i.e. multinationals, but rather a mixture of everything, a dynamic, mutually balancing ecosystem of tradecrafts, small-, medium size- and large enterprises.
Not a two-leg theory, such as in China: a theory that has as starting point two systems that co-exist practically independently: a modern urban industrial production organization and alongside of this, a small-scale rural enterprise; but rather a theory that has as startingpoint, pluriformity in the social production,in mutual coherence,with the same norms and values beneficial to mankind and the environment.

This does not take anything way from what has been stated in the previous chapter, concerning the desired essence of large-scale enterprise, i.e.: large-scale provisions are at the service of aims having a decentral character. Not the top, but rather basic groups are the determinant factor, in deciding about the usefulness of provisions.
With an ecology of the social generation, the case is not different than it is with the ecology of cultures and nature. A pluriform living community probably affords a better chance of survival, by reason of its inner balance, than would a society of large monocultures. Therefore, an ecological state-housekeeping will have to be aimed at pluriformity, but also at inner balance and independence, i.e. aimed as much as is possible at selfsufficiency and selfdetermination.
The ecological state-housekeeping is an economy of responsible accounting. The bill that is presented to ecology by Appropriate Technology, maintains

the living community as a basis of our existence and assigns economy a place side by side with other human knowledge and not above it.
The nature of todays economy is such that the bill will be presented to our progeny in the form of a raped earth. An economy of unpaid bills (Van der Doel, 1980).

Concerning totals and parts, holism and tunnelvision

The danger of tunnelvision lies in that the specialist may loose track of the connection between his work and the surroundings and for that reason, unintentionally, by lack of knowledge and insight causes damage to the total. The total, the living community, requires adequate management. From the standpoint of this holistic total vision, it is possible to judge the meaning and value of parts and of specialities. In this, the right is not the right of the most powerful or the wealthiest, but rather the right for a humane existence for everybody and the duty to govern ecology in an intelligent way. Right, therefore, has the function of protecting the possibilities for everyone to fulfil their living requirements in such a way that the living-capital does not become destroyed.
Facts are only of importance in as far as they indicate such possibilities. The value of facts, based on technical science, will thus be measured against the usefulness for the living community and the usefulness for the fulfilment of living requirements and not primarily from the basis of financial usefulness. In order to avoid misunderstandings it should be stated that it is not a case of preventing expertise or tunnelvision.
With the growth of science it is probably as it is with the growth of an organization. In this growth three steps can be distinguished.

- the pioneer phase: everyone knows all about the organization. Oftentimes, there is a leader who stimulates the development.
- the differentiation phase: the organization establishes departments, administration, production and sales.
- the integration phase: management, together with the employees, attempts to make a total of the organization.

Where it concerns science it would seem that the time of the pioneers is long gone. It looks, however, that we are still right in the middle of the

differentiation phase. Everybody is trying to be a little king in his own "little science store". Much to the detriment of mankind and the environment. This is what the phase of integration, the solving of problems of mankind and the environment, jointly by the various different professional disciplines, amongst others with the aid of Appropriate Technology, is ultimately all about: the principle of holism in science.
Science and technology in the service of liberation and for the prevention of the destruction of mankind and the environment by hard technology.

A first attempt to synthesis

Appropriate Technology is a complex concept. It contains a vision on mankind and on society; on the relation between mankind and society, embodied in the tools and means of technology. Appropriate Technology also contains a vision on the order of - and in - society wherein it assigns to the superstructure i.e. the thinking about norms, values and living style as embodied in legislation, a higher position than it assigns to the social substructure aimed at government and administration. In this connection, everything is placed in an ecological perspective: the living requirements, the tools and means to fulfil these requirements, the society construction, the relation between man and society, are all viewed from the basis of the possibilities and the limitations of the living-community, since these determine its continued existence.

Definition of Appropriate Technology

There are at least as many definitions as there are names and currents in Appropriate Technology. The descriptions that follow serve to provide a "framework" definition. A definition that can be used for all currents (Jéquier, 1983, p. 10 and 11). During a symposium held in 1979 of the international society for the advancement of Appropriate Technology for development countries in Michigan, an important element for the description of Appropriate Technology is proposed by Bill Ellis. He states that changes are desirable in scientific starting points (paradigmas) in order to reach alternative developments. He poses that the prerequisite paradigmatic changes are known, but that the meaning has not been understood or researched (Ellis, IAATDC, 1980). A definition of Appropriate Technology

will have to answer the question "Appropriate to what?" since not a single technology is free of values. Some technologies are suitable for growth, extensive raw material supplies, low population numbers, while others are fitted to circumstances of stability, abundance of labour and scarcity of raw materials.

> "Some technology makes a few people rich and simultaneously impoverishes many, while other technology distributes power and wealth equally. Some technology demeans and destroys the people that use it, while to others it affords the opportunity for growth,for skills, selfconfidence and knowledge; some technology produces goods, while others produce what is good" (De Moll en Coe, 1978).

Here points of departure are indicated such as were mentioned by Ellis. Appropriate Technology reminds us that prior to selecting tools and means, it is necessary to know what norms and values are strived after, since some technologies are in service of these, while others place them out of reach.
In order to define Appropriate Technology, it is necessary to view the necessity of harmony between mankind and the living community in the correct way. In the first place, that living community does not constitute a stable network. The natural environment changes constantly, usually slowly; we are concerned with a slowly changing equilibrium. When, for example, the climate changes, the population of man, animal and plant necessarily adjusts itself to such change. That balance, that precarious equilibrium, between man and his environment becomes disturbed by industrialization and its connected urbanization. Quite naturally it would not be possible to live on this planet with great numbers of people without changing that environment. We should strive for a change from the present non-stable situation to a system that is relatively stable, one that mankind can "bear". Ultimately, it is a case of facing the challenge of deliberation in the 20st century (Ministry of Supply and Services, Quebec, 1978).

Appropriate Technology is a technology that supports the development process in a direction that aims at autonomy of persons and basic groups, serving manking with its liberation and leading to a free-floating equilibirum between ecology and humanity.
But it is equally possible that Appropriate Technology is the result of a development process.
Concerning the conditions for the process of technology-development for the third world, Reddy states as follows:

1. "The making of clear-cut regulations and mechanisms aimed at changing the filtering process at relevant institutes, in such a manner that they will react and become directed at the fundamental requirements of people.
2. Scientists and engineers that are involved with Appropriate Technology will have to absorb such new preferences, regulations and points of departure as are essential for the develoment of Appropriate Technology.
3. It is necessary to construct a new pattern of technological skills in the third world since the technical possibilities feasible in the third world are determined by the relations with institutes in the industrialized countries, which causes to come into being a technology only in the interest of the elite".

An alternative strategy must contain two component parts:

1. "to forge strong ties between educational-, scientific- and technological institutions and the needs of the poor in the rural areas and their traditional technology.
2. Drastically weaken the existing ties between such institutions and institutes in the industrialized countries which is analogous to drastically weakening the wishes of the elite" (Reddy, 1979).

Chung, with the Technical University of West Berlin, complains about the slight interest of technical scientists for the development of Appropriate Technology:

> "For the time being, in the development countries as well as in the industrialized countries, there is a lack of scientifically justifiable explanation of the basic principles of Appropriate Technology. With few exceptions, Appropriate Technology by engineers and technicians that are involved with the third world, is not taken seriously even though, at the same time, they are aware that the value of western technology is questionable. Furthermore, it can be observed that it is a difficult matter for technical scientists to distantiate themselves from the value judgements that belong to the western system of technology and to doubt the logic of the current science of engineering and to develop new norms and values in its place. It is, therefore, no coincidence that it is primarily the social scientists and economists that are involved with

> Appropriate Technology. In the meantime, isolated technicians are directing their aims especially at the development of prototypes that not always touch the problems at the deeper level ....." Chung, 1977.

Chung is quite correct in this observation. Fortunately, in the meantime, five years later, some work has been done in the way of theory-formation. But the process of Appropriate Technology-development has become stuck for the greater part on the point, of what the Appropriate Technology engineer calls: the implementation; the absorption of Appropriate Technology by the population.

The reason that Appropriate Technology has, oftentimes, remained stuck on the implementation, probably has to do with the complexity of the Appropriate Technology-process and the laborious shifting of judgements and values that goes along with it. This shifting in points of departure may, naturally, also occur downwards from the top, which, however, is highly improbable. Those in power, regardless of whether they are politicians, engineers, scientists or the nouveau-riche, do not by nature seem inclined to let go of power, unless forced. The description of the snowmobile revolution, in the first chapter, was a striking example of this fact.

Enterprises that are taken over in selfmanagement are, oftentimes, previously written-off by banks. One of Appropriate Technology's early authors, Jéquier, has this to say about it:

> "The development and growth of industry, based on Appropriate Technology, strongly depends on political decisions taken on the highest level". (Jéquier, 1976).

Jéquier attaches great importance to this "highest level", while Roszak, in his publication "Person and Planet", takes as point of departure ordinary people and basic groups, i.e. the "lowest" level. Personally, I must agree with the latter, since the working masses are of greater importance than are the elite, who ultimately profit from the labour of the masses. Roszak pleads for a creative demolition of the industrial state and, simultaneously, a reconstruction from within of a better alternative of contemporary society, the soft way, that leads to emancipation, also for those in power. In the framework definition of Appropriate Technology a choice is made for a development process that supports emancipation, protects the ecology and gives people a greater say-so about their own life and work. Looking back at the figure in the previous paragraph, concerning the relation between key con-

cepts of Appropriate Technology, the working definition of Appropriate Technology formulates as follows:

> "Appropriate Technology is aimed at the production and application of the tools: emancipation, organizational regulations and technical provisions in order to obtain the means of selfdevelopment, selfdetermination and selfsufficiency to the end of fulfilment of the fundamental needs of development, relations and existence of persons and basic groups, in harmony with their own culture and natural surroundings".

Hypotheses

As previously stated in the remarks concerning the formation of theory, theory consists of a part that cannot be put to the test, termed code in this context, and a part that can, consisting of concepts (elements), description of those concepts (definitions), hypotheses (relations between the elements) and a working method, for example , to regulate the inputs and evaluation of the results. Hypotheses are the key to theory formation, since these can be strengthened, weakened or exacerbated through research, making the theory more useful in reality and this is what counts.

The hypotheses in the Appropriate Technology theory are related to the quality of its inner direction, aimed at the base. The basic hypothesis that may be deducted from the definition is that the fulfilment and satisfaction of the fundamental needs of people by means of selfsufficiency, selfdetermination and selfdevelopment is in agreement with the desires of human nature. The second hypothesis, coherent with the first, is that self-development, selfdetermination and selfsufficiency require simultaneous application.

This requires further clarification.

If, through selfsufficiency the existential needs are satisfied, this does in no way guarantee that the person or basic group involved has satisfied or fulfilled the need for relations. To do so, selfdetermination is required, that permits the establishment of greater political independence. But a group or person that is mentally dependent, can still be pushed in a direction that is undesirable.

Emancipation, by means of selfdevelopment, leading to mental growth such as is necessary in order to see through and form for oneself the substructure of technique and organization is, therefore,of equal importance.

A liberation-movement that has succeeded in gaining political independence is, according to these theoretical views, only truly free if at the same time economic independence is established by means of selfsufficient techniques. This was also the working hypothesis for recent field research in Yugoslavia, where emancipation and selfmanagement are fixed by constitutional law. Notwithstanding the imperfections in the system of councils in Yugoslavia, we may assume that political and spiritual autonomy are guaranteed, within reason, in that society.

The working hypothesis stated literally:

> "Selfmanagement and emancipation are only possible and sensible where selfsufficiency can be strived for" (Ravensteijn, 1983).

In this hypothesis, selfsufficiency should be regarded as the determinant factor and keystone in a development policy in which emancipation and selfmanagement are the official ends. The research material points in a direction that indicates that a striving for selfmanagement can be followed up by a striving for technical selfsufficiency.

7. The characteristics of Appropriate Technology, an attempt at ordered arrangement and the problem of intangibles.

Criteria, characteristics and norms. To measure is to know and to know is to feel secure.

In our culture numbers inspire confidence, while beautiful has become the field of the artist. Norms form the domain of technical science and non-measurable qualities the domain of the social scientist and the artist. That duality is incorrect and dangerous as is the case with many dualities. Day and night stand in contra-distinction, but at the same time form a total, a cycle. Good and bad also stand in contradistinction but are also present in everybody. There are scientists and laymen but in every layman hides a scientist. And many scientists are incredible amateurs, outside their own field. Every quantity has its quality and vice versa. The arts and science do not stand quite so far apart as we are led to believe. Social scientists and engineers working in a co-operative way would be far more effective and efficient in their approach to Appropriate Technology than is currently the case. In any case, quality, in the sense of beauty, is of vital importance even though the part played by beauty is seldom mentioned in the precise sciences.

"Where scientists reflect upon their work, the development of concept-frameworks and the theories that they expound, it is clear that intuition and beauty underlie their feelings that tell them "this is the way it has to be", according to their feeling of exactitude" (Judith Wechsler, 1981).

It is necessary to clarify this problem of beauty in science, since beauty forms the non-measurable quality that is of importance in the order of observations. Wechsler states that the exact science, as well as the science that is based on observations, are subject to a judgement concerning beauty. In the arts and in daily life it is possible to indicate the part that beauty plays, however, this is not such an easy matter in science. In Wechsler's publication beauty is viewed as a decisive element in de scientific process, as a way to differentiate and to evaluate the correctness of a scientific expression. Science could equally be a source for the enjoyment of beauty as would the enjoyment of a beautiful painting. The non-measurable quality of the beauty of science is found in the way a formula, a theory or a concept-framework is beautifully balanced which leaves an impression that cannot be easily verbalized.

Appropriate Technology offers the engineer a lesser degree of security that do the measurable end-results of Industrial Technology, since the latter can be measured in neat formulas of profits on investments, the useful employment of labour, energy and raw materials. All this is required with Appropriate Technology as well; only a lot more has to be done in the superstructure of thoughts as well as in the substructure of technique and organization. In the following outline, taken over in somewhat altered form from a lecture, the basic characteristics concerning policy formation, aims, norms and values of the superstructure and substructure of Industrial- and Appropriate Technology are compared with one another in a black/white manner (Riedijk, 1981). In a student's paper at the Institute of Technology, Delft, the characteristic elements of Appropriate Technology were searched for in about 35 of its definitions (Storm, 1979).

Storm arrives at 24 characteristics and out of these he selects 8 basic characteristics as follows:

- directed at the basic group (14)
- the fulfilment of basic needs (10)
- the striving for harmony with the living community (9)
- the use of local resources (9)

- the use of "appropriate" techniques (8)
- the use of a state of small-scale (8)
- the use of labour-intensive processes (8)

He arrives at this choice on the basis of the number of times that these elements occur in the 35 definitions concerned; this number has been placed in parantheses behind the characteristic.
Miedema and Brouwer take over a list of characteristics from Robin Clarke (1975) that compares 36 aspects of the hard- and soft technological society with one another. They also compile a classification themselves and arrive at 11 characteristics.
For reason of its unarranged character it is difficult to utilize this summary for the evaluation of the failing or succes of an Appropriate Technology project. Therefore, in the following diagram an attempt has been made at proper arrangement and supplementation of the characteristics found thus far.

Fig. 14: Aims, values and characteristics norms of Industrial- and Appropriate Technology

	Industrial Technology	Appropriate Technology
basic characteristic	technology of abundance	technology of scarcity
decision formation	those in power/tunnel-thinking	basic groups/network-thinking
aims	survival of capital, making of profits	survival of living-capital, making of equilibrium
norm and values	<u>the economic principle serves as norm</u> . economic growth is possible and desirable . the earth exists for humanity . consumers exist to consume products and to make profits . science will discover new forms of energy and materials . science will solve pollution problems . to strive for consumption	<u>the ecological principle serves as norm</u> . growth is only feasible if the living community is no further effected . humanity is a part of the living community . the possibilities to adaptation in nature are limited. Man is the manager of ecology. . ecology can no longer absorb large quantities of waste heat and waste products. . we don't know enough about long term effects of pollution . to strive for durability
characteristics of the superstructure	<u>underdevelopment alienation</u> . short term planning with economic norms. . quantity . dependent urban society	<u>selfdevelopment</u> . long term planning with economic norms. . quality . selfsufficient rural society
development	. dependent . no say-so . inequality . standardized needs	. autonomic . emancipation . participation . fundamental needs
of the substructure: organization	<u>Subordination</u> . steep, bureaucratic organization . labour extensive . capital intensive . centralization/one way communication . large scale . monodisciplinary working method . labour splitting . expertise . uniformity (monocultures)	<u>selfdetermination</u> . level, democratic organization . labour intensive . capital extensive . decentralization/multi way communication . to strive for human measure . interdisciplinary working method . group work . school of reason . pluriformity
technique	<u>oversufficiency</u> . hard technique . raw materials/energy intensive . one-time use/waste . usually employs energy-sources,large material currents . complex, oftentimes unsafe systems . world technology in the hands of large enterprises . wasting	<u>selfsufficiency</u> . soft technique . raw materials/energy extensive . recycle, repair renovation . prefers energy currents and local resources . relatively simple, safe systems . local techniques and skills of basic groups . frugal

The fact that non-technical quality cannot be measured will remain a problem, however, in the theoretical framework of the above figure it will be possible to take an ordered look at the quality of Appropriate Technology.

The non-measurable quality

The concept of quality can, naturally, also be misapplied in order to camouflage the misapprehensions that can be combatted with Appropriate Technology. Kenneth Boulding, a well-known economist claims in a book concerning Appropriate Technology and social values in his chapter about wealth and poverty as follows:

> "The differences between the rich and the poor are more of a qualitative and structural nature than of a quantitative nature..... It would be true to state that the rich countries are rich and the poor countries poor, not primarily due to exploitation, since this is an unimportant though real element in the process, but for reason that the rich countries have experienced a process of far-reaching economic alteration while the poor countries have not." (Boulding, 1980).

A lack of feeling is evident in the remarks of this specialist-representative of the industrial state. To see your child die of hunger cannot be described in the cold terms of "qualitative structural differences". It is nonsense to refuse recognizing that the continual exploitation of the third world, the poverty, the overarmament and the destruction of the environment are all simply fruits on the tree of the industrial state; such a viewpoint is questionable in the extreme and probably just plain dishonest.

The way Boulding expresses the problem, scientific and chilly, finds its departure point in the prejudices in the industrial state, i.e. the aims, values and norms of industrial technology. To put it crudely, one could add under the left hand column of industrial technology in the above figure, in the section norms and values: "The white race is better than the other races since it owns the best weapons" and "the masses require leadership" and on the right hand side under Appropriate Technology: "all races are equal" and "ordinary people are quite capable of directing their own lives". If only they get the chance to do so.

Power and riches on the part of a small, usually white, elite goes hand in hand with powerlessness and poverty of the largely coloured masses. Those

differences in quality can be measured.
The quality that cannot be measured is found within people themselves. In the battle inside every one of us between satisfaction of desires and fulfilment of needs, between the lower and the higher, between the "I" and the "self" (Schuurman, 1976). Poverty as a symptom of disease is caused by the addiction to the satisfaction of desires aroused by the industrial culture. The quality that cannot be measured also lies in the choice for fulfilment of fundamental needs .

8. Controversies - Appropriate Technology - proponents, paper tigers?

Appropriate Technology, regardles of what name it is called by, is, in fact, viewed everywhere with mixed feelings. Not only by the critics, but also by the producers and the consumers that themselves have enthusiastically created their own Appropriate Technology. Oftentimes, doubts arise as a result of the many resistances against their activities and also for reason that their attempts to, with the aid of technique, gain influence over their own lives and works are, in fact, barily, or not at all, successful. For example, in The Netherlands the returning of electricity out of wind-power to the public network has been held back by the electricity producers (SEP) on one pretext or another. Naturally, standing alone or in a group, doubt arises concerning the sense of one's work. If in sections of the city biogas installations were to be constructed, which is a good idea, it is likely tht the same problems would arise with the gas as is the case with windmill-electricity, even if the quality would be good. Breaking through the established positions of monopoly of public companies that supply gas, electricity and water, would be one of the controversies Appropriate Technology would run in to.
Appropriate Technology - in my minds eye appears a picture seen recently in a Dutch newspaper: four technicians are constructing a windmill; all four have a beard. The fourth, standing on a stepladder working at the propellers, enthusiastically sucks a pipe. Homeknitted goat-wool socks, wearing sandals; freaky windmill-builders. An image of Appropriate Technology valid to some degree even today.
The established order is starting to get the point of Appropriate Technology even though what it is all about is not as yet comprehended: Veldhuis, one of the topmen of Unilever, the food and soap multinational, projects a picture

of Unilever as an enterprise that has taken Appropriate Technology out of the sphere of the goat-wool socks technicians. Without a doubt, Unilever has some outstanding achievements in the field of local independence; ultimately, Unilever looks more like a collection of reasonably independent companies than any other multinational enterprise; however, Unilever, just like any other industrial enterprise is, in the first place, bound to the making of profits even if this would involve competing the local little soap producers to death.

Veldhuis states: "It is very well possible for development countries to influence the importation of Appropriate Technology by first determining what is important to their wishes, for the short term as well as for the long term by the creation of an investment climate that attracts commercial enterprises" (Veldhuis, 1979). Importation, investment climate, (foreign) commercial enterprises. All this has very little to do with Appropriate Technology. The development from the technology of large industry to Appropriate Technology is difficult to imagine, not only due to the goat-wool socks but also due to the basic principles of Appropriate Technology.

A number of the prejudices are as follows:

- "It is amateuristic". This is oftentimes true: mutual quarrels, a well-known phenomenon with people of the "left", a lack of support by the established scientific institutes and self-conceit have in the past led to trifling work and this is likely to continue for some time to come. Some Appropriate Technology institutes reject specialism because they fear, possibly rightly so, that the established institutes will terminate them. However, a second generation of Appropriate Technology has undoubtedly come into being, one where technical expertise is the primary criterion, but also with these institutes there is great reticence in putting the social-economic and cultural quality of their own work open to discussion. And in this way they react in precisely the same manner as those that they criticize.
- "Back to nature is impossible. We cannot set back the clock" Naturally this is true and this is not the aim of Appropriate Technology. Nature, the living community should only stand as model for what is and for what is not permissible.
- "Ridiculous, Appropriate Technology is far too expensive. You can't manufacture lightbulbs in a factory with only 50 people". Naturally, since Appropriate Technology looks for the fulfilment of fundamental needs in

equilibrium with the ecology, it leaves room for large factories and mass production only inasfar as this is the express wish of the workers and as can be tolerated by the ecology.

In any case, "expensive" is a very strange concept. A coat made from seal skins should be prohibitively expensive; however, seals have little power...

- "Tradecraft and small industry can only exist in a welfare-state". Nonsense? Or the other way around: the third world is poor, because there they have a great deal of tradecraft and small-scale enterprise. The answer is no, since the small enterprise affords the possibility to create one's own work. (Katernen 2000, 1981). While the large industry shows that "the strived for uniformity with natural processes cannot be put into agreement with the rich diversity of life-forms which are the essential condition for the conservation of living nature". (Hoefnagels, 1979).

Small-scale enterprises promote not only the stability of the social productivity, but at the same time have a better understanding concerning the consequences of their activities for mankind and the environment. Furthermore, it is anticipated that around the year 2000, 50% of the employment opportunity will result from small-scale enterprise (in The Netherlands), (Boonman, 1983).

Small can sometimes be necessary, while larger is, oftentimes, superfluous. The welfare-state does not take into consideration matters like sensible work and the equilibrium of nature.

- "Tradecraft is a thing of the past. It is something done by old men during a fancy-fair". Hans 't Mannetje, in a paper "The old tradecraft - a new branch of science?", himself a sculptor and enterpreneur of tradecraft, states: "Traditional technique and handicraft are currently in a waiting-room-situation. Traditional techniques are hardly taken into consideration, while tradecraft is associated with folklore..."

"...however, it requires evaluation of how the tradecraft, as a personal gift, manifesting itself in the going-together of individual intelligence and manual skill, is capable of playing an initiating and corrective part with the utilization of modern science in the creation of an efficient industrial or artistic product". ('t Mannetje, 1981).

In 1694, the firm of engravers, Luyken, published a summary of 100 tradecrafts. In a modern reprint (Pfann, Amsterdam n.d.) 106 tradecrafts are listed. The condescending attitude of the engineers in particular, towards the tradecraftsmen, could be changed for the better by assuming an

attitude of reverence for the tradecraft instead. This is particularly so where an answer is needed to the question: "What needs to be done in order to, also for the future, guarantee the economic conditions for the existence of humanity..." (Hoefnagels, 1979). The craftsman oftentimes does important preparatory work for industrial ativities. Craftsmanship is also difficult to automate out of existence. The manner in which the tradecraft is carried out includes a respect for the life that is necessary for our continued existence. For these reasons, it would appear as though research into the tradecraft can be of great importance.

- "Appropriate Technology is a romantic current emited by alienated scientists". In spite of opposition from the outside and the mutual squabbles from within, Appropriate Technology has managed to keep in existence as a current. Why should it be called romantic to acknowledge that the law of preservation of misery such as is maintained by contemporary technology, offers no permanent solution, but pushes the problem along instead. (Brouwer and Miedema, 1975). Romantic, in the sense of dreamy, would perhaps be a better description: dreaming about the possibilities of a healthy future. But romantic in the sense of having little contact with reality, sooner applies to the established order of engineers than it does to the Appropriate Technology-engineers. It might possibly be termed as weird- and alienated behaviour to hope for, and to work on, the prevention of a world calamity, but is certainly shows a good sense of reality to work on techniques that are beneficial to mankind and its environment.
- "It is without doubt true that we need technology for the benefit of the poorest, however, it is not necessarily useful to describe this as a new sort of technology. It is incorrect to view such technologies as the basis of an entirely new sort of development". (Rybsczynski, 1980). According to Rybsczynski, Appropriate Technology is not a different sort of technology. This is in complete agreement with the departure point of western science: There is no better science than western science. Alvarez, in his publication "Technology and Culture" (1980), indicates precisely, that out of a multitude of technological paradigmas (points of departure) only, in fact, one remains, i.e. the western. This viewpoint becomes further re-enforced if, like Rybscynski, we take as point of departure that there is only one sort of technology in existence.

  The correct point of departure would seem to be that there are as many sorts of technology as there are cultures.

The fact that, gradually, there is only one sort of technology left, proves that the multitude of cultures is being reduced to one: the dominating industrial culture, that terminates every alternative right in the bud or absorbs it completely.

- "Better technology cannot substitute for social reform" is Rybsczynski's claim and on this point I would tend to be in agreement with him, if technology is viewed solely as a part of the substructure (the technical provisions); however, if one views the superstructure and the substructure as one interconnected whole, than everything becomes different. Galtung had also already shown that it is not a matter of the substructure alone, but especially of the superstructure, the code.
  Superstructure and substructure belong together, like a glove fits the hand. With social reform goes technical/organizational reform and vice versa.
- "It is not possible to beforehand stipulate the characteristics/criteria that will determine if we are involved with Appropriate Technology", since, so goes the argument, Appropriate Technology will differ because the economic- and cultural circumstances differ in connection with the degree- and scale of development. The choice of non-appropriate technology is, oftentimes, more a case of institutes than it is of technology; this also connects with what Reddy previously had to say about the significance of institutes in relation to Appropriate Technology development in the third world. They must be directed at the very poorest and drastically weaken the ties with institutions in the wealthy countries. Naturally, it would be possible to stipulate criteria. Criteria, such as have been worked out and arranged in the foregoing diagram (Fig. 14), may in principle be used for every community but its efficacy can only be established by further research.
- "Appropriate Technology doesn't work because it is not economical". The Dutch development economist Duller also walks into this trap. He has written a book on the subject of soft technique, in which he shows that there is no place for soft technique in the established economic order. It is too expensive, because it is too labour intensive and it is indeed true, that within the existing international economic dependencies Appropriate Technology is too expensive. Within that same order there is sufficient food for the entire world population, however, that food is too expensive for the poorest. Appropriate Technology can work and it is economical,

but only within a different economic order.

I had called that a bright economy; where new relations in work come into being between people out of necessity, since the population increases as the availability of energy and raw materials decreases. For this, the established economy offers little opportunity; Appropriate Technology is not economical for the bankers and large industry and for this reason little information concerning Appropriate Technology can be found in the official reports; however, for those people that have to fight for their existence, Appropriate Technology is important for survival in a humane way. Only such Appropriate Technology as is capable of producing a profit is being absorbed by the established economy and, for that very reason it is no longer useful for those people it was intended.

In a publication of the Canadian Hunger Foundation (1980): "Experiences with Appropriate Technology", a number of projects over the entire world are described. "It is easy to take pictures of Appropiate Technology products, but not of the process, wherein local people describe their problems, discuss their possibilities and choose feasible solutions. This process is the critical element that, oftentimes, is lacking in the descriptions of Appropriate Technology. Furthermore, in many an instance, local knowledge and skills can no longer be made productive for reason that social, political or economic circumstances do not allow so. An approach of Appropriate Technology that is solely aimed at the adjustment of technology to social- and economic circumstances and that does not aid in the re-inforcement of the local organizations in such a manner that these circumstances become altered, should be considered an incomplete approach". Duller and Rybsczynski as well as other Appropriate Technology critics make a fundamental error by judging Appropriate Technology as a technical subject within the established economy. Appropriate Technology should be viewed more in the sense of a developmental strategy for survival on the basis of an ecological economy that takes mankind and its environment as its point of departure.

"The third world is the place where Appropriate Technology belongs". This is probably the most interesting of controversies around the subject of Appropriate Technology.

When the Delft Institute of Technology, in 1978, decided to go ahead with the establishment of a Centre for Appropriate Technology (CAT), it was stated during a disussion at the Institute Council, that CAT should, in the

first place, be aimed at the third world, since that would be the place for Appropriate Technology. With some difficulty the proposal was made to include permission for CAT to also be directed at industrialized countries, since it was assumed that there would be practically no need for Appropriate Technology in such countries.

However, unemployment is still on the increase and it looks as though the current economy and industrial technology are locked in a vicious circle of insolvable problems. It is quite possible, that Appropriate Technology will prove of equal, or even greater, significance to the industrialized countries as to the third world.

The gap between the richest and the poorest countries continues to grow, as revealed by the world-development report annually published by the world-bank. In the viewpoints of both the pessimist and the optimist the gap is becoming greater. (Weenink, 1981).

If the industrialized countries were to introduce Appropriate Technology, the third world would gradually become freed of the lethal embrace in which the industrialized countries must of necessity hold the third world, because by working with Appropriate Technology local or regional independence is being developed so that the industrialized countries will become less dependent on the inexpensive raw materials fromt he third world.

9. Appropriate Technology, here and in the third world - the poor rich and the rich poor people.

The poor rich

It may well be true that, in the industrialized countries, the food, as a result of its additives and manipulations, is not quite what it could be; however, for practically anybody that is willing to go to some trouble it is possible to obtain healthy food. With the exception of the poorest, but of those there are currently relatively few in the industrialized countries. Where it concerns health care, housing and recreation it becomes a different matter.

"Not taking into consideration the middle groups, the social gap is undeniable: whoever belongs to the great mass of people lives in a simple home in a medium class neighbourhood, drives a little car and when one becomes ill, one is a health-insurance patient. For these, the "gains" are intended that our civilization liberally makes available, aside from bread. On the

other hand those that have a significant position can live in a villa outside the city, they drive a large automobile and own a second car; they are being treated "privately" and in hospital they are bedded "first class" while the official culture is tuned-in to their needs". (Hoefnagels, 1979).

But even though there seems to be gratification of living requirements in a dual-current country: there is food, there is health-care, there is housing and there is opportunity for development, still there is little real satisfaction and happiness, which also goes for the wealthy.

"The measure in which the population is permitted to disturb the peace where peace and silence still exist, to be miserable and to make life unpleasant, to run over with familiarity and to sin against all reasonable norms, is alarming, since herein lawful- and even organized attempt finds expression, to disregard the personal right of others and to prevent autonomy on even a slight separate piece of existence. In the overdeveloped countries, an ever greater segment of the population is becoming one single large mass of fettered public; fettered not by a totalitarian regime, but by the liberties of the citizens who's amusement media force others to enjoy along with them , their sounds, images and scents". (Marcuse, 1974).

The voluntary slavery to our non-appropriate technology is becoming an ever greater burden. A burden we are trying to free ourselves of by

"the ideology of personal growth, that, superficially, radiates great optimism, but that, nevertheless, shows deep despair and resignation. It is the faith of those that have no faith left." (Lasch, 1980).

The lacking of a humane superstructure has left the substructure soulless and without inspiration and this soulless substructure again places mankind in front of its mirror-image showing an empty gaze; but, fortunately, there still is hope. The wealthy can go to the marketplace of welfare and happiness, even though matters also don't look any too good any more even there:

"What Illich has remarked concerning education: it is a case of an education industry that occupies a central place in the economy and the same holds true for health- and welfare care. In health care, it is, for example, not only a matter of social control of the population via the medical system. Illich shows that this medical system itself is becoming an ever more important enterprise.... mental health care in particular is becoming big business here.

Thirty to fifty percent of the health-care budget of many of the american states is intended for mental health-care, which, oftentimes, is the single

greatest employer in the public services sphere". (Achterhuis, 1981).
A society that creates illness and that keeps its subjects ill by means of its specialists. The poor rich man is getting ever poorer as a result of the non-appropriateness of its own science and technology and by his continual choice for desires that can never be fulfilled.
In his publication "The real worlds", Galtung splits the living-level of the world population into three groups:

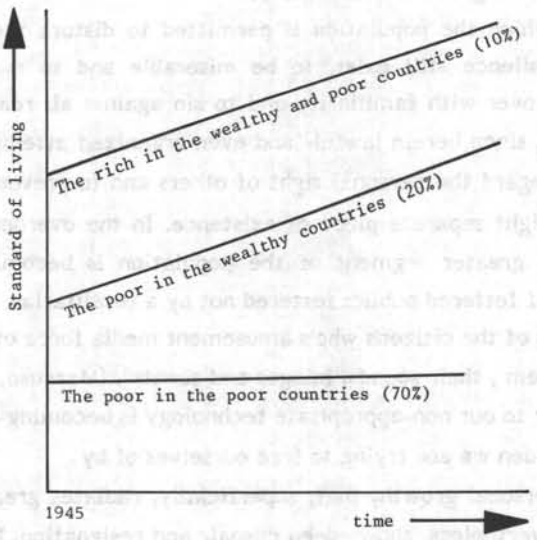


Fig. 15: The standard of living of the worldpopulation since the Second Worldwar.

The single most significant aspect of the above figure is that the lowest line falls below the level for satisfaction of fundamental needs. Consequently, there are two different points of departure one can take a stand on, in order to exert political pressure. One would be on the basis of misery, because the lowest line drops to below the minimum. The other is on the basis of inequality, because the lines run apart and are running further apart at a rapid rate. There is a gap, not only between countries but also between classes". (Galtung, 1980).
The poor rich man is poor, because he behaves as though he were alone it the world, without either past or future. He is satisfied with surrogate fulfilment of his needs and in this manner prevents for the rich poor the possibilities to obtain the means for a humane existence.

The rich poor

We will refrain from making statements such as "things are not as bad as they seem where it concerns poverty and hunger" or "exploitation is of subsidiary importance", as does Boulding.

The poor are rich, because they bear no guilt in the four primary causes for the problems of humanity (Galtung, 1980):

- the increasing damages through war
- the persistant failure to fulfil living requirements
- the increasing inequality in the gratification of needs in accordance with a clear geographic/political pattern
- the increasing exhaustion and pollution of nature.

The poor are rich since they are not as yet completely enslaved by our western science and technique. They are exposed to the consequences of inequality as a statistical quantity, without being asked how they experience these consequences.

They are the victims of the new industrial state. The poor are the victims but, nevertheless, they still experience a relative degree of freedom.

And yet, the poor in the third world are probably in a better position to take advantage of Appropriate Technology than is the population of the industrialized countries.

Galtung states that there are three lines of development that run through his publication "The real worlds".

- a change away from the capitalistic manner of production (in the first as well as in the second world),
- a change away from large scale enterprise and hierarchical organizations,
- a change away from the nationalistic manner of society, to forms that are not bound to any area or country.

The developmental possibilities such as indicated by Galtung connect with those of the technology for liberation, for reason that:

- characteristic for the capitalistic manner of production is the international economic dependence. Selfsufficiency is the way that leads to economic independence
- hierarchy and large scale enterprise can be collected in selfgoverning organizations

- nationalism disappears when the population becomes emancipated.

For all three of these basic data given for liberation, it would seem as though better opportunities are available in the third world than would be the case in the industrialized countries, but this would involve that the industrialized countries must clear the way for Appropriate Technology to come into being in the third world or otherwise the third world shall have to go its own way.

Chapter III

APPROPRIATE TECHNOLOGY A WORKING METHOD - "WHEN IN A HURRY, TAKE YOUR TIME"

1. Introduction; a strategy for change - the attainable ideal

A strategy for change

"Well, perhaps you're right about Appropriate Technology, but it'll never get of the ground here. It is a fact of life that people want western technology and you can't withhold it, if that is what they want."

Undoubtedly, the most difficult point of Appropriate Technology is the reinforcement, the bringing to the attention of and the implementation of changes that lead to Appropriate Technology. The technostructure, the industrial state, is organized so well that it would seem impossible to break into it or to break through it. Despondency is rampant on every level. It appears as though all of us are caught in a tiger cage of our own making, that is gradually lowered into the water by our own hands. That cage seems to be the western culture and its firm conviction that this culture is worth more than are the non-western cultures. The manner in which people of the west have always seen fit to approach the "primitive" cultures is a clear indication of this fact. They took western civilization as the standard of measurement for their research, which, in fact, only served to affirm their own prejudices and values. A prerequisite for the evaluation of another culture is an intense- and loving interest in the other culture, without any trace of prejudism. (Lemaire, 1976). That, of course, is easier said than done. Still, a primary condition for the alteration of the existing prejudices and values, is a becoming aware of the fact that such prejudices and values form a part of our own personality, partly determined by the culture of which the personality is a part.

It is these cultural fetters that make it difficult to look over the edge of the tiger cage. Technology and culture are closely interwoven. The engineer that applies other values and prejudices as a departure point for his activities is like the ant that is being invited to reach for the ceiling. It is perhaps human nature to prefer your own way of living above that of other races or people; however, this ethnocentric viewpoint does not take away from the fact that other cultures can only reasonably be judged by the participants of that

culture. (Lemaire, 1976).

The next step, after becoming aware of the conditions set by our own values and prejudices, is the realization of our own (power) position and the consciousness of the equality of races and people. This than is an essential point of departure for the improvement of the world.

The second point of departure that can be responsibly assumed, is that there is an increase in knowledge (of science and technique). But the evaluation as to its usefulness can, in fact, only take place on the basis of the equality of cultural systems. In a transition strategy, from domination of the world by western culture and its technology, via an acknowledgement of the value of other cultures, to development of appropriate technologies, western theories (also those proposed by Appropriate Technology) will have to be used with the greatest of caution.

Also marxism, pre-eminently a western theory, can, when used as an instrument in the hands of indigenous liberation movements, serve to further westernize humanity "because it is primarily a philosophy for an industrialized society, that sets as a condition for the possible liberation of mankind, the will to dominate nature." (Lemaire, 1976). This is also the reason, why from the standpoint of Appropriate Technology, the technology of traditional civilizations are viewed in a different manner.

Appropriate Technology places itself side by side with traditional technology, since the latter also seems to be based on the scarcity of natural resources. A strategy for change will, therefore, consist out of at least three parts:

- Becoming aware of our bindings to culture and its connected position (of power).
- Acknowledgement of the inherent values of other cultures.
- An understanding of the essence of a technology based on scarcity.

This third step is of vital importance, because the technology of scarcity requires adaption to the natural environment by means of the substructure of technical provisions and organizational regulations directed to this end.

The essence of the technology of the non-western societies, such as remain, could well be that they have developed a relationship with the natural environment in such a manner that a humane sort of life becomes feasible in terms of a durable harmony with the changing natural environment. (Lemaire, 1976).

These societies have created an ecological economy that prescribes a technology of scarcity, while the economy of western society, with its technostruc-

ture, has become engaged in battle with the ecology in which humanity will be defeated, quite naturally. Some may react: "That may all be very well, but I still have to eat". That is true; however, when the doctor is familiar with the patient, it becomes less difficult to affect a cure. The best way to cure western culture is from within. Less so by fooling around the fringes of the substructure by construction of a nice little solar panel, but more so by freeing mankind from the domination of western science and technology. Even though it may well be so that the manner in which the industrial state organizes and produces, supplies western man with the norms and values such as he has and vice versa. This means that by changing the substructure through the creation of selfgoverning organizations and selfsufficient soft-techniques, mankind will change, or so we hope. Because in a selfgoverning organization, working as little as is possible with specialists and hierarchy and where soft techniques are applied, it is possible for the participants in such an organization to develop. "Marx expects from the abolishment of division of labour not only rebirth of the "total man", of man in his entirety, but also the breaking of the power, assumed by a product made independent, as opposed to the working man, that is to say the breaking of the power of alienation" (Lemaire, 1976).

According to Marcuse, one-dimensional man comes into being within the industrial state, also for reason that standardized needs are being satisfied in such a manner that the "lower" living requirements are partially satisfied and the "higher" needs remain partially unfulfilled. The main point is, that only after becoming aware of our own essence of being, after acknowledgement of the other and after the coming into being of the understanding of the value and scarcity of the natural environment, can mankind come to a real gratification, of his lower- and fulfilment of his higher needs. To attain this, he shall have to assure himself of gratification and fulfilment of his living requirements out of the superstructure of becoming aware, making free and self-development, as well as out of the substructure with the aid of a technology of scarcity. "Society" (law, government and administration) will have to be made to serve these ends by allowing to take place whatever is locally conceived, regulated and accomplished.

It is my viewpoint that the question of whether we should do things in a different manner, no longer requires an answer. Those in power, like the rich Skolt Lap people described by Pelto, will, without a doubt, find that to do things differently is not necessary. The question if it is possible to do things

differently has not yet been answered conclusively and this can in fact only reasonably be done by showing an example of daily life.

The attainable ideal - communal selfinterest in a village

There are some communities in existence, not necessarily bound to a place, section or village that are for the greater part withdrawn from the ordinary economy of money. People pay one another at any moment that is suitable or desirable or when asked for; however, this is done, in preference, in goods or services. No calculations are prepared to this end. People know the "value" of an item or service and take care that a reasonable countervalue is given; there is confidence in one another's good will. Solidarity and friendship are not just words but everyday reality. To the outsider everything looks very normal. If one requires a product or a service one pays the normal price, in money. This bright economy, quite naturally, is also involved in the ordinary money economy since it is, for the time being, practically impossible to withdraw completely from such an economy.

An example of such a network of bright economy is a community in Main, situated on the North-Atlantic coast of the United States. In this community, many people are handy in almost anything; people cut their own wood for fuel, build their own houses or a boat, repair fishing gear, fish, hunt, keep animals for meat and dairy products, maintain their boats and cars, do plumbing, weld, and some are capable of drilling a well. Whenever there is sufficient money available, services and products are purchased. As long as there is work or fish available there is also work for plumbers, garage-operators and carpenters but when the fishers have no money, neither is there money for specialists. In that case, the process that keeps the official economy turning over is the surplus of fish. When there is fish, money is saved for things needed in the winter. Even though every fisherman is capable of doing almost anything himself, naturally some are better at some particular thing than are others.

One is very capable of repairing engines while the other's wife is good at making cheese. The tuning-into one another where it concerns personal needs by means of local skills and needed goods requires information.

To this end an informal network exists. What to the outsider would appear as improper curiosity, is in fact no more than keeping a close watch on what is going on and how this can be put to intelligent use. People in that fishing

community spend a relatively great amount of time in the keeping up of their network of personal relations. This network consists out of persons whose skills and resources are necessary to ensure a reasonable existence. Local cafes and stores are the places where information is exchanged. The network is maintained every day by means of personal contacts; if the contact has been lacking for a few days they ask: "where have you been stranger?". Once you have been taken up in the network you have to be available from one moment to the next. If you have an unwritten labour exchange agreement with your brother in law and you notice that he is fixing his boat you do not simply pass by but you go and help him.

This manner of living makes it impossible for the fisherman to participate in the industrial society or, more specifically, industrial labour for wages because he would detach himself from the local economic network. The price that you have to pay for participation in the bright economic network is a great investment in time. The yield is a great degree of independence of the money economy.

The point of departure for the economic network of such a community is the awareness of the limitation of the natural environment. This network is being determined by a natural equilibrium between mankind and the surrounding environment. This fishing community in Maine approaches the egalitarian form of society which is based on equality, as was the case with the Skolt Lap people previously discussed. Quite naturally, the influx of capital and technological innovation have disturbed the fishing community; however, the egalitarian character of the community has been retained. They take each man for what he can do and for what he does and not for what he presumes to know. Friendship is not a basic segment of the egalitarian networks. In a world with a restricted quantity of means for existence this is not possible. The actual basis is communal selfinterest.

This sketch of a modern egalitarian fishing community in Maine is a liberal and abbreviated version of an article in Co-evolution Quarterly by Bryce and Margaret Muir (1981).

The attainable ideal, therefore, in fact exists in every country, naturally. The basis is communal selfinterest which is again based on acknowledgement of the fact that worldy resources are of a limited character.

The elements of Appropriate Technology are easily recognized. Techniques are kept selfsufficient as much as is possible. The network organization is entirely non-hierarchic and literally selfgoverning. People view one another

as equals and stimulate one another's development by making use of it. The economy is chiefly ecologic and the economy of money of the city people is to a certain degree experienced as an interference.
This sort of community may serve as a blue-print for Appropriate Technology development in other communities. They can be visited and questioned as to their needs for reinforcement of their community and in which areas this necessity exists.

The attainable ideal - the jigsaw puzzle of a new reality

The day is october 25, 1982. On that day a number of leading good quality newspapers in Norway, the United Kingdom, West Germany, France, Italy, Spain and the Netherlands, publish the results of a large scale opinion-poll held in western Europe and the United States of America. The poll was involved with subjects taken out of daily life concerning the (inter)national problems confronting eight western countries.
In the context of this book, it may be considered as an important conclusion, that there is little difference of established opinion in the aforementioned western countries and, in view of the subjects thus far treated in this book, this is not at all surprising: the industrial culture, "the white giant" exerts a powerful equalizing force over the human psyche.
The second conclusion is, that unemployment, crime and inflation in the west are most worrisome. Nuclear weapons and the threat of war form, (particularly in the Netherlands and Norway) an item of grave concern in all countries that participated in this poll. The reason for this is obvious, since unemployment and safety are both subjects that stand in direct relation to existential needs. In the Netherlands, for example, 70% of those questioned considered unemployment and 84% safety and security (crimes and criminality (45%) and nuclear weapons (49%)) as significant problems.
Still, this presents a curious phenomenon, in view of the tremendous technical possibilities and so many clever minds.
The new reality is hard. The technique, so full of promise, in its current guise, is evidently not suitable to impart a feeling of security and to provide meaningful work.
Who are the people that are capable, in the jigsaw puzzle of the new reality, of bringing closer the attainable ideal of a sound society? It is those that, voluntary or otherwise, withdraw themselves from the direct influence of the

technostructure: the unemployed, housewifes, students, the aged, in short, all those that have the opportunity to free themselves.

But what are the practical points of connection necessary for such a becoming free? On the short term a number of concrete possibilities are available. The most important and the most evident possibility is to strive for independence of money. This can naturally not be done in just one step. This is not possible and probably also not desirable, because there are a lot of things that one simply has to buy. How, in heaven's name, can one make oneself independent of money? Seek for possibilities for saving and, together with others develop or carry out such possibilities. Subjects, such as the isulation of homes, more efficient heating, communal provisions in a street or section can be made for washing, small repairshops etc. all bear consideration. This, in turn, will lead to development of conservation techniques: the recycling of materials (like automobile parts, packing materials), the reclaiming of materials that are still useful from waste (old paper, glas, organic materials for biogas installations), the repairing of old equipment and appliances (washing-machines, refrigerators, television sets), the striving for use of renewable sources of energy (solar heat for warm water, windmills for the production of electricity, co-operative biogas installations), but also the production of food in personal gardens or in communal gardens. This is all concrete and can be carried out immediately or almost immediately. It leads to savings and prolonged use of products that are actually made to break down quickly. By the re-utilization of parts, reclaiming of materials, repair of tools, parts and machines, the fixing of larger equipment such as automobiles, lower consumption of energy, the utilization of renewable energy, the self-production of food, the dependence on money can gradually be reduced.

As a consequence of this, it is just those most vulnerable groups in society that are in a position to reduce their economic dependence, with simple, easily understood technical means capable of promoting the degree of self-sufficiency.

From such a position of economic independence a more aware choice can be made as to which technical provisions one wants to remain dependent on. This manner of working also involves the creation of employment opportunity for oneself.

It is evident that it is no simple matter to start this sort of activity by oneself. The manner in which we are housed provides little or no inducement to speak of. The family living in a one-family home is an excellent economic

target group that is in need of everything in the consumption society: a car, furniture, household appliances, television, radio etc.
The living in communal facilities does, in fact, damage the manner of production of the industrial state: people are purchasing less. The family, neighbourhood- and area groups are consumption groups. If a gradual turn-about has to be made, from consumption group to production group for selfsufficiency, it will be necessary to start from the base with political autonomy or, as Peter Harper calls it in his publication "Radical Technology" (Katernen 2000, 1972): co-operative independence. Perhaps this does not seem immediately apparent, but it is just this increasing economic and political independence that can lead to the formation of self organizing production groups.
These exercises in selfdetermination on the part of customers and workers are an education for political-, economic- and spiritual independence. When Illich, in his publication "De-schooling of society" (1979) pleads for the abolishment of schools, he actually refers to the problem that our schools educate to promote dependence. A sound, healthy society can only come into being if people are brought up and educated towards independence and that is not the same as expertise. Because the tunnel vision of the modern specialist is difficult to fit into the network-thinking that is required to make independence possible.
The compulsion to adjustment that emits from the code and structure of the industrial society, leaves freedom a relative concept, also for those in power. In the jigsaw puzzle of the new reality, the compulsion to adjustment is a problem capable of being projected against a background of an ever increasing degree of neglect and petrifaction of relations, that reaches deep even into the most intimate of human relationships. Yet it is this very neglect wherein lies the key to change of the technostructure. Warmth, friendship, consideration, solidarity, reliability, faithfulness all are concepts that cannot be bought for money, yet are probably of great importance for the becoming free from dependence.
Today, whether in the Netherlands or anywhere else in the world for that matter, the transition strategy towards a healthier society will afford the greatest chance of success:

- if consumption groups will gradually start behaving like production groups.
- if the business-like aspect of relations is gradually driven out of organizations and groups (that is not to say that people should become un-business like) and replaced with humane aspects.

- if, from the concrete situation such as exists in street or neighbourhood, there is a striving for the reduction of dependence on money through the development of selfsufficient techniques.
- if expertise and specialism is called in only where it is conducive to the promotion of independence of persons and groups.
- if unemployed people and others that are not involved with the techno-structure, strive to become involved with people of similar inclination and of equal mind to, together, continue striving to bring about a greater degree of say-so concerning their own life and work.

The jigsaw puzzle of the new reality is such that it is just the very hardness and petrifaction of the industrial framework that creates the room in which, bit by bit, the weaker can free themselves to, together with others of their own choosing, gradually reduce the dependence on money and the consumption compulsion.

2. A three dimensional model for the description of the renewal process by means of Appropriate Technology - the engineer and the ant

A future with Appropriate Technology can, in fact, not be imagined. Not so much for reason of its accepted values or the desired living style, but rather because of the far-reaching consequences of the changes that are ultimately required.

The ruling process of the western culture, whether written or verbal, barely permits any other way of thinking. We have to learn to imagine a different future and in that manner break through the limitations of our own cultural present. We have to look over the edge of our own culture in order to perceive and describe the necessary process of renewal. We have to become free of what we consider possible.

A new paradigm of science and technology would have to come into being that is seen as a challenge. A vision that is based on change of the system of the industrial state, in such a way that a healthy society comes into being, one that promotes human development and that is based on - and encourages - the striving for equilibrium and respect for the living community (Bennis, 1979).

All the cynicism and sarcasm of our times does not take away from the fact that a start has already been made, however small; here and there some small stores attempt selling vegetables that have not been sprayed with dangerous

chemicals and here and there a farmer tries to raise these vegetable in that same way; a newspaper tells that somewhere some 100 employees are taking over a construction company in their own management, while another enterprise is moving into wind- and solar energy and biogas installations. The future has already begun some time ago. The processes that ring in the new future are manifest. They are a morning blossom in the evening twilight of the previously mentioned report to the President of the United States, called "Global 2000".

It sometimes seems that out of these processes, a new science of life is coming into being very gradually; a science that takes into consideration the given conditions of the ecology; a science that also has as point of departure the fact that we are an intimate part of the processes of change in the living community. That new science of life assumes that the creation is selfregulating in the following manner:

- the characteristic forms and patterns of the organization of systems depend on influences that lead to recurrence of the forms and patterns of the preceding corresponding systems. The regularities of nature should sooner be viewed as habits than as the result of timeless laws. The question as to an explanation of the cause of new forms and patterns is left open. That cause may be coincidental or may be a creative power in nature.
- The assumption is based on the acceptance of morphogenetic fields (form-creating fields). These fields carry the forms and patterns of earlier systems over unto future systems by means of form-creating starting points or seeds.
- Distance or difference in time are not considered to enter into this process; rather, all "habits" of all systems from the past are added up and carried over unto future corresponding systems.
- If we carry the idea of morphogenetic fields over unto the probability of events in the nervous system, this would explain how the inheritance of behaviour-patterns takes place in a similar fashion. (Sheldrake, 1981).

If we accept that nature is self-regulating, as indicated above, we could view the current seekers for new forms of science and technology, to better patterns of co-operation and to a healthy society, as participants in the coming into being of new "habits" of humane existence in closer agreement with the "habits" of the nature around us or, as a wellknown Dutch politician expresses it: "those that have faith are in no hurry".

The attainable ideal, a transition from industrial technology to Appropriate

Technology is in reality no more than an attempt to create room to experiment in an aware manner or for a new "habit" of the building of technical provisions and the creation of organizational regulations that factually connect to what is consciously or unconsciously living in the people at the basis of societies.
It is possible to make such change visible by the making of a spatial image of the construction of such a "habit". We have made this choice for a spatial image for reason that, as previously discussed, society may be viewed as a tissue of organizations and techniques, the substructure and the program, and the code of that tissue, the superstructure. A spatial image makes this visible for observation. A human that develops himself to a person that frees himself and, as a consequence, becomes spiritually independent, raises himself above the low level of daily life in society, while a human, an individual, that is spiritually dependent goes to his ruin, immersed in the structure of society.
A society that leaves room for development becomes a community, a living community. That room for development is lacking where the existential needs cannot be satisfied. A poorly fed body is poor lodging for spiritual freedom and people in a subservient position in work or family will have difficulty in becoming emancipated.

The forms and patterns created by people also create society. It is possible to tune the technical activities of people to the assimilating capacities of nature, through utilization of soft techniques beneficial to the environment and to take into account the limitations of nature through thrift, re-utilization and reclaiming of raw materials and energy.
Simplicity is a goal that can be set to make visible the consequences of technical activities and to make possible an understanding of such technical activities in one's own natural environment. Processes that meet these requirements will probably lead to an equilibrium with nature. Living requirements are being satisfied in appropriate techniques and fulfilled with a humane form of health-care and with education aimed at development. Hard technique does, in fact, only take these matters into consideration when it is already to late; the production quantities are more important than the quality, in terms of purity, safety, beauty and human development.
Food is being contaminated in order to increase the productivity, drinking water is treated chemically for the same reason. Homes are, oftentimes, primarily considered as profitable objects. Health-care is a market for the

pharmaceutical companies and education is aimed towards preparation for adjustment to society. Goods are produced with built-in obsolescence, which causes them to be thrown away, which is good for business but not so for nature. Complexity is of no significance, just as long as the investment shows a profit. The technical provisions of western technique are characterized by superfluity. Production is not intended to satisfy the requirements of local or regional demands but rather for an impersonal market, by preference international. Large means good and any enterprise that prefers to remain small is viewed with suspicion. The technique of superfluity removes us ever further away from nature as a consequence. Superfluity for the wealthy group of people goes hand in hand with its opposite where it concerns the poor and where it concerns quality.

Technical provisions demand for patterns of co-operation, i.e. forms of organization. The type of organization that stimulates people towards development in Appropriate Technology is the selfgoverning organization. In such selfgoverning organizations the means of production are, or become, the possession of the participants in that organization. In order to keep the degree of alienation as small as possible and the degree of involvement as great as possible, it is feasible to move the decisions that should be taken towards the basis of the organization and there is a striving to have small groups in a non-hierachical organization.

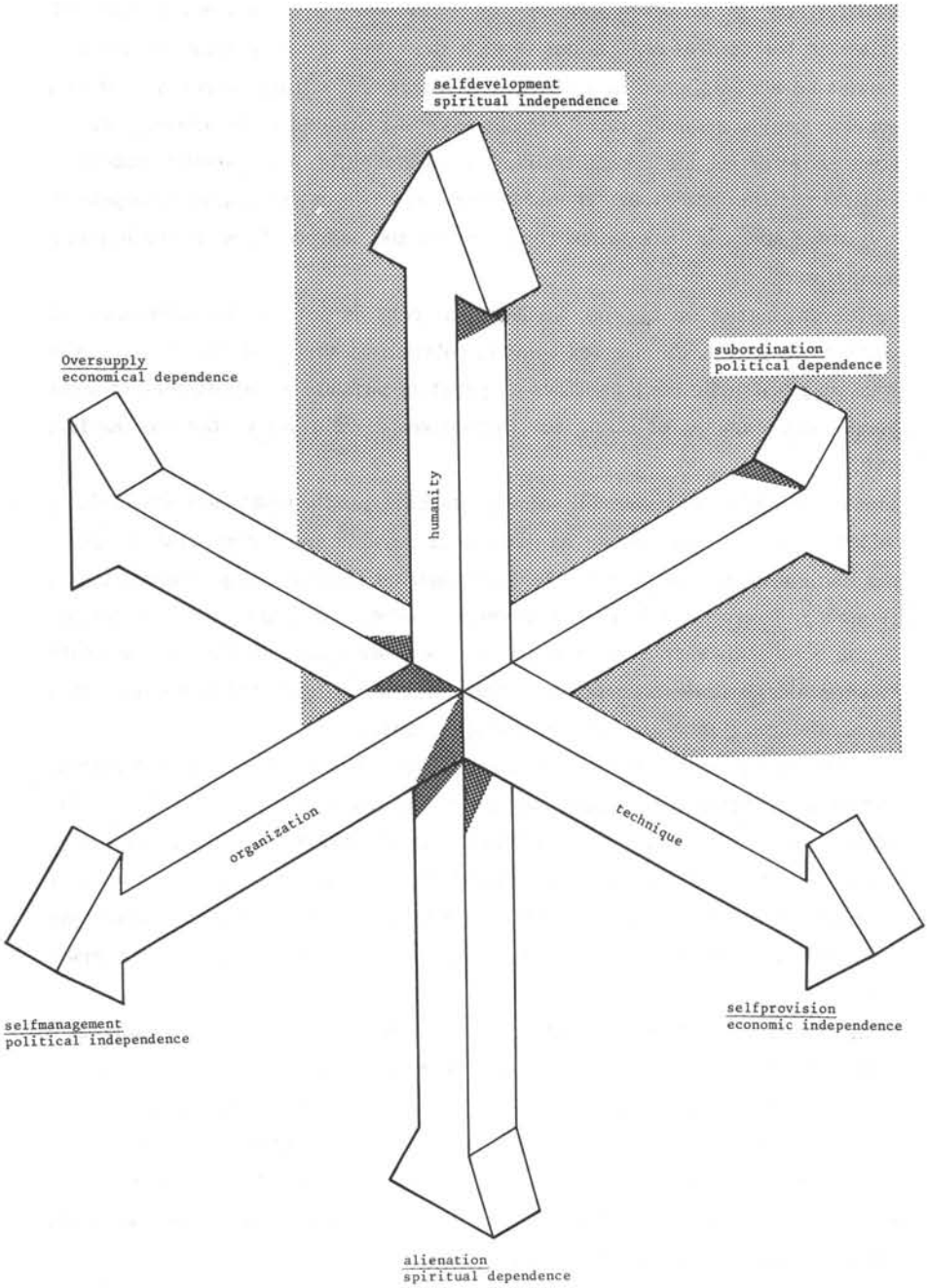


Fig.16: A three dimensional model for the description of processes of innovation for Appropriate Technology.

Pluriformity in co-operation can be stimulated in this manner and the criterion for central regulations is such that they are only made inasfar this cannot be accomplished in a de-central manner. Central governments should provide provisions and make regulations that stimulate democracy, small-scale enterprise and de-centralization. Meaningful work should occupy a central position and money should be used as little as is possible. Group-work and broad spectrum education can maintain the degree of specialization at a minimum level.

Selfdetermination as an end, involves as great as possible an adjustment to what basic groups themselves want in relation to their culture, much in the way that selfsufficiency provides as great as possible an adjustment to what people are capable of doing for themselves in relation to the surrounding nature.

The organization in industrial society, keeping people small and subservient, makes use of ordinary labour as little as is possible and has expensive machines and buildings; she governs the world market from a headquarters in Paris, Hamburg, Tokyo, New York or London and makes demands on the participants in the organization that, oftentimes, are no more than a yielding to voluntary slavery. Large scale enterprise is often an end in itself and these organizations of subservience are ruled by the specialists.

The goal of Appropriate Technology is to gradually render this type of organization superfluous. The superstructure of contemporary society, through its money-based economy, stimulates short-term thinking, the growth of vulnerable monocultures such as bedroom-cities and tea plantations and the city dwellers, that are entirely dependent and that have no other alternative than to adjust to superfluity and subservience. Our model is intended to make visible that:

- there is a three-fold direction of development in technique, organization and development that may be summarized in terms of

over/under provision to	- selfsufficiency
subservience to	- selfdetermination
underdevelopment to	- selfdevelopment

- the substructure of society is characterized by its forms and patterns, through its techniques and organizations
- the superstructure is determined by the possibilities of becoming free and selfdevelopment of people
- a process of renewal will result in Appropriate Technology, if positive

results are obtained, in the substructure as well as in the superstructure, in all three directions simultaneously. This presupposes that activities applied only to the superstructure (liberation movements) or only to the substructure (soft technique and/or selfdetermination) can only hold firm if the other aims are simultaneously pursued.

The engineer behaves much like an ant, if he only occupies himself with (organization) technique. The well-known centers of Appropriate Technology are, at best, occupied with appropriate technique. The suspicion in which people of the left regard Appropriate Technology can easily be understood, since it is, of course, true that a good windmill can also be manufactured by a large factory. This also explains the interest displayed by large industry for Appropriate Technology (Harvard Business Review, Nov. Dec. 1982). They can also manufacture such products in a simple manner in serial and this all looks very kind; however, the big bosses at the top remain big bosses. Therefore, it is a smart idea for Philips to have in the Netherlands a pilotfactory for the third world; but further than appropriate techniques they cannot proceed. Possibly, if forced by circumstance, such companies will grasp for less hierarchical organization forms; however, selfdetermination would, of course, not be possible and neither would co-operative ownership of the means to production.

It is also possible for developments originally rooted in co-operative movements with self-administration, to become reabsorbed into the technostructure. Because, if such an enterprise, as is usually the case, starts working with western technology it, simultaneously, gets involved with the various dependencies that belong to it: specialists are needed and this means levels and classes, expensive techniques, dependence on banks... For a co-operative movement to succeed, it requires circumstances that not only accept its character of selfdetermination but also support it and it is a fact of life that the available techniques are not being made to promote selfdetermination. Our structure of society is neither aimed at selfdetermination nor at selfsufficiency; yet, these very elements seem conditional to the provision of work for oneself.

Each process of renewal capable of leading towards Appropriate Technology can begin, irrespective as to where or how; however, in order to maintain the impulse it is necessary to know just why it is better to work in a certain way and not in another way. The working methods, the technique and the organization may also serve as a starting point. But Appropriate Technology, in

fact, only comes into being when there is a simultaneous development of all three basic elements; this is the basic hypothesis, the basic preproposition.
The spatial segment of the model expresses the events indicated by the three axes. Emancipation and selfdetermination are, most likely, the least difficult to realize, particularly on a small scale. The development of an indigenous technique, coming into being from within, appears to be the central problem however.
Galtung also perceives a process of change in technology. He presupposes a development in five stages (Galtung,1976):

1. the old international technological order; a worldwide network, ruled by the multinationals.
2. the new technological order; there is a fundamental criticism on the contents of phase nr. 1; however,the questions being asked are of a purely economic nature.
3. the ecological phase, wherein the possibilities for survival of the human species are of the essence.
4. the phase of selfsufficiency, wherein technology for local production and consumption is being developed.
5. the phase in which the west sheds its vanity and no longer occupies itself with missionary activities, but starts to listen to new sounds and signs such as, for example, emitted by the Indian Sarvodaya villages, Chinese communes, Israeli kibbuts and Tanzanian Ujamaa villages.

As is well known, the industrial society is still rather caught in the phase of dominance by the technostructure. The initial hesitant criticism is still on the level of economics: what is there to be done about unemployment, inflation and the new (international) economic order. Even a juster (inter)national division of income would not yield a change in relations of power and certainly would not yield a technology that would be capable of freeing men and living nature from domination.
Galtung's third phase has, in part, already started; however, oftentimes the relation between the ruling system, its science and technology and the destruction of other cultures and the environment is not clearly perceived and less so the relation between the dominance of the western industrial culture and the survival of the species. Selfsufficiency is still being considered as an impossibility and/or as being undesirable, while the shedding of our vanity has not even begun. Still, Galtung's vision contains aspects that are clearly the

domain of Appropriate Technology, the ecological phase, selfsufficiency and villages of a co-operative character.
A publication concerning developmental strategies and Appropriate Technology compares the Russian- and Mao Chinese models. (Diwan and Livingston, 1979).

	Russian	Mao-Chinese
1. production method	centralized	decentralized
2. production	capital goods	basic-need goods
3. techniques	capital intensive	labour intensive
4. education/technology	specialized	non-specialized
5. reward	material	non-material
6. location	urban	rural

Fig. 17: A comparison between two development models

The striking aspect of this analysis is, that the Chinese model, both in theory and practice, agrees with that of the model of Appropriate Technology, while the Russian model meets the requirements of the strategy of the western technostructure. The American model may in fact be characterized with the same concepts and in this manner the assumption that state-capitalism and free-capitalism are in principle identical, is well supported.
Still, the government of China, after Mao, has also made a choice for a western development model, i.e. for western technological culture and the problems that go with it. Evidently, the power of conviction exuded by western culture and technology is so strong that it is capable of transforming pure Chinese selfdevelopment into the dominating process in the direction of the western industrial state, that rules elsewhere. In other words, a state in which labour is rather prevented than improved.

3. Employment opportunity and the economy of a bill that can be afforded - the economist and his fear of change

According to Hans van Doel, a professor of economy, the problem of unemployment is not due to a shortage of jobs, but rather due to a shortage of money. (1980), i.e. what is needed is more money. That money has to be earned through an increase in export, a lowering of wages, a reduction in working time, an increase in productivity and an expansion in public services. Van Doel claims that, for example, in The Netherlands there are three possibilities of increasing the employment opportunity and, simultaneously, satisfy the fundamental needs as well as promote the emancipation of women. This can be accomplished (1) by an increase in exports, (2) by an expansion in the social services section and (3) through a reduction in labour time. According to van Doel, these three aspects can be instituted simultaneously.

Production has to be increased for the benefit of export. The gross national product, the income per capita, has to come up; this would seem to be an irrevocable law in economic thinking. To accomplish this, it is necessary to expand the base supporting-level of the economy, so as to create additional employment opportunity.

The argument is developed as follows:

- Production is the basic supporting factor of consumption; therefore, production has to be increased.
- Profit is the basic supporting factor for employment opportunity and vice versa; therefore, profits have to be increased.
- Those that are active are the basic supporting factor for those that are non-active. Van Doel remarks that, in this context, those that are active should stand in solidarity with those that are non-active and that there should not be too many non-actives. I would like to remark here that those termed non-active, such as, for example, housewifes, form the basic supporting factor for those termed active.
- export is the basic supporting factor for import; therefore, export has to be increased.
- the monetary yield from products in the market sector is the basic supporting factor for the payment of public services. Van Doel claims that three quarters of this yield is again utilized for products out of the market sector; therefore, it would be well to permit growth in the market- and public services sectors simultaneously.

In short, more money has to be earned in the production sector in order to create jobs. Income, whether expressed in terms of products or in money per capita, must be increased. Growth is the only answer that we receive on our question for more work. This is the answer of the sympathetic economists, like, for example, Tinbergen and also of the less sympathetic economists, like Friedman.

Why is it that no one is asking the question if it would be possible to do things in a different way? Why is it that no economic theories are being evolved around the problems of employment opportunity beneficial to mankind, fundamental needs and environment?
In other words, an economy that has as its primary aim the provision of employment opportunity that is both pleasant and healthy for everyone. Is this not feasible? Why then is it feasible to do so for a great many people in leading positions and for the specialists and why is there so little left for the workers in the production process? Why are the workers automated out of existence, but not those in the leading positions?
An important characteristic of industrial society is the production for consumption, for articles with a short duration of useful life, with a great deal of waste, raw materials and dissipation of energy, coupled to a very weak maintenance- and repair sector for reason that maintenance and repair are "too expensive". But is this really so? If we can conceive of a society, where repair, re-utilization, reclaiming, renovation and utilization of renewable sources of energy play an important part, does this not put us in a situation that asks for a great deal of manual work and considerable skills, which offers the best of possibilities for employment opportunities in the future? (Davis, 1981).
This sort of techniques promote local selfsufficiency and, therefore, a breaking away from international economic dependencies. Imported goods, with the exception of certain inevitable materials, could be replaced by those self-produced and this is also beneficial for the employment opportunities and for prosperity. In the United Kingdom an automobile lasts for 11 years and in Sweden for 15 years. If one could imagine that automobiles were to be manufactured in such a way that they would last for thirty years (and this is very well possible), this would revolutionize the automobile sector and, most likely, would create additional employment opportunity. For a great many products an increase in the duration of useful life could immediately be

realized, but this would involve at the same time a revolution in the type of employment opportunity, thus, in the economy and here arises the problem. Naturally, there are possibilities available to gradually direct the production structure of a country towards employment opportunity and economic independence; however, where are we to find an economist who would even dare contemplate or make propositions that would tend to lead to such a revolution, such a shift in power relations.

A stable economy means, in fact, no growth. It would appear much simpler to have a situation with many millions of unemployed that could be controlled by the deployment of police, army and riot squad whenever they would turn troublesome.

In any case, resistance, such as it exists today and for the time being, is primarily directed, just as it was in the beginning of the industrial revolution, against the symbols of the industrial state: nuclear energy, the neutron bomb, the closing down of an enterprise; however, the liberation movements in the industrialized countries and in the third world are also capable of promoting the resistance of the population against the system. Important consequences of the far-reaching degree of industrialization, such as the observable increase in temperature of the world climate, according to NASA-research, and the devastation and dehydration of large areas previously fertile, are becoming well-known facts.

The fear of change, not only on the part of those in power, expresses itself in the attempt to curtail change, even in those cases where change would be for the better. The employment opportunity problem is perhaps not in the first place an economic problem, but rather a consequence of unbridled industrial growth moving against the reality of the limitations of the ecology. The using up of our living capital appears, for the time being, the only possibility to support continued growth.

New employment opportunity and Appropriate Technology are closely connected, because "our survival and the survival of other species is dependent on our willingness to make peace with nature and to start living in a co-operative way with what remains of our eco-system. If we are capable of doing this and if we will give the natural re-utilization process enough time to recover from the injuries that we have inflicted upon the earth, then we may be able to expect that we and all other forms of life will have a long and healthy stay on this planet." (Rifkin, 1980).

Selfsufficiency, that is to say: becoming economically independent, is an

attractive possibility to restore a healthy equilibrium with nature. According to Rifkin, there is a fundamental error in most economic theories, be they capitalistic or socialistic. Everything in nature can be viewed as being without value and only after human labour has been added, it attains to value of a sort that affords trade or utilization. By the inversion of the meaning of the first two primary laws of thermodynamics, the modern economic theory has wrongly laid down the foundations for economic activities.

The first primary law states that all energy is fixed and can neither be created nor destroyed, but only transformed.

The second law states that energy can only be transformed in one direction, from useful to less useful, from available to less available.

Whenever, or in whatever manner, energy is utilized, a part of it is lost, or leaks away, until everything, inclusive of that part that has been put into products, finally, in one form or another, lands up as waste at the end of its life-time. For most economists this presents a difficult dilemma. They are wedded to the notion that human labour adds value to the natural raw materials instead of to the fact that the value becomes less due to the production of waste. According to them, costs are being kept as low as is possible, in opposition to the fact that costs are being made as high as is possible. They, apparently, are not capable of understanding that machines and people cannot make energy, but can only transform it from a condition of usefulness to a condition of waste via temporal technical provisions.

On the basis of the thinking model of the laws of thermodynamics, an increase in productivity signifies only an increase in the quantity of waste (heat), therefore, it is of the essence to have such increase proceed in as slow a fashion as is possible.

This also means that a process that is economically attractive, oftentimes, ecologically looses more, in proportion to the number of steps contained in the process. The creation of complexity of industrial processes is a part of the technostructure. Large enterprises and complex processes with many steps signify in particular a great deal of waste energy and more long term problems for the living community. The current economy can be unmasked by any student who has followed and also understood a basic course in thermodynamics theory. That this doesn't happen is due to the fact that all their lives they have been spoonfed with the one-dimensional notion that "growth is necessary and, therefore, good". The truth, that stares us in the face everyday, is something else entirely however: "the end of the industrial age is

announced by the depletion of non-renewable energy". (Rifkin, 1980).
A gradual transition to an ecological economy that is based on the conservation of our living-capital, the utilization of renewable sources of energy, recycling and reclaiming, repair and maintenance, is capable of creating a sufficiency of employment opportunities; the only disadvantage will be that the labour force cannot be governed as easily, since new employment opportunities will be small scale and more flexible and will stimulate self-government.
It is a case of where an economy of unpaid bills and squandering of our living-capital will have to be transformed into an economy with bills that we can afford, an economy of equilibrium.
To this end, policies will have to be made; policies that will strengthen an ecological economy, aided and stimulated by Appropriate Technology; policies that are intended to create humane employment opportunity.
The american economist Daly, in his publications concerning steady-state economics, has enumerated certain prerequisite points for the realization of such policies. The illusion that economic growth is necessary has to be abandoned. Any attempts to reduce production cost to as low a level as is possible, must inevitably lead to as high as possible a level of damage to mankind and the living-community. The aim should be to produce as little as possible energy- and materials waste. Selfsufficiency is worth striving for, since a gradual breaking away from economic dependency makes clear what is locally or regionally desirable and possible. Employment opportunity will, therefore, be created in direct relation to the actual existential requirements and aimed at a thrifty administration of nature.
In this manner it would also be possible to abandon the impracticable concept of gross national product per capita of the population and have it replaced by the measure of satisfaction of fundamental requirements per person and basic group.
An important problem in a steady-state economy is that of measurement: by what standard can one gauge the usefulness of a process. Up till now this has been easy enough, money being the standard. In a steady-state economy money may still be useful as a calculation-unit, but never as a standard for measurement; for this, for example, the measure of increase in waste (heat) in relation to a complete system, from the mining of raw materials to the treatment/disposal of waste, could be used, while, in addition, every factor of tax or stress on the environment should be treated as a cost factor. Indeed, it

is a difficult subject: Appropriate Technology and economy; a steady-state economy; however, we are working on it (Boes '83).

The technological store - a key to success

If the basis of society, i.e. mankind itself, is to attain to the possibility to develop independence and to stipulate its own developmental goals, it will be necessary that the government provides the required incentives to this end. If we take existential needs as the point of departure for a development, then it will be necessary to have, or make available, the means to satisfy those needs, such as food, housing and health-care, as well as the tools necessary to produce such means. As previously stated, the translation from needs to means and tools will have to be in accordance with what is locally available, making as great as possible use of modern knowledge.

In The Netherlands, for example, at the various universities and institutes of technology so-called science stores are coming into being. These stores provide those groups that are poor in chances with the scientific know-how required to support their various activities.
A technology-store has aims similar to that of a science-store; it is established in a region where developments are actually taking place. A technology-store is a place where basic groups can actually see which particular technology is useful for the realization of their goals. Usually, prototypes, functioning examples of apparatus, are on display of a type that connect with real local needs. There are people on hand to take care of the various courses of instruction concerning technical- and organizational aspects of the implementation (Riedijk, 1981). The technology-store can form a link between the industrial specialists and science, the government and the local populus.
The laboratories of industries and universities are usually established in urban centres in buildings that are neither accessible nor inviting. No point of transfer, no multi-disciplinary centre and no science store can avoid being a part of an organization at the top of society. A project or a program can only be regarded as succesful if those involved are capable of viewing it as their project or program.
Technology-stores, provided that they are manned and operated in co-operation with the local population, can return technology and science to the base of society. An example that corresponds with the idea of the technology -

store is the field-station. This was realized in the project, or rather program of co-operation between the Development Technology Centre (DTC) connected with the Institute of Technology in Bandung (ITB) in Indonesia and the University of Technology of Eindhoven in The Netherlands.
The project was mediated by the TOOL Foundation (Technical Development for Development Countries) in Amsterdam. This project was started in 1976 through contacts with DTC and the Faculty Appropriate Technology of the University of Technology, Eindhoven, The Netherlands. Through co-operation with the authorities it was possible to have field-stations available, while the Institute of Technology in Bandung and the University of Technology in Eindhoven could take care of the prerequisite technological support by way of DTC and TOOL. But in actual fact, it was a co-operation of the population in the vincinity of the fieldstations in the province of Sukabumi on Java, the local authorities, the Indonesian technicians of DTC/ITB and their Dutch colleagues.
Training programs in Appropriate Technology were arranged, for example, in the field of manufacture of ferro-cement. In order to accentuate the significance of Appropriate Technology for the development of the rural areas and also to affect the introduction of Appropriate Technologies with other universities in Indonesia, these training programs were also arranged for staffmembers of other universities.
In 1980 there were about 60 people directly involved with the project. On the premises of the Institute of Technology in Bandung the office of DTC was established; there was accommodation for giving of various courses and, if necessary, experiments could be carried out in the laboratories of the institute. DTC had three field stations available where prototypes were demonstrated and courses were given (Herudi, Hommes, Sapiie, Riedijk, 1980).

Those rare organizations that are succesful in the implementation of Appropriate Technology evidently have placed their supporting technical- and organizational activities in the local surroundings of the basic groups. Fundamental research, comparative product research and testing of prototypes could be carried out in well-equipped university - and technological institute laboratories, but the development and implementation of Appropriate Technology itself can only be accomplished in direct dialogue and co-operation with the basic group.
This creates room for people as a result of the fact that the structure of

society is not dumped over them in the form of bureaucracy, products and services, but rather that they are provided with room to make their own products and to set up their own organization and services in correspondence with their own wishes and possibilities. Projects and programs capable of promoting and stimulating these aims belong to the field of Appropriate Technology.

4. Evaluation - the quality that cannot be measured

Evaluation occupies an important position in daily life. In the schools progress is represented in terms of numbers; in many a company the employee is annually evaluated and in daily life we pass on one another, either in private or in the presence of the one that is evaluated, judgements about each others lives and activities. Usually such evaluations take place coming from up above to down below. The teacher from up above to the student down below, the boss up above to down below those who work for him and the parent to the child and, in part, it would be difficult to do otherwise. Knowledge and skill are capable of being transmitted in an adequate process of learning; however, modesty is the characteristic of the true master. The good master knows that in order to promote beneficial progress, a good process of learning is prerequisite and that, in this, the quality of mutual exchange between student and teacher is of the essence. Bad pupils and a good teacher don't go together in the same manner as good pupils don't go together with an inadequate teacher. Many an unsatisfactory mark given in the teaching of mathematics may either indicate that the pupils are stupid or that the teacher teaches poorly and it is likely that the first situation occurs less often than does the latter.

Evaluation is a concept that is often used nowadays. It is a judgement in which a situation of learning, a dialogue, an enterprise, a club or a society, a project or a program, is reviewed in such a manner that it involves all parties concerned. The concept of evaluation has its roots in the science of behaviour, which is a scientific field in itself; for example, at the State University at Utrecht, The Netherlands, a separate course in evaluation-research is given at the faculty of social sciences.

Evaluation of qualities capable of being measured is not so difficult a matter, even though, according to A.D. de Groot, a well known Dutch methodologist

the reliability of our grading system is very questionable indeed. This indicates that even measurable qualitites are difficult to determine with a high degree of reliability.

The things one needs to know in the evaluation of Appropriate Technology projects and programs belong, in part, to the domain of the measurable quality: what happened to the raw materials, the energy, the production equipment, the money, the employment opportunity. For the other part they belong to the domain of non-measurable or not directly measurable quality, such as: to what degree have selfsufficiency and selfadministration been accomplished, what has happened to the natural- and cultural environment, are we dealing with a process of selfdevelopment. In order to evaluate data that belong to the field of "to measure is to know", the specialists are capable of making a study of the administration, the yield in terms of products, the sacrifices required to make the products.

With these and other similar data, the effectiveness and efficiency of a technology can be measured; the value of the effectiveness in this context is the ratio of the real means employed to the norm that can be attained. The efficiency gives an answer as to the degree in which the desired result has been accomplished. A provision for coastal hydraulics may be designed effectively, but due to inefficient construction the money may be used up before the project has been completed. The means for a project for the provision of food may be administered efficiently, but those for whom the food is intended may have died in the meantime; as such the project is not a very effective one. Evaluation for effectiveness and efficiency may be carried out by "outsiders" and the average project or program contractor may be satisfied with the findings; a short inspection-visit will suffice and more is not to be expected, neither here nor in the third world.

The question as to what the significance of a particular project or program may be to those involved is difficult to answer. This is true in relation to questions such as: "What precisely has the project accomplished where it concerns the people themselves. What has been the effect on the environment. What do the people themselves think about it ". In order to find answers to this sort of questions, it is necessary that one is inside, a part of, the project. It is necessary to know and understand the people and their circumstances intimately. This is best accomplished by working along with them in their activities. The aloof stance assumed by the technician or the economist is adequate where it concerns the evaluation of the usefulness of the means

that are employed, but they fail in their evaluation of the significance of these means. This requires the participating sort of observation, i.e. the working method of the ethnologist or the antropologist who attempts to be a part of the total, while at the same time retaining sufficient distance, so as to permit meaningful interpretation and judgement. In the Dutch Thinking-Tank Appropriate Technology (DAT) a scheme was proposed and accepted for the evaluation of Appropriate Technology projects (DAT, 1980). The evaluation of projects and programs serves the function of supporting policy making, i.e. the furnishing of information where adjustment of policy is required and for the approach of similar activities. There are three types of evaluation:

- evaluation of significance, i.e. the question if the activities are conducive to the realization of the (policy) aims.
- evaluation of effectivity, i.e. the question as to the relationship between the means employed and the direct results.
- evaluation of efficiency, i.e. the relationship between the means employed and the attainable norm.

In view of the above, the accent of development projects should be placed on the evaluation of significance, without loosing sight of effectiveness and efficiency.

To this end, evaluation should include the following elements:

1. Short description of the project. Who are the people involved.
   What are their aims.
2. How has the problem-description come into being.
3. Where are the projects to be carried out.
4. What is the participation of the basic group and the researchers involved in the problem-description and in the execution of the research/project.
5. To which degree does a need appear to exist, on the part of an institute or organization in the (development) country, to carry out the activities aimed for.
6. In how far- and in which manner - can be expected that the activities are of importance to:
   - the poorest population groups
   - the backward rural areas
   - the selfreliance of the country
7. On which level can the project find application:
   - household
   - village
   - regional
   - inter(national)
8. Will there be a contractual agreement of co-operation with an organization in a (development) country.
   If so, how is the relationship between this organization and the organization that is sending out regulated and how are the lines of responsible authority- and communication arranged.
9. In the event that an agreement can be reached:
   What is the character of that organization: government or non-government.
10. Does the project feature built-in training aspects for the participants in the (development) country.
11. Will there be acquisition of knowledge, transmission of knowledge or technical adjustment.
12. Will there be follow-up assistance after the completion of the project.
13. What is the time schedule for the project.
14. What quantity of material- and personnel means are built-in into the project.
15. How is the project appraised by the people involved.
    Professionally: very high/high/moderate/slight
    In relation to the importance for development: very high/high/moderate/slight.
16. Why is the evaluation considered to be of importance.

Fig. 18: Elements for the evaluation of a project.

Every project changes an existing situation. Oftentimes, the project-proposal is formulated in such a manner that no provisions are made for the evaluation of changes in the immediate or distant surroundings of the project. The evaluation of the means required needs to be coupled to evaluation of the significance. It is quite possible that a project must be regarded as having failed, in the sense of the evaluation of its effectiveness or efficiency, while

the further-reaching result of the project has created a positive climate for further development and vice versa. These considerations should also be related to the evaluation. Finally, the evaluation needs to be a part of the development process of the project.

Evaluation - another way of doing it

From 1977 to 1980 an evaluation investigation has been performed by six scientists out of various disciplines concerning the project administration of a Dutch joint-financing organization (Hommes, 1980). This policy group, after a few months of preparation, has developed an evaluation experiment with a duration of two years, designed to obtain insight into:

- how the organizations that carry out the projects function
- how does a project progress, where it concerns the aims/effects, means/-execution
- what does the pattern of relations between the organization giving aid and the project-organization in the third world look like.

This, in fact, is both a significance as well as a means evaluation. Of great importance for this evaluation was the choice for a relatively long field period of 14 months, while only 27 project organizations were evaluated in that period of time. The policy group employed four evaluators: one for India, one for Africa (Kenya and Tanzania), one for South America (Bolivia, Peru and Columbia) and one for Indonesia. The field period was preceded by several months of preparatory study and training. Halfway through the field period a visit was paid to The Netherlands for interim deliberation and consultation. In order to make reasonable comparison of the research results possible, the four-field workers completed a course in evaluation and a research outline was prepared, while the members of the policy group also made field trips. The reports that issued from research in the field were discussed in considerable detail within the organization and in the project organizations and implemented with the necessary, and oftentimes emotional, commentary. For this reason, the research reports have remained unpublished and rightly so.
From this may be deducted just how very sensitive, in particular the area that deals with the evaluation of significance, is for all people involved; this in spite of the fact that a great deal of deliberation preceded the evaluation, concerning the aims, motivations and execution of the evaluation.

This sensitivity in particular connection with the evaluation of significance can readily be understood, since the aim of the organization involved is usually the stimulation of a liberation process intended for the poorest and most dependent people, with the accent placed on self-reliance and independent organization on the part of the basic group, while the aid-organizations, as a rule, have as point of departure the realization of freedom, independent organizations and forms of self-reliance capable of supporting selfsufficiency. This means an improvement of position in the material sense as well as in the non-material sense of the word; thus, for example, employment as well as education. Where it pertains to emancipation, a distinction is apparently made of four levels of increasing liberation:

1. the basic group accepts and uses the aid that is offered, but remains passive otherwise.
2. the basic group is actively involved with the execution.
3. the basic group has say-so in the execution.
4. the basic group has say-so concerning policy as well as execution.

In the field of self-determination, four types of organization of increasing self-determination were found:

1. organizations for mediation - a sort of brokers in development aid
2. project organizations - those that execute the project
3. the animation group that works for the basic group, but that distinguishes itself from that group by reason of caste, grade, class or race.
4. the organization is from - and through - the basic group.

It is interesting to note that in the reporting, the technical segment of the evaluation-vision is absent, while it would, in this instance, certainly be possible to apply a similar scale of increasing selfsufficiency:

1. complete dependence on the supply of equipment, raw materials and energy.
2. raw materials and energy are obtained without the aid of outside interference, while equipment is supplied.
3. raw materials and energy under self-management, while equipment is self-built.
4. raw materials and energy are obtained from the own surroundings, the development of techniques takes place under self-management and the production equipment is owned by the organization.

With the aid of these three characteristics of evalution of increasing autonomy in relation to emancipation (self-development), selfdetermination and self-sufficiency, a frame of reference has come into being that would make possible the evaluation of significance as well as the evaluation of means for Appropriate Technology projects and programs in industrial countries and the third world.

With the abovementioned arrangement for evaluation it also becomes clear why various developmental possibilities not always lead to liberation:

- Development and production of appropriate technique by an organization that is not in the hands of the basic group. The basic group has only agreed with the appropriate technique. At the very best, the final result is that technique and employment opportunity come into being of benefit to the environment; however, the group may still remain politically and spiritually dependent.
- An organization of - and through - the basic group; selfdetermination with appropriate organization. The basic group accepts the technical aid that is being offered; this technical aid consists of modern western technique. Raw materials, equipment, energy and knowledge come from outside. The possible result is that a non-hierarchical humane type of organization comes into being. There is employment opportunity with self administration; however,the awareness of technical dependence will probably lead to dissatisfaction. Even though there is a degree of self administration, policy, execution and technique are not in the hands of the basic group, therefore, there is probably spiritual and economic dependence.
- There is self-determination and self-sufficiency; however, the basic group has not by itself developed the policies and the execution for the construction of the soft technique and the self-governing organization; therefore, there is a certain degree of dependence upon those that are giving the aid. When the organization giving the aid disappears, the chances that the substructure will fall back to a position of dependence is great.

  The making free, without technical-organizational tools is just as complete as is a self-reliant substructure of technique and organization without liberation.
- There is selfdevelopment and selfdetermination; policy and organizational execution are in the hands of the basic group, but without technical know-how. It will be practically impossible for an emancipated, selfgoverning organization to free itself of the infra-structure of western technique, the

supply of essential spare parts, drawings, maintenance technicians and equipment.

Autarky seems the most difficult and the most important link for the development of Appropriate Technology.

- If only the factor of selfadministration is absent, it is possible for opportunists, or for these usually in power, such as the bankers, industrialists, politicians, scientists etc. to assume power over the free autarchic basic group.

An arrangement for evaluation that is capable of reproducing the three non-measurable quantities of Appropriate Technology: selfdetermination, selfsufficiency and selfdevelopment in relation to the significance of the project, while it is capable of giving the normal classical yield in numbers (such as the yield for energy and raw materials), makes possible the evaluation of even the most advanced forms of technology in terms of its usefulness towards the attainment of liberation.

In the foregoing paragraphs Appropriate Technology has, in fact, been described as a technology that aids in the creation of room for development. Development was indicated as a process leading to greater self-reliance.

In evaluation-research we are on the one hand concerned with questions such as: "why evaluate, what has to be done, who will do it, where is it happening, when has it to be implemented and how", and on the other hand with the personal opinions and theoretical ideas about "technology for liberation".

Research into the conditions, determinant for the successsful introduction of appropriate technology still hasn't been done to any significant degree. In particular, the engineers and technicians involved have done very little to gain insight into the significance of their own contribution. Regardless of whether the research concerns the chances for success, quality control or the evaluation of the results obtained, it would seem that an integrated approach from the various points of departure, such as technical, economical, social or cultural, is of considerable importance. In order to arrive at results that can be compared, it is of essential importance to quantify along the three axes of the model.

- Technical-economical elements can be selected for value determination (profits-costs/profits). The maximum value of this factor is 1.
- Social-political elements, the feasibility for dissemination may be selected as the critical standard. If every inhabitant is capable of governing and

maintaining the technology, the factor is 1.

- Social-cultural elements, acceptation of the required technique and organization can similarly become a maximum of 1, where everyone involved is able to absorb and understand the technology concerned.

The development space that is spanned in this manner runs simultaneously towards a technical-economical value, a social-political dissemination and a social-cultural acceptation of 1.

Vellinga (1985) gives a clear summary of the successive development-theories and the methods of evaluation that are connected with it. It is evident that the working methods here proposed are situated on the right hand side of his summary (simplified by the writer).

	classical	modernization	dependence
points of attention	costs-profits	costs-profits effects	costs-profits effects significance
factors	technical-economical	techn-economical social-political	techn.-economical social-political social-cultural
level	micro	micro/meso	micro/meso/macro

Fig. 19: Comparison of development models (Vellinga, 1985)

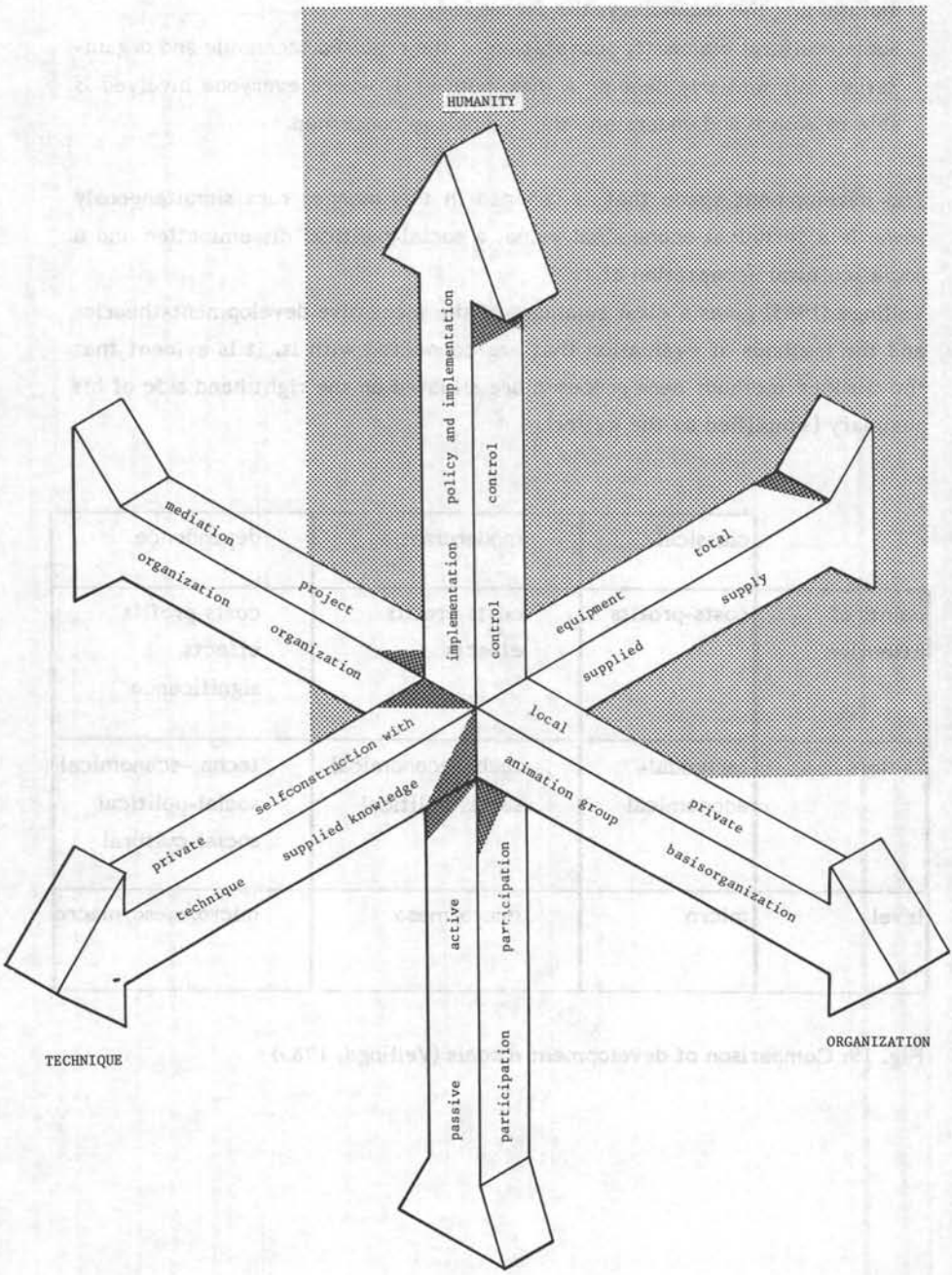


Fig. 20: Evaluation outline for Appropriate Technology development projects

CHAPTER IV

PRACTICAL EXAMPLES OF APPROPRIATE TECHNOLOGY - small scale is not easy

In this chapter a number of examples of projects will be discussed. Based on the model developed in the previous chapter an evaluation will be made in order to establish in how far we may consider this as Appropriate Technology.
We have selected as an example an urban project in the field of energy, that has, in the meantime, been terminated and a rural project in the field of food-production and energy, both in The Netherlands.
Further we will discuss two examples in the field of provisions of drinking water and traditional medicine in the third world. It is the intention of this chapter to show that it is not, by any stretch of the imagination, a simple matter to develop Appropriate Technology.
In the industrialized countries, the inducement for the initiation of a project is, oftentimes, the becoming aware of the necessity to have a greater degree of dictate in one's own life and work, to create pleasant work for oneself or to satisfy the need for purer food. In the development countries we have seen that is a difficult matter to reach the people that are in dire straights, from the top of society downwards. Projects intended to strengthen existing provisions for basic needs or to bring new provisions, that lead to selfsufficiency within reach of the basic groups, are difficult to establish. Difficult, because it is not a simple matter to make a small provision for drinkingwater on the village level or to accept that a medical traditional system that is more than 2000 years old may have some considerable merit and may be reinforced with modern knowledge. It is also difficult because it is not easy to make good contacts with basic groups, especially in the development countries. We have kept the description short. The inputs from the base as well as the (desired) contribution by engineers and technicians are represented in as clear a fashion as is possible, since these are of considerable importance in Appropriate Technology.

1. "Revolving around the sun" - Appropriate Technology in your home

"What can one do all by oneself? Is it not true that in a great many instances I am dependent upon the authorities?" It is indeed true that gas, water and

electricity are supplied by the large (public) companies. If it is decided by the cooperating producers of electric power in the Netherlands or elsewhere to, for example, install thirty percent excess capacity, it is the consumer that has to pay for it, whether he likes it or not. Or is it possible to do something about this dependence?

In 1978, Hannie and Bart Didden in the Netherlands, decided to establish in their own home, located in the city, an energy conservation project.

> "Right from the start they had the idea that others should also be able to profit from their experiences; for this reason they intended their project to be of an informative nature. Their house is, in their opinion, particularly well suited for the application of wind- and solar energy. The downstairs floor has sufficient room to set up demonstrative facilities, while the second- and third floors have spacious balconies and flat roofs, capable of collecting an adequate amount of solar heat".
>
> THD-News, 1978, Nr. 14.

There are quite a few groups, companies and families that are actively engaged in the conservation of energy, usually in the form of insulation while, sometimes, they also strive for a higher degree of selfsufficiency in the field of energy. With families and other basic groups we are usually talking about rural projects.

The interesting part of the Didden family's project lies in that they want to prove that it is possible to by themselves conserve- and generate energy, in the city and in an existing housing area.

Once the Diddens knew what it was that they wanted to accomplish, they started to collect information and gradually became convinced that they were on the right path. They took the initiative for the establishment of the "The Hague Energy Working-group" called "Revolving around the sun". The aims of the working-group are as follows:

- To make the (city) population aware in relation to alternative possibilities of energy consumption.
- To propagate the conservation of energy and the utilization of renewable sources of energy within the home or living surroundings, particularly in existing homes and other such facilities.
- The execution of plans, together with the inhabitants of homes and others to transform their home or living surroundings with the object of reducing energy consumption and to promote the utilization of renewable sources of energy".

In what activities did the work-group, consisting of eight volunteers of varying background, engage in order to attain their stipulated ends?
Their home was first insulated as adequately as possible, using various materials and techniques. A solar collector was placed on the roof. All work was prepared and executed by the group itself. Through the utilization of solar- and wind energy and the conservation measures, a great degree of independence of the public utility provisions was thought to be possible. Normal, commercially available materials, were utilized of the type that can be installed by oneself. This is all easily said; however, if you want to do everything yourself, adequate technical know-how is needed and this sort of know-how cannot always be gleaned from books.
Therefore, the workgroup managed to have a small article placed in the newspaper of the Institute of Technology requesting assistance from specialists in the fields of insulation, the utilization of solar energy and windmills in existing housing. Only in 1982, the public utilities company agreed to lending some instruments for various measurements. Financial assistance was requested from the city council, however, no such aid was granted.
Ultimately, the Plan-store in Delft, an organization established by engineers of the Institute of Technology to aid communal groups with their problems, prepared the insulation plan for the Didden's home. It is evident that in a world with such a tremendous amount of technical knowledge available, it becomes easier to translate this knowledge to the basis of society, where the basis itself requests for such translated aid and indicates what their wishes are.
The project is also a collection point for the Recycling Centre of The Hague, for materials such as bottles, tin, corks, tubes etc. The question is: does his project meet with the characteristics of Appropriate Technology?

Putting it to the test

In this case, we are dealing with an initiative at the basis of Dutch society, taken over by a work-group in the section of the city were those involved reside. There is evidence of a having become aware, of selfdevelopment, on the part of those that have taken the initiative. They have penetrated - and understand - the consequences of industrial technology and are desirous of taking steps, in their own sphere of life to take whatever measures are needed in order to arrive at a higher degree of self-reliance.
(Level 4, say-so in policy and execution on the vertical axis of the evaluation

model).
The organization selected, i.e. a workgroup, involves deliberation and participation in the matter. The object that is being worked on, is not owned by the workgroup; however, the experience and knowledge such as the project yields is placed at the disposal of the population, free of charge; therefore, this is a case of selfadministration without co-operative ownership.
(Level 4, basis-organization on the organization axis of the evaluation model).

The techniques used are aimed at selfprovision; personal skills are applied as much as is possible. The total effort is aimed at one important aspect of daily life: the provision of energy in the home. There is a striving for selfprovision in the field of energy for the home.
(Level 3, self-construction with supplied knowledge on the technique axis of the evaluation model).

To summarize:
The project meets, to an important degree, the characteristics of Appropriate Technology. It is limited to one important aspect of daily life: energy in the home. The project is not owned by the basic-group.
An interesting question that will again be asked towards the end of this chapter, is: Why is it that we don't see this sort of initiative, that finally may lead to savings in the energy budget, more often?
It is obvious that such a task should be shouldered by the municipality, who, in co-operation with the various technological institutes, could take care of technical information and corresponding with the wishes expressed by the basic groups. A pleasant side effect would be that it would open up significant possibilities for technical students, in their final year of study, for small-scale employment opportunities. It is also to be expected that people with a social-scientific education, such as the antropologists and sociologists, could beneficially support such an effort, since they are particularly capable of imparting the form to a project, that is needed to factually result in selfreliance for the basic group.
For reason of lack of financial means this workgroup was discontinued in 1984...

The Small Earth - Appropriate Technology in agriculture and in the household

It may be stated, without exaggeration, that the foundation "The Small Earth" (De Kleine Aarde) in The Netherlands has become a wellknown concept.
It stands for biological agriculture, the magazine "The Small Earth", a biological store, courses and work-weeks, ecological construction of homes (which can be viewed in the spherical recycle home and the pyramid home located on the grounds of the society), books and papers in the fields of healthy nutrition, biological agriculture, vegetarian food, re-utilization, energy production and conservation, for living and for transportation.
The Small Earth was started by Sietz Leeflang in 1972. Gradually the Small Earth was developed into a centre of considerable importance to Dutch society. It looks about as follows:
The biological garden of the project has an area of about one and a half hectares. The garden is surrounded by hedges and wooden fences, which serve as habitation for insect eating birds. Seven hundred square meters of glass-houses are situated on the grounds. These glass-houses are not heated, since this would demand the raising of special crops. The same crop is raised in the same soil only once every six years in order to prevent overcultivation and also to prevent the occurrence of diseases and plagues. No artificial fertilizer is being used. Manure and compost, derived from organic waste, serve as fertilizer. Only in the event that it becomes absolutely necessary are remedial materials utilized, but only those that can be biologically justified.
The vegetables raised by the project are distributed, by way of a centre, to biological stores in the southern provinces of The Netherlands. It should be interjected that currently there are a score of similar biologic, or biologic-dynamic, agricultural-and gardening projects in operation in The Netherlands.
On the farm operated by The Small Earth, called the van Coothoeve, courses, seminars and work-weeks are provided concerning biological agriculture, energy conservation and alternative sources of energy, re-utilization of waste or the starting of a small enterprise. There is a room where courses can be conducted and where cooking lessons can also be given. A new subject, just recently started, is bicycle technology: the further development of the bicycle as a means of transport beneficial to mankind and the environment.
An independent biological store is located on the grounds of The Small Earth: untreated vegetables, tasty bread and real farmer's cheese. It is the intention of the store that people visiting The Small Earth for courses or for a guided

tour are in a position to obtain the products concerned and, in this manner, become better acquainted with biological foods.

The generation of energy with windmills, biogas installations and solar-heat collectors also belongs to the activities of The Small Earth. In the spherical recycle home, that has been inhabited for more than two years, this energy generation is combined with energy conservation by means of insulation and storage methods for energy. The spherical home is not connected up to the public (municipal) energy utility company and, in that sense, has been an interesting and succesful experiment. In a final-study project, the recycle home was evaluated against nine characteristics of soft technology (Mennes, Smit, 1974):

1. The use of workingmethods that promote the conservation of raw materials and energy.
2. The avoidance of toxic or polluting materials and production processes.
3. The use of locally available raw materials, energy and resources.
4. The promotion of techniques that make possible decentralization.
5. Techniques and working methods that can be understood by the users.
6. Techniques that are humane and that stimulate human development.
7. Techniques and working methods that promote co-operation between the various different specialists.
8. Techniques and working methods that cannot lead to abuse.
9. The development of techniques that can also be applied in the third world.

In this study the spherical recycle home appeared to be a success in practically all areas, even though it was the opinion of the students that there was possibly slightly too much iron, copper and lead (for the batteries) present in the house. Also it was thought that perhaps plastic and glasswool could have been substituted for by alternative materials. Still, this did not prevent some 50.000 people from visiting this house.

The experiences resulting from this experiment were used to design and build the Pyramid house. This is an inexpensive house that is largely constructed out of natural materials and equipped with solar collectors, a windmill and heat storage. The house is also equipped with a small glashouse for the production of vegetables, which is a new- and important development in solar architecture. In this manner the living climate is improved and, at the same time, the selfprovision of food is enlarged. It is the intention of The Small Earth to stimulate the building of houses in a way that is beneficial to the environment. Information is issued in the form of the magazine "The Small Earth", appearing

quarterly, covering the aforementioned areas. A number of books have been published concerning living in a fashion aware of the environment, the building of windmills, ecological food and re-utilization of materials and, in addition, there are a good number of papers available concerning the consumption of less meat, ecological gardening, biological agriculture, the insulation of houses, the production of biogas out of manure and waste, the meaning of compost, solar energy in the home and the aware use of energy.
Because the University of Technology at Eindhoven is located in the immediate vincinity, it would seem that it would be a simple matter to utilize knowledge from that source; however, experience has shown that this does not appear to be an easy matter at all, since the knowledge produced and available at this source is not always designed for activities that are beneficial to mankind and the environment.
It is my viewpoint that the limitations in this connection may sooner be ascribed to a failure on the part of the University of Technology to support this development in an aware fashion, rather than on the part of The Small Earth. The contacts with the University of Agriculture at Wageningen are good on the other hand, particularly in the fields of the production of biogas and fertilizers that result from the production of biogas.

Putting it to the test.

In the evaluation of the various activities of The Small Earth against the characteristics of Appropriate Technology it may be stated that, in view of the aforementioned, Dutch society is hereby stimulated to selfdevelopment through awareness. Also, where it concerns the consumption of energy and food, self-provision and health are accentuated. Within the organization, level 4 is applicable for both the vertical axis as well as the technical axis (complete say-so and techniques that are their own).
In the area of selfdetermination, attention is being given to the establishment of small enterprises, by means of various courses. In the past there have been some problems at The Small Earth where it concerned the co-operative form of administration. In the area of organization The Small Earth has the character of an animation-group (Level 3). Changes in the working force, that previously consisted largely of volunteers, was almost certainly a major cause for this.
But the subject itself, the project The Small Earth, is the type of project that

demands a great deal of its participants.
The good name that The Small Earth has build up seems appropriate. If there is any justifiable critisism due, it should sooner be leveled at the address of he University of Technology in Eindhoven and the University of Agriculture than at The Small Earth, where it concerns the technical/agricultural level.
It might be suggested for the future of the thought behind The Small Earth, that besides becoming aware and selfsufficient techniques, some additional attention should be paid to the building up of selfgoverning organizations. To summarize, it may be stated that The Small Earth has earned a high score as a developer of Appropriate Technology.
Here also arises the question: Why is it that The Small Earth, where good, healthy and honest work is put into practice, is still assigned to the alternative fringe that is difficult to subsidize? This can't possibly be due to the fact that their information is published on recycled paper. Many a stately organization does the same. The articles and drawings published radiate most certainly an aura of expertise and are in that sense comparable to the publications of the wellknown New Alchemy Institute at Cape Cod in the USA, that has a much higher concentration of titled experts amongst its participants, but with similar aims.
With The Small Earth things are going the way they have gone with a good many other projects of Appropriate Technology; the aim is for changes in the direction of a healthy society with selfadministration and selfsufficiency and, from the authorities' viewpoint, such development should certainly not be encouraged for the time being.

3. Appropriate Technology on Java - small-scale is difficult

Fortunately, the governments of the industrialized countries sometimes also support projects aimed to make the poorest economically independent.
A bridging one might call it, of a gap that seems almost impossible to bridge in, for example, the Dutch two-track policies of economic independence and its concentration on the poor target groups.
An example of this is the co-operation between the governments of Indonesia and the Netherlands in the field of supply of drinkingwater in the rural areas of West Java.

This project has been executed by a Dutch consultancy bureau and is financed

by the Dutch Government. The project was supervised by the previously mentioned Prof. van Bronckhorst, formerly a teacher with the University of Technology of Eindhoven in The Netherlands.
Since the project, both in its aims and execution, was rather extensive, we are selecting a clear, well arranged part-assignment for further discussion:

"Implementation and development of appropriate technology in the field of the provision of water for small living communities in West Java".

This assignment was given to the assistant-expert Pompe in December of 1979.
In his report of 1981, Pompe expresses an original vision on the function of a technical specialist in projects of development co-operation. In the transfering-process, Pompe perceives for the specialist a function involving translation. He translates the wishes of one party into the frame of concepts of the other party, in such a way that the technique can be adjusted with success.
According to Pompe, after the translation-process has been completed a working method needs to be developed through which the appropriate technology involved may be transfered, further developed and introduced.
The preliminary research, the reconnaissance of the problem area in connection with the rural drinkingwater supply on West Java, was carried out in co-operation with the Development Technology Centre of the Institute of Technology in Bandung and the Foundation Technical Development for Development countries (TOOL) in Amsterdam, in particular one of the founding groups of TOOL, the Centre for Appropriate Technology of the Institute of Technology of Delft, The Netherlands.
The conclusion of this study was that it is necessary to continuously seek for complete systems of water supply, water consumption and waste-water treatment; only than does all the effort pay off, in the larger frame of reference of health-care for the rural areas.
On the basis of this study a choice was made for the testing of technical solutions, proposed by those that have the knowledge, for application in the village situation.
The system selected thereafter is applied on a larger scale and introduced with the groups involved with the supporting aid of students. Through the building up of experience, these students in their turn will function as those that carry the knowledge, which enables them to independently be of help in other village communities.

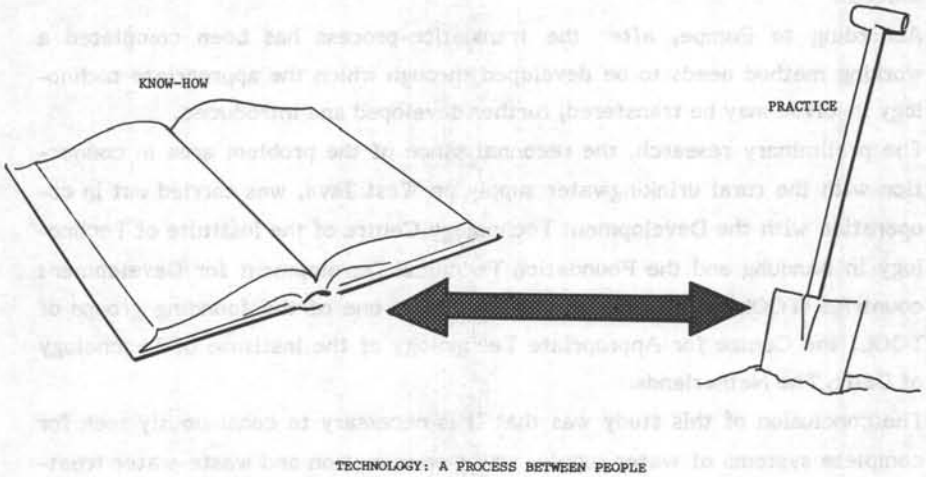
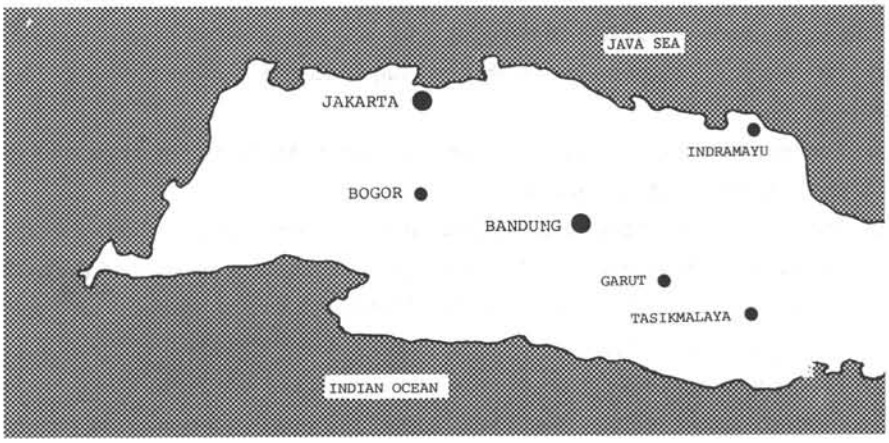


Fig. 21: Technology - a process between people.

Indramayu was selected as research area. This is an area with considerable problems in the field of health-care.



WEST JAVA

Fig. 22: West Java.

During the first six months, the research group became familiar with the village situation; this consisted of observing and listening in order to get a picture of the existing water supply and to get to know what the people themselves were thinking about it, what their complaints may be and what it is that they would like to see changed.

It is also equally necessary to evaluate the attitude of the villagers towards outsiders, which applies to Indonesians from the city as well as to people from the western countries. Also it has to be ascertained which people are important in the villages and from whom to get permission to start something. In order to accomplish all this, it is very important to know the national or local language.

According to Pompe, the gap that oftentimes exists between those that have the knowledge and those that can use the knowledge, is due to the lack of adequate contact between these two groups.

Where this contact is good, Appropriate Technology can be developed.

The first question that is asked by people in the village is: "how much is it going to cost". Not only in terms of money, but also in terms of labour, materials, time and space. Again according to Pompe, the villagers will want to think along in the finding of appropriate solutions, provided that the problems

are adequately expressed, in such a way that the people are able to precisely perceive what it is all about. To achieve this end, he constructed a model of the drinkingwater supply system.

This phase made it possible to determine what fringe conditions were necessary for succesful adjustment of the technique to the circumstances of the village.

1. The investment-costs have to be low, in relation to the monetary income of the inhabitants of the village.
2. The use of resources, such as fuel for the pumps or chemicals for the purification of water, should be avoided as much as is possible so that the functioning of the systems is not interfered with due to problems of supply or shortage of money.
3. The people should be made to become co-owners of the installation, in the form of labour supply, materials, space and beautification. This can be accomplished, for example, by purchasing the locally made bricks from the villagers at a lower price than would normally be the case.
4. The technique should be such that it is easily understood and fits into the social structure of the village.
5. The village must be willing and able to take care of the maintenance of the installation. Simple instructions, for example in the form of a pictorial strip, should be made available.
6. The water production capacity, in accordance with Indonesian norms, has to be 60 liters per day per inhabitant.
7. The technical solution has to be attractive and pleasant for the users, such as for the women that do the washing, children that bathe and water bearers.

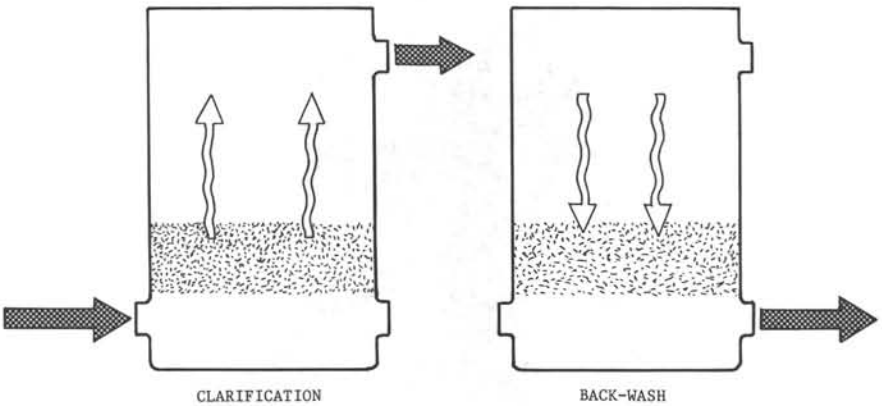


Fig. 23. Up-flow filter.

In the practical research, the technical performance of this filter was taken as point of departure; however, the equipment was adjusted to the particular circumstances. Valves, floats and gauges are not used; a cork serves as check-valve. Instead of galvanized pipes, hose is used. The filter is constructed out of crushed bricks, tiles and layers of sand and the entire installation functions very satisfactorily.

Also, for the low flowrate sandfilter that is used for bacteriological purification, the approach is very similar and also with excellent results.

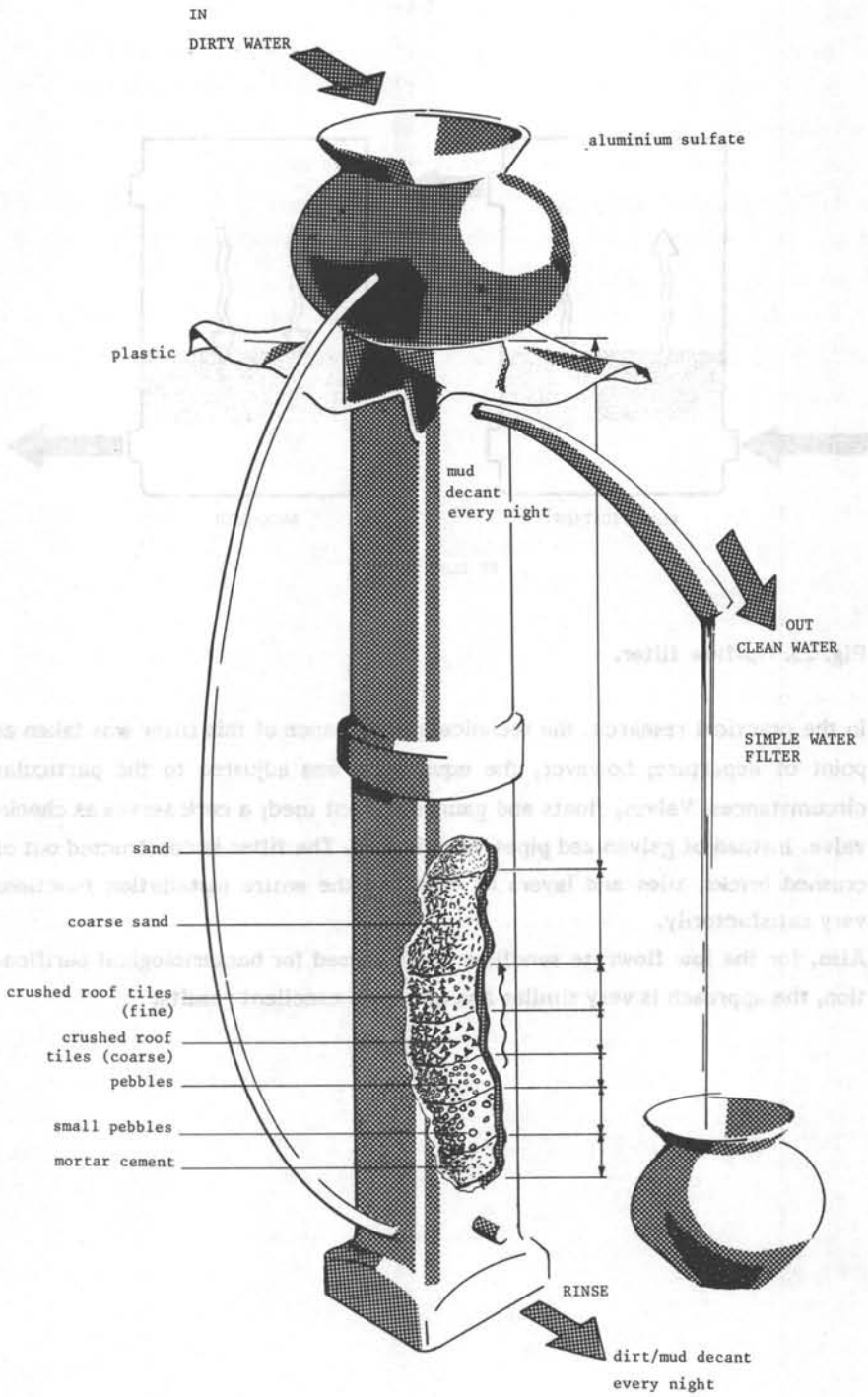


Fig. 24: Simple low-flowrate sandfilter

In this development, locally available materials and knowledge have been utilized as much as is possible. From the taking over of the techniques under the supervision of the villagers themselves, the clarity of these techniques is evident. On the basis of the experiences, it thereafter becomes possible to, with mutual consultation and deliberation, get started with the design, the preparation of instructions for construction and maintenance and the construction itself in the village.
The report also includes a photographic account of a village water supply installation for two thousand people, that was designed and built in accordance with this working method, in co-operation with the villagers. This is all very easily written down and explained in a manual; however, small-scale and still adequate, is not easy to attain. With the projects "Revolving around the sun" and "The Small Earth" the initiatives came from the basic groups, while with the project for the village watersupply the initiative originated with the government. In the latter instance the technicians have a difficult task since they have to gain the confidence of the villagers through patience, attention and interest; only than can they gain insight into the wishes of the basic group, while, thereafter, the wearisome work of translating the needs into means and tools, together with the people involved can take place, resulting in the construction of appropriate technical provisions.

Putting it to the test

The evaluation against the characteristics of Appropriate Technology reveals that the becoming aware of the villagers and of those that have the knowledge concerning the desirability and the possibilities of Appropriate Technology may be considered a success. (Level 2 - active participation). The development that was mutually experienced resulted in a basic organization of villagers (Level 4 - basic organization) that independently supervises the watersupply and maintains it with the aid of their own skills and utilizing, to as great a degree as possible, local raw materials (Level 3, selfconstruction with supplied knowledge). All this was made to happen in the aforementioned project, due, in part, to the special training of the one with the knowledge involved, who was aware of the necessity to adjust his technical knowledge to the local social-economic, social-cultural and natural circumstances.

4. Appropriate Technology for traditional medicine - pills and people

The conflict that comes into being by the application of science and technology from the industrial culture to forms of traditional medicine also finds expression in the vanishing systems of traditional medicine in non-industrial cultures.

The World Health Organization (WHO), out of social- and economic considerations, has chosen for a policy in which is acknowledged that the western medical-technological system is, for the moment, out of reach for the greater part of the world population.

It should be possible to bring medical care within reach of those that are currently lacking in adequate health care, by means of the "bare-foot" doctor.

The subject of Appropriate Technology for traditional health-care has in 1975 been taken as a point of consideration by the Appropriate Technology Group of the Institute of Technology at Delft, The Netherlands, after two visits to Laos. During these trips it became evident that traditional medicine had played a major part in the health care of the Pateth Lao, the army that managed to rid Laos of the U.S. forces. (Riedijk, 1975).

For political reasons, it appeared impossible to develop the contacts that were started with the government of Laos into a relation of co-operation in the field of technology and traditional medicine. During working-visits, amongst others in 1977, with the Appropriate Technology Group Sri Lanka, there appeared to be a lively interest for the possibility of supporting and reinforcing the existing comprehensive traditional system of medicine, such as Ayurveda, with modern technical-scientific knowledge. (Van der Eb, Riedijk, 1977).

In co-operation with the Dutch Co-operative financing organization (NOVIB) a plan was prepared for a mixed Dutch-Sri Lankan preliminary study. A research group was established consisting of two medical doctors, one of which of Ayurvedic education, two pharmacognostics (those that have knowledge in the field of plants that contain substances that are medically active), two engineers and a Sri Lankan economist. This group carried out a comprehensive research program for a period of two months.

The team regularly met for deliberations with the members involved of the Appropriate Technology Group Sri Lanka that had taken care of transport, personnel for research support and housing. The assignment of the research team was of a dual nature:

1. The selection of two plants or herbs, naturally occuring in Sri Lanka, of economic interest. The medicinal properties of these plants or herbs must be such that it would be economically feasible to cultivate these and extract and market their medicinal substances.
2. It is the policy of the current government of Sri Lanka, as was also the case with the preceding government, to promote the traditional systems of medicine of the country and provide them with a deserving place within the medical health care organizations. The execution of this policy is being retarded by the lack of clinical, pharmacological and, in particular, technological know-how and facilities.

   This second objective of the study was to find certain concrete points of connection that may serve to reinforce the system of traditional medicine, specifically Ayurveda. Of particular interest would be the aspects of quality control and the efficiency of the extraction methods for the plants such as are being applied in the ayurvedic factories as well as by the preparation of medicines by village-doctors. (Riedijk a.o., 1978).

At the start of the study it was decided that the second aim would serve as the base for research and that the selection of economically interesting medical herbs also needed to be based on a forecast of export possibilities for the medicinal substances extracted from these plants. The research group prepared a program, aimed at the collection and classification of factual information concerning the practices of the ayurvedic medical system, during the period of the study.

This program was as follows:

1. Discussions with patients and persons professionally involved with the Ayurveda, such as doctors, medicine dispensers, engineers, sales outlets, civil servants and the clergy.
2. Visits to both educational training institutes for Ayurvedic doctors in Colombo and Gampaha.
3. Visits to research institutes of universities and the government.
4. Visits to hospitals and clinics, both of traditional as well as of western medicine.
5. View the production facilities of traditional medicines by government, hospitals, small enterprises and village doctors.
6. Visits to traders and dealers in medicinal herbs.

It is evident that the four examples of projects selected for this chapter are of an ascending nature where it concerns their extent, complexity and historical significance. The study in Sri Lanka, having as subject a several thousand year old system rooted deeply in the culture, was, therefore, complex and extensive to such a degree that this study could definitely amount to no more than a pointing out of a direction, along which modern science and technology might be able to reinforce this ayurvedic system of medicine, based as it is on insight arising from experience.

Sri Lanka is an island off the coast of India. It has a surface area about twice that of The Netherlands and 14 million inhabitants, the majority of which are Singalese with a minority of Tamils, many of which are employed on the tea-plantations. Sri Lanka is one of the poorest countries in the world. The contageous diseases that occur most often are those of the respiratory organs, malaria, tuberculoses and enteritis. Undernourishment and anaemia are also endemic. The aforementioned diseases are of critical importance to public health in Sri Lanka. It is precisely the Ayurvedic system of medicine that, for reason of its particular social- and cultural position, could play an important part in the prevention of these diseases.

The system of health care is, for the greater part, operated by the government of Sri Lanka. More than 3500 medical doctors have a western education. The average distance to a clinic is no more than approximately 2 miles. The ayurveda has at its disposal 7 hospitals and 211 clinics. There are more than 16000 ayurvedic doctors spread over the entire island. The average distance from a house to the nearest ayurvedic clinic is 0.9 mile. All in all an excellent situation for public medical services. Already five hundred years B.C. a flourishing medical system was in existence in Sri Lanka. Hospitals, gardens for the cultivation of herbs, preparation of medicines, operative- and preventative medicine were an intimate part of this system. Ayurvedic philosophy teaches that the creation is present in - and projected onto- men, who are composed of these same five elements: air, water, fire, earth and ether. The body is composed of seven functional systems (Dhatus): digestion, blood, muscles, fat, bones, bone marrow and the sexual function. There are three biological factors (doshas) that govern the seven systems: Watha regulates the equilibrium of pitta and kapha, that are one another's counterparts. Pitta regulates the warm metabolic processes, while kapha is present in the cold functions that do not use energy.

Whenever the three doshas are in equilibirum, the seven dhatus are functioning

and one is healthy and not susceptible to contageous disease and vice versa. An adequate diet is essential for proper equilibrium of the doshas. Food has special properties. The different types of food have their own specific effect on the seven life-functions and their three biological elements of regulation. It is important that the classification of diseases is in correspondence with this. The classification of western medicine, that is based on organ diseases, is entirely different in character, as is diagnoses and therapy for these systems. The treatment of disease in Ayurveda is aimed at the recovery of the equilibrium of the three doshas; to do so, the ayurvedic doctor has an ample quantity of therapeutic working methods available. In classical Ayurveda, the use of medicinal substances is of second choice. Not the pills, but rather the entire person is of the essence and here lies the important difference with western medical technology. With the latter, medicines are first choice and aimed at treatment of the phenomena that are manifest, the symptoms. In the case of infection, in Ayurveda, the individual condition, the equilibrium of the doshas is placed centrally. In western medicine the contamination with bacteria or virus is considered to be the cause of an infection. Persons and pills, causes and phenomena, code and structure of society, ecological values and economic norms, traditional medicine and medical technology:
Of what value are they to one another?

On Sri Lanka two medical systems exist side by side. It is selfevident that under the influence of the fast- and extensive growth of western scientific thinking, Ayurveda has come under considerable pressure. A threatening development is, that it has been observed that the classification of disease, as is done by western medicine, is penetrating into the ayurvedic practice. The diseases described seem to correspond; however, the background is of an entirely different nature.

> "Western medicine's concepts are akin to visitors from a strange country that do not know how to speak the local language and that cause confusion" (Nijhuis,1978).

The increasing significance of medicines in the Ayurvedic practice therefore appears to go together with an increasing influence of western medical science.
According to the opinion of the research team, Ayurveda should, as is also the case for other culture-bound medical systems, be in motion like a living science. To remain static on a point of 2500 years ago is not considered to be bene-

ficial, because with the development of new knowledge and techniques, new possibilities for traditional medicine come into being simultaneously. But here we have to be very cautious, since in this case appropriate means that the code of the applied science and technique has to be carefully scrutinized. Thoughtless- and unhampered acceptance of concepts out of western medical technology would only serve to gradually push the concepts of traditional medicine right out of existence.

What is necessary, is to leave the religious- and philosophic aspects of the system (the code) intact, while reinforcing the system with the power of the western system of science and technology and the experimental evaluation of propositions, but only within the cultural- and natural frame of the medical system concerned.

Within the circles of the traditional medical system there is the justifiable fear that the only interest of the western scientists is to obtain valuable information necessary for the further promotion of western medicine. For this reason, the research group has accepted the value of Ayurveda as system, as the basis of the propositions made and acknowledges as factual that Ayurveda is essential for the health of the population of the island.

From the medical-, pharmacognostic- and technological report, the research group came to the following conclusions and recommendations:

1. On Sri Lanka there is an express wish to reinstate and develop the traditional system of medicine.
2. For reasons of economic independence it is of importance, that the basic materials required for the preparation of Ayurvedic medicines are produced locally. This can be accomplished by the establishment of a long-term cultivation program for medicinal- and other economically important plants. This would be of importance for health care, employment opportunity in the rural areas and the economy, because costly imports, particularly those of indian origin, would no longer be required.
3. A long-term program for the standardizing, optimizing and quality control of Ayurvedic medicines is desirable for the cultivation of original plants on plantations, research into the importance of the medicinal qualities of species of plants, the preparation of medicines under conditions that are standard and optimal, the composition of a summary of clear methods of preparation and the formulation of Ayurvedic medicines in the form of a pharmacopea.

Since the start of the study much has transpired; however, much of this was in the area of economics. A feasibility-study has been prepared by a Sri Lankan advice bureau in connection with a project aimed at the preparation of Ayurvedic medicines from plants available in Sri Lanka. This well accepted feasibility study has been further worked out by instruction of the Appropriate Technology Group of Sri Lanka in order to determine the economic- and financial feasibility of a medicine production facility. A written inquiry, followed by personal interviews was conducted with 66 Ayurvedic doctors, has made possible a selection of a number of preparations. Also the availability of raw materials was taken into consideration. On the basis of real prices, financial calculations were made, while it should be noted that 44% of the doctor's questioned were found to use self-made medicines; still, there was a considerable interest for factory produced ayurvedic medicines of high quality.

The evaluation report arrives at the following conclusions:

1. The marketing of products from a pilot plant would present no difficulties, since the extent of the production would amount to less than 10% of the total market for liquid medicines in Sri Lanka.
2. The policy should be aimed at the sale of large quantities of medicines to ayurvedic doctors.
3. During the beginning period the price should be kept low. Once the tradename has become established, the price can be raised, especially for sales to drug stores or dispenseries.
4. Once the production facility has been put out to contract, a stable supply of raw materials has to be secured.
5. A program for the cultivation of plants in various parts of the country has to be stimulated. An extensive study as to the availability of ayurvedic raw materials has to be carried out.
6. After the second year of production the factory will start showing profits.

This then is the most recent state of affairs of a co-operative project of the Appropriate Technology Group of Sri Lanka with the TOOL foundation of the Netherlands. (Bank of Ceylon, 1982).

Putting it to the test

What is there to show for seven years of co-operative effort and preliminary research and what has remained of the original aims of the project and, also, in

how far are we concerned with Appropriate Technology in this instance? In the original design this was certainly the case. The entire study was constructed around the becoming independent and reinforcement of the Ayurveda.
During the study it became evident that Ayurveda represents a proud cultural heritage of Sri Lanka, that also, to a certain degree, is of an emancipatory character. As a system, Ayurveda is strongly aimed at the basis of society. The self-reliance of village communities is an unspoken point of departure. It should be noted that the Ayurvedic doctor has great influence in "his" village. As a system it will lead to further economic self-reliance, by the use of local raw materials and techniques.
When we look at the development process over the past few years however, it becomes evident that the project is gradually moving into an economic direction, where the development and reinforcement of the ayurvedic system is no longer stressed, with the exception of the excellent initiative to again start with the cultivation of plants occuring naturally, instead of importing them. It may also be considered a good development that the initiative and its effects, during the past five years, has gradually become centered in Sri Lanka. All elements required to turn it into an Appropriate Technology project are available. It would suffice if, at the basic level of the village, the needs of the villagers and the doctors were to be investigated simultaneously and to decide on that basis what technical provisions and organizational regulations to initiate, inclusive of technical-, medical-, and pharmacognostic research-support. If this could be realized, this could be considered as a case of adequate co-operation between western science and Ayurvedic medicine by the creation of small-scale production units on the basis of simple technical renewal, easily maintained, and rationally planned and developed integration of elements from one system (pharmacognostic knowledge, process knowledge and production technology from the west) into another system (Ayurvedic preparation of medicine) (Nijhuis, 1982). Pharmacognostical research has laid a firm foundation for such a development (Middelkoop, 1985).

5. In retrospect - Appropriate Technology unwished for and uneconomical?

The four practical examples outlined above are projects. According to Bilzen (1982), projects are temporary activities of co-operation intended to realize clearly stipulated aims within a certain period of time and estimate. With the project "revolving around the sun", the striving was for energy conservation

and the awareness of such possibilities in existing urban areas of the Netherlands. "The Small Earth" is striving for becoming aware in the Netherlands of healthy living and housing. The state of temporality is determined by the moment that the various functions are adopted by society and, simultaneously, halted at "The Small Earth".
An example of this is the starting of the MeMo Society. This was an initiative of "The Small Earth".
The project "Water provisions for rural areas" on West Java will be finished when all the villages in this area have an adequate watersupply or when the co-operation between the governments of Indonesia and The Netherlands will come to an end on this project.
The co-operation with the Appropriate Technology Group Sri Lanka for the Ayurveda project is aimed at the construction of simple medicine production facilities within the cultural framework, such as is offered by this traditional form of medicine.

For the fourth example it has been shown that, making use of normal calculation methods, such a production facility would already be making profits after two years. This sort of calculations are rarely used in Appropriate Technology; in my personal viewpoint it represents a weakness but, at the same time, it is understandable. Independence of existing frameworks, that are experienced as being alienating, oppressing and aimed at monetary gain, becomes the goal in this case. However, what may be desirable or, hopefully, feasible in the future, needs to be conquered today within the existing- and dominating system and in such a manner that the ultimate aim, liberation, is not lost out of sight. The various enterprises united in the MeMo Foundation have understood this. They are relatively young people, between the ages of 20 and 30, that work in small groups of 3 to 5 employees, with self determination. They manage their affairs in an emancipated manner with forms of self-administration, within the existing social-economic framework. Quality is the main objective, while profit is not a dirty word. The income falls below the Dutch minimum. (Van Alphen, 1982). The central problem for MeMo is the difficulty to have at their disposal techniques that are beneficial to mankind and its environment; this problem was also touched upon in the chapter: "What is Appropriate Technology."
A calculation such as was done for the project "Appropriate Technology for Ayurveda" is very rare. This is partly so, for reason that social benefit is considered to be of greater importance than is economic benefit and, for the

greater part, for reason that Appropriate Technology projects seldom rise above the level of occuring just once. "Non-desirable" may be explained in a defensive manner: just once, because Appropriate Technology is not being taken seriously due to images of the past: "enthusiastic amateurs" and this does not fit into the picture of modernization, where innovation only means more of the same.
Where households manage to become independent of the public utilities, this disturbs the large public companies and causes them to raise their tariffs, since this renders their technical provisions too extensive for the remaining demand; it is only profitable to those households that have managed to become independent to some degree. In a similar fashion, if people take care of their own vegetable production or buy biologically cultivated vegetables and also, if they buy less meat polluted with antibiotics, from the bio-industry, this disturbs the large food companies and the supermarkets; yet the people themselves are becoming healthier and economically less dependent. That is, if the supermarkets don't jump on the bandwagon and install special biological food counters, which is already happening everywhere.

If adequate water provisions in the rural villages in the third world come to be under the administration of the villagers themselves, they would become healthier and less dependent. This is disturbing to the central government, but liberating to the villagers. If traditional systems of health-care become stronger, this is very disturbing to the large western pharmaceutical companies, who are trying to prevent this. For the people in the development countries, but also in the industrialized countries, it means an approach to health-care that is aimed more at well-being than it is at turnover. In general, traditional health-care is far cheaper than medical technology; so it is possible to make the traditional health-care systems cheaper, while leaving expensive medical technology for those instances where it is really necessry.

To go back for a moment to the remarks made in the previous chapter concerning employment opportunity and the economy of bills we can afford to pay, it may be stated that with Appropriate Technology, the way is prepared for an economy that is difficult to express in terms of profits and enterprise, but that creates openings for becoming less dependent on money and public provisions and that provides a kind of employment opportunity not easily perceived in the statistics of the central government, but rather finds it expression in the

satisfaction experienced by the people from their own work.
The undesirable aspect of Appropriate Technology is found to lie in the pleasant manner in which the established power-systems are being attacked; its uneconomical aspect in the intangibility of its concepts, where it concerns employment opportunity, which is difficult to understand by the oldfashioned economist. Employment opportunity having to do with bridging the gap between producer and consumer and the quality of life of those directly involved in this process.

Innovation that originates at the basis is one of the answers that are handed to the industrial states to combat the problems of increasing unemployment and decreasing income. This answer involves the reclaiming of all sorts of materials, such as biological, glass and metals, re-utilization of parts, such as automobile parts and parts for expensive appliances, also repair of various items, such as automobiles and washing machines in small workshops, renovation of homes and means of transport such as bicycles and, finally, the adequate insulation of housing. All these examples are capable of providing small-scale employment opportunity that is locally applicable. The technical universities can aid in this process by teaching their student engineers how to design equipment and tools of the type that is easily accessible, maintainable and useable. (Riedijk, Van der Graaf,1984).

CHAPTER V

EDUCATION - a school for living

1. Introduction - knowledge and insight

Education, what does this in fact mean? It is the passing on of knowledge, the cultivation of know-how? Is it the necessary preparation for participation in social life? It is the preparation for achieving insight into the process of life? Is it possible to teach someone else more than knowledge and know-how or is that precisely the only thing that education is meant to do?

This introduction discusses the question in how far knowledge and insight are in conflict with one another. The further question would be if knowledge, or rather the knowledge that we distribute in our schools, leaves the possibility to attain to insight in the first place.

There is an English saying: your can't have your cake and eat it too. If a child or a student is stuffed full of knowledge, in how far does this leave room for insight? The parents of a child that has failed to master reading and writing in the first grade of elementary school, become seriously worried. Why is this so? Apparently, because those parents experience the straightjacket of the educational system as being correct and to the purpose. I still recall vividly how, when it was my turn to speak in class, the other children laughed about me, because I spoke in a local Dutch dialect, specifically that of the city of Rotterdam. Why did they laugh in fact? Apparently because the language of the common people is not the same as that of society. This is no unimportant phenomenon. Ivan Illich describes the value of the language of ordinary people as an important instrument to indicate some essence that specifically belongs to a group of people, something inherently their own. Not acknowledging the value of the language of basic groups in society signifies, it would seem, a denial of the inherent value of that particular group op people, a denial of their culture. The fact that the language of the ruling class in a number of third world countries is still the language of the earlier rulers, is a denial of the value of their own culture. The formalized language, that is to say, the language that is being taught in the schools as being the correct language, can, therefore, easily be used as a means for social oppression. According to Chomsky, when language is used in a normal fashion it is of a renewing character and he states that the number of sentences anyone is immediately capable

of understanding in his own native language without any feeling of difficulty or alienation, is infinitely great.

If, however, the language in which one has learnt to express oneself, is the formalized language of the ruling class, than the element of renewal is preserved, but the quantity of renewal is restricted. It is possible to cook a meal on either gas or a charcoal fire, but the taste will be different. If one is only capable of using the luxurious instrument of language of those in power, how than would it be feasible to get beyond the language-zone of the poor city section, with one's worries and problems, since no one outside that zone understands the language.

Paolo Freire has expressed this in his publication "Pedagogics for the oppressed" (1972), pertaining to South America. Freire states that those oppressed do not notice that they are stepped on, since they are submerged in the reality of the oppression and they are not able to view themselves as being the counterpart of the oppressor. This then is the problem where it concerns the use of "the language of the other" in formal education. At home, the dialect of the city section, but in the schools throughout the country the formalized language.

Language is capable of being an instrument for liberation, provided it is one's own language. It is not possible to give an answer to this; however, the question may be posed if it might not be intelligent to abolish difficult words from the language in education. But that is only the first step; here, also the maxim: simple is not an easy matter, holds valid. Common language is permissable and desirable even, for radio, newspaper and television, but in the formation of policy concerning laws, rules and regulations all over the world the language of science, of the ruling class, is used.

Not only is the power maintained and preserved by a relatively small group of educated people, they also use the language, which is the most important medium of contact between people, to preserve and reinforce that power. The knowledge that we pass on to our students is verbalized in the language of the establishment, while the products that this language yields are in terms of this language. Language is the lubricating oil for the machines of oppression. It is evident that knowledge and insight, in this context, are conflicting concepts; the knowledge that is taught in the schools is only suitable for the maintenance of the existing technical provisions and organizational regulations. All this pertains to the essential characeristics of the western system of education. The manner in which knowledge is transmitted: knowledge in the service of the

striving for expertise; we have to learn a trade, a profession and we have to be the best in whatever field.

Illich has indicated the inherent danger of this and termed it: funnel-thinking and the symbolism is evident. At the end of our particular education we come crawling out of our funnels as specialists, however, we don't understand one another any longer and neither is this any longer necessary because man has become useful in only one single way, as a wheel in the production organization of the society and that is both necessary and sufficient.

Education is therefore not permitted to become a school for living but, for the time being, serves primarily to keep production going.

In our system of education knowledge and insight are, oftentimes, in conflict, because insight would lead to the realization that our production system functions in an oppressive manner, whereas the intention of knowledge is precisely to maintain this very system.

In our schools, regardless of whether these are on the elementary or the university level, great- and exaggerated attention is being paid to the transmission of knowledge so that there is barely time left over for other matters such as insight and contemplation. Neither is this necessary since dependence is a property that is easily stimulated and, in fact, an important aim of education. Not officially quite naturally. Officially, education is intended to lead to independence, the sort of independence as can be allowed in a very restricted playroom.

Where is the engineer that is capable to assume the work of a factory labourer? No matter which position we occupy in the structure of society the mutual exchangeability of workers is kept at a low level, not only in the vertical direction, from boss to employee and vice versa, but also horizontally for the same lower functions from one organization or department to another. Less specialistic knowledge and more insight into what is socially necessary and possible would tend to enlarge the mutual exchangeability of workers; however it would, simultaneously, create a social structure with more equality, more independence and less specialized work. In a social system that is aimed at the creation of dependence, knowledge and insight will remain concepts of conflict, especially when a third concept is added, that of proficiency.

2. An Appropriate Technology program of education - from skilled tradesman to engineer

Proficiency and knowledge, with insight functioning as a bridge between the two.

Current professional educations are aimed at the gathering of knowledge and the achieving of skills such as make possible an efficient and effective deployment in the labour process. In this connection, specialization indicates that individuals are being equipped with knowledge and know-how aimed at existing labour-profiles. This is of essential importance, since this makes possible the fitting in of individuals into the organization of society in as noiseless and frictionless a manner as is possible. This also causes the personal development of the individual concerned to be directed at this social usefulness and this, at the same time, determines the problem of the professional education, namely the fact that professional education and social usefulness are divorced from insight into the possibility of personal development.

In the existing relations, a profession, regardless whether this be that of engineer or a tradeskill, represents only the market value in the social-economic relations of a society. In this sense the profession is nothing more or less than a precisely defined contribution to a network of professions in an existing structure of relations of authority and techniques. What kind of work people can or would like to do is no longer determined by the situation but solely by the possibility of fitting into the places of employment as are available.

Specialization of individual proficiencies and knowledge are made subservient tot the rigid compartments of the structure of society. Is this a matter of serious concern? Most definitely; a human is far more than just a functionary: a pipefitter, a director, a student or a professor. Functionaries easily degenerate to competitors in the battle for the acquisition of a profession. This affirms and perpetuates the relations of power between the representatives of the different classes of profession. The competitive battle between professions becomes reduced to the battle for income - and status connected with power, as is, for example, the case with medical doctors and specialists. In this manner the professions only affirm the existing state of stratification and classes. The four levels of technical education in, for example, The Netherlands: primary, secondary, higher technical school and technical university, run parallel to professional education in other fields. In order to perpetuate such stratification and classes a number of fringe conditions are available (Funcke, 1981):

- Language codes: the use both of difficult words and pronunciation required, to indicate what class one belongs to.
- Perseverence to keep up and complete a particular education or training, necessary for the acquisition of knowledge and know-how.
- Intelligence, more specifically its social state of direction. It has been my experience, when still a teacher of physics in a secondary school, that a girl student from a wealthy family and of average intelligence, managed to graduate by means of remedial teaching and a substantial dose of perseverance. A boy student in that same class, from a workingman's family, and of exeptional intelligence, failed to complete even the third grade, for reason that at home there was no place to study, while his pronunciation of the official language presented a serious obstacle at home as well as in school.
- Attire: at schools located in the better neighbourhoods an entirely different garb is worn than is the case at schools in the lower income sections.

The fringe conditions of attire and language come into being out of the existing structure of classes. Perseverence and intelligence are not the prerogatives of the higher classes; however they are, oftentimes, consciously cultivated.

There are, therefore, indications that the existing classification of professions is not so much a consequence of the necessity of an effective - and efficient management, but rather an expression of battle for social - and economic power and especially an expression of the existing structure of classes and power relations.

Educational programs, whether at the primary school or university level, are of influence on the development of the personality. If it is true, that professions are especially an expression of social-economic interests and structures of power, it follows that whatever is taught in that profession will have an inhibiting influence on the development of the personality:

- The classification of professions consists of standardized development processes and proficiency packages. They are not designed to stimulate the possibilities, interests and development needs of the individual; quite to the contrary; the individual is forced to adjust to these standards if he is to meet the demands of the profession.
- The profession is, oftentimes, a final destiny in life. One is a busdriver or a bookkeeper and after the training up to that level, any further development of the personality terminates in that profession. One has "finished" the

training and remains stuck in that position for the remainder of one's further social life.

- The classification of professions has an additional inhibiting consequence. There are those that are called laymen, i.e. those that are not permitted to have judgement, since they do not belong to this or that particular profession and there are those that are specialists, i.e. qualified to express judgement.

  This state of being considered qualified to judge is also some kind of private possession of those that belong to that profession. Christopher Lasch, in his publication "The culture of narcissism" (1979) describes how in the industrial culture gradually an ever increasing number of qualifications, normally the domain of ordinary people, are taken over by specialists, such as medical doctors, therapeutists, welfare workers, jurists, union workers, mechanics and teachers.
- Specializing for a profession is also a process of physical- and spiritual isolation. This state of one-dimensionality, this one-sidedness of people, promotes not only alienation, but also leads to one-sided perception of their fellow human beings and the world. For example, at the technical universities there is, generally, a feeling of contempt for the social sciences; this concept is rooted in the idea that engineers are capable of "creating" something, while the social scientist is "only" capable of describing something. The fact that the engineer, oftentimes, understands less of the realities of society than does the social scientist fits nicely into this one-sided picture of contempt that the engineer holds of the social scientist.

To summarize: standardized packages of education, the profession as final destination, the delivering up of qualifications by the "layman" to the "expert", the alienation that is the result of specialization, these are four important elements that appear to be the obstacles in the way of developments that have emancipation as their primary goal.

It should be emphasized that this petrifaction resulting from the one-sided classification of the profession, not only has its consequences for the human spirit; also in the physical sphere such consequences are evident. Research carried out by the faculty for safety studies of the Institute of Technology in Delft, The Netherlands, into the effects of vibrations and shocks in the exercise of certain professions, on the human organism, has shown that one-sided forms of work may eventually lead to damage of the organism.

The question is: is it possible to arrive at forms of training and education that do not lead to alienation and petrifaction, but, to the contrary, lead to self-actualization and flexibility?

Within the narrow confines and precise definitions of professional knowledge and know-how, creativity is certainly expected; this also holds true for the industrial culture. The latest gimmicks incorporated in the automobile -of-the-future are an example of this type of creativity. But also artistic aspects such as make possible a degree of feeling of identification with the product, regardless of whether this may be a beautiful home or a stove produced through skilled workmanship. Knowledge, know-how, creativity and, if possible, artisticity; the first three are, evidently, not sufficient by themselves. The factor of artisticity, if and where it can be applied, already serves to make the product and the production process more humane. The artisan has a greater chance for development than does the mechanic that operates a machine.

In a previous chapter is was stated that three aims may be stipulated for technology:

- to understand by oneself
- to administrate by oneself
- to produce- and maintain by oneself

In the case of understanding by oneself, what counts is not only the "how", the knowledge, but also the "why", the insight. In self-administration it is knowledge and know-how of management and organization that play a part, while in the instance of producing and maintaining by oneself it is especially the know-how, creativity and, possibly, artisticity that are of the essence. How can these aims be applied to the learning process, to an educational situation?

In the first place, by not defining the character of education by its content, (the knowledge and proficiencies), and the process (in what manner does the transmission of content occur), but, instead, by defining- and plying it as the provision of opportunity for the student to develop himself on the basis of aims that are determined jointly. (Riedijk, 1981).

It should be noted that I do not propose to have the children at the elementary school level, in a pseudo-democratic fashion, vote on the subject of whether they would like to learn arithmetics. This is not what we have in mind. Even as writing, reading and arithmetics are the inevitable aims of learning at elemen-

tary school, so is learning how to weld indispensable for the welder and the learning how to calculate the angle of a rafter for the architect. Basic knowledge is necessary and the ordinary lessons for this purpose should be arranged in as intelligent a manner as is possible.

"Funnel"-knowledge, in the sense described by Illich, is, to a certain degree, inevitable. But since education should also serve to develop people, every learning process should also provide for a build-in development towards self-reliance, both for the student and the teacher. To the degree that the student approaches the finishing mark, graduation time, he has to be able to stand on his own legs. In the relation between teacher and student this means a gradual growing towards equality, i.e. not only a teacher's monologue but rather a dialogue between teacher and student. But since it is necessary that, besides the coming into being of funnel-thinking and tunnel vision, networks for human developments have to come into being, it is evident that we need more than just the ordinary subject, capable of being graded with an "A" by a "good" teacher and "C" by the "bad" teacher.

Learning to co-operate in groups, in working-colleges, in project-studies, in a society that is in movement is of great importance. In order to have networks of knowledge and insight, know-how and proficiency come into being, it is necessary to co-ordinate subjects with social themes. For example, the theme of purchasing could be connected with the subjects of arithmetics, writing, reading and the study of commodities at the elementary school level, while at the university level the theme of health may be connected to subjects such as biological production of foods, drinking water supply provision, waste treatment, natural medicine, medical technology, the study of safety, healthy housing- and construction methods. In proportion to the educational progress, work-groups and project studies should occupy a more important place. Also, in higher education people of the various faculties should work together in work-groups; this would permit the introduction of theme-directed subjects in the various vocational training fields. A prospective civil engineer in the field of irrigation works could make a study of countries in connection with an irrigation project in the third world; he could become oriented concerning the culture of the people that live in the vincinity of the project and the environmental problems in- and around the project. The development of network-thinking in the establishment of educational systems, but also with other activities of human co-operation, leads to a different approach. In this manner the terminal phase of a study could be of an entirely different content: thematic terminal

assignments. For a period of three years I was assigned by the Institute of Technology at Delft to the Technical College of the Hague as a teacher of industrial management; in 1974 the students had a collective theme: the professional transportation of commodities by road. We were interested in the circumstances in which professional drivers are made to work, the government rules and regulations, the manner of industrial management and the part that the professional drivers have in this. The theme was divided into a number of partial themes. Two students, during the practical stage of their training worked with the department involved, of the Ministry of Buildings and Roads, another two students worked with the Union, some worked with a semi-government transport company, others with large public transport companies.

The partial studies were selected in such a manner that they could be mutually complementary. In this fashion a concrete picture could be formed for everyone involved, teachers as well as students, concerning this socially important theme. The group that was finishing their studies met once or twice every fortnight in order to compare the results of their research and to discuss progress. Naturally, this working method can also be used for subjects of a more technical nature, such as the treatment of waste in The Netherlands or the possibilities for the conservation of energy in existing housing in urban areas.

All this, however, demands a different mental attitude supporting the working methods of the teacher. The "superstructure" of the working method demands acknowledgement, on the part of the teacher, that students, if given the opportunity, are capable of developing themselves with the aid of the tools supplied to them in their basic subjects, regardless whether this would be welding, arithmetics or mathematics. Leading the students to selfsufficiency and self-organization of their own work is the sole point that characterizes the "substructure" of the working method.

He carries out his part of the assignment by himself on the basis of his own working plan in co-operation with the others. His segment of the work is highlighted by himself in the working group. The other characteristic point is that the technical elements in the study or training are not considered separate from the natural surroundings. If, at the elementary school level the theme of nutrition has been selected, what is discussed will be how the means of nutrition come into being, how healthy food can be produced, what is required to return waste resulting from food into the cycle of nature in the right manner. In the training for a skilled trade it is the custom that the prospective

artisan gets to know the origin of his materials, how to work them up and how to give them form. That knowledge is necessary in order to be able to create a product of high quality, with the proficiencies developed in his trade. To impart this type of quality to the technical aspect of an education, it would be necessary to give to the concept of technique a broader perspective: it should be placed in relation to the limitations of the animate- and inanimate nature that surrounds us:

- Thriftiness, (and in technical education, thrifty design), with as motivator the limited available supply of raw materials and energy, leading to working methods and products aimed at reclaiming and re-utilization, easy repair and maintenance and, where possible, the use of durable sources of energy.
- Simplicity and simple design: in which the most up-to-date knowledge is used to attain to a product that is simple, accessible and easy to maintain.
- Thinking that is beneficial to mankind and the environment, in which the security and continued existence of the living community is made clear and its importance explained.

It is a matter of course, that in a class at the level of a primary technical school, these elements of thrift, simplicity and safety are represented in quite a different manner than is the case for an education on the engineering level; however, it is possible to present the concept of technique in relation to the limitations that nature imposes, in every eductional situation. Thinking in terms of systems, for example by making a connection between technique and the need for selfsufficiency from local resources, expresses the responsibility that man has both for himself and the environment.

An Appropriate Technology educational program's aims are to provide knowledge, insight and proficiency of the sort that stimulates selfreliance. The program does not pass by the social benefit; however, it does look beyond the existing structure of the profession. It attempts to make students and teachers live through and experience a mutual process of learning-teaching, in which the standard fringe conditions, such as language, intelligence, perseverance and attire are not of limiting essence.

Educational programs that include Appropriate Technology are not directed at standardized knowledge- and proficiency packages. A degree "for life" is not its sole aim. Personality development and judiciousness concerning one's own life and work are aims of even greater importance.

Emancipation of the prospective holder of a profession is an educational goal. Knowledge, know-how and the stimulation of creativity can go hand in hand with artistic proficiencies. The enrichment of educational situations by the cultivation of artisticity is of great importance in a process of learning, where the student learns to develop himself. A certain degree of funnel knowledge cannot be avoided in nearly every type of education or training. This knowledge only lends its significance from network situations in which social themes and educational subjects are brought into connection with one another. These networks attain to form in working groups and project-education, where it is the object of the working group to be an exercise in self-administration. Deliberation within the working groups is a part of the educational situation. It is essential for the technical aspects of the educational program, that technical provisions are always placed into a coherent connection with the surrounding system. Thrift, simplicity and safety are basic elements for the design or evalution of designs for technical means and instruments. Whether artisan or engineer; in an Appropriate Technology eductional program these types of profession will remain in existance; however, the relations of power in the society become altered through insight into the importance of one another's contribution to a healthy community.

3. An education for an Appropriate Technology engineer - the non-specialized expert

It is likely that in the industrial culture the relations of power can only become altered, when, in particular, those in power liberate themselves. Quite naturally, they can - and must - be assisted in this effort. The important contribitors in this process are the jurists, the economists and the engineers; because whatever way one may look at it, the fact remains that if no factories were to be designed and constructed, there would be no products and no newspapers and no weapons that can be used to oppress people.

It is the truly well aware engineer in particular who, provided that he is properly (appropriately) educated, is capable to, in co-operation with others, change society from within into a community that is pleasant not only for those in power, because it is only the technicians and the farmers that are capable of creating something:

Engineers are in a position to choose just how they wish to put their specific talents and experience to work for the benefit of society.

An Appropriate Technology engineering education has to be capable of providing insight as to why such a choice is of importance as well as the tools to

give form to this insight. The most important basic elements for this education have already been discussed in the previous paragraphs; however, these need to be further developed. This will be done on the basis of arranging the three ground principles of Appropriate Technology : to this end, each of the three development processes is divided into four sections and related to the education:

1. the spiritual development process: from spiritual dependence to spiritual freedom
   - phase 1: the lonely individual. Alienated individuals, standing divided from one another. People in a society that experience themselves as being powerless and lonely; they are underdeveloped.
   - phase 2: the aware individual. The spiritual development from alienated individual to aware person has been completed. There is motivation towards selfdevelopment; there is still a feeling of being powerless, however, one "knows" one's own thoughts, feelings and will.
   - phase 3: the liberated group. Aware persons unite into basic groups, in which the will is transformed into collective activity.
   - phase 4: group solidarity. Selfdeveloped groups co-operate.
     The choice for co-operation takes place within the framework of the desirability to preserve the living community and to collectively care for the safety and health of mankind and the environment.

2. the organizational development process: from political dependence to political freedom.
   - phase 1: subordination with funnel-organization. The work within the organization is done on a one-way basis, from boss to subordinate. Functionaries standing divided from one another in established relations of authority form the organization. Division of labour is at its peak.
   - phase 2: co-ordination with funnel-organization. The means for two way traffic are available. The subordinate has the right to talk along with the boss. Humane aspects play a part in the formation of the organization that, however, is still directed at an extensive division of labour.
   - phase 3: co-administration with network-organization. The right to co-administration is available. In the organization the management is chosen by the workers. The classification of functions

is determined by the workers or is done in close collaboration with them.

- phase 4: network-organization with self-administration. Not only is there self-administration by the workers and is the workcontent determined by the workers, but also the means to production are in ownership of the collective group.

3. The technical development process: from economic dependence to economic freedom.
   - phase 1: mass-production based on waste. Technical provisions are aimed at oversupply, i.e. supply of products outside the production location. The safety of mankind and the environment are of importance only in as far as this affects productivity. The applied techniques are of a complex nature.
   - phase 2: safe mass-production. The safety of mankind and the environment are consciously taken into consideration in the design and construction of techniques; however, the techniques themselves remain of a complex nature and are not yet capable of being democratized.
   - phase 3: safe and simple production for the masses. Not only is the safety aspect incorporated in the design and construction, but also the technique itself is made to be democratizable by means of advanced knowledge, so that production by - and for the benefit of - the masses becomes possible.
   - phase 4: selfsufficient production for the masses. To the aspects of safety and simplicity, the aspects of thrift is added. The scarce resources of the immediate surroundings are used in a thrifty manner. The aspects of thriftiness, safety and simplicity make possible a maximum degree of selfsufficiency.

These four steps of development in Appropriate Technology education have been arranged in a renewing development model as follows:

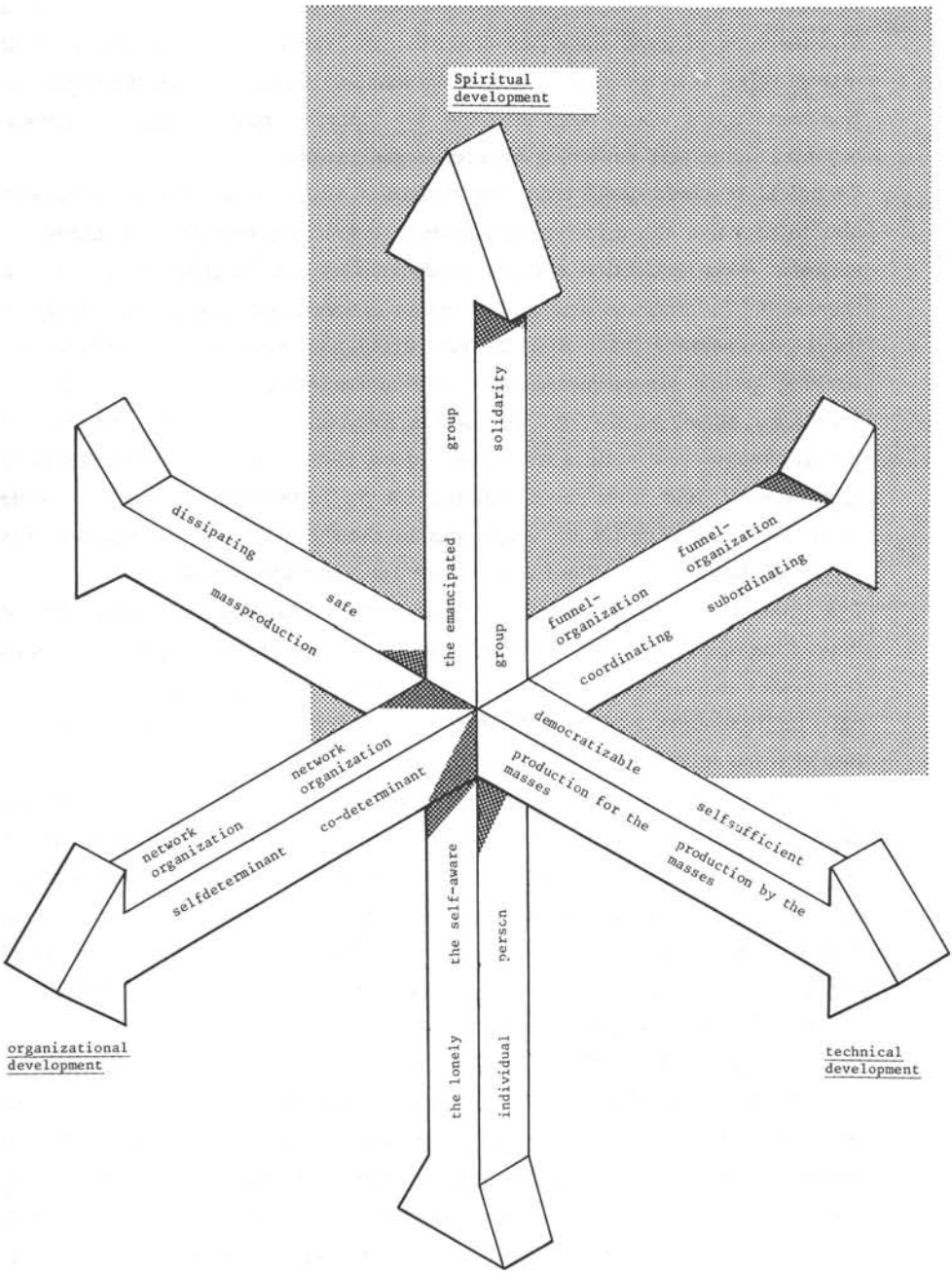


Fig. 25: Develoment model for Appropriate Technology for the benefit of education and research.

Education along one of the axes can partially take place in the normal lessons. The teachers of psychology can deal with the various development-phases of man in relation to emancipation and the humanizing of labour, while organization-sociologists would deal with the development from hierarchical funnel-organization to self-governing network-organization.

Technical teachers could train the student in such a manner as would enable him to perceive the differences between technical development intended for wasteful mass-production and for production of a selfsufficient nature and, thereafter, incorporate this in the design process. But also in the education itself circumstances have to be created that leave room for the individual, i.e. working groups for projects, excercises in knowledge, skills, creativity and artisticity aimed at the use of durable sources of energy, conservation of energy, repair- and maintenance techniques, reclaiming and re-utilization of raw materials and other goods. All this for the benefit of creation of flexible employment opportunity by employees in their own (small) enterprises that supply products made in the first instance for those that are not rich.

The final aims of an education in Appropriate Technology engineering are to impart knowledge, proficiencies and insights that enable the engineer to design techniques and organizations that tend to lead to a greater degree of economical-, political- and spiritual independence of those involved. In this, the accent lies with the small- and medium sized enterprise.

The engineer-entrepreneur, graduating from these studies, is a different kind of engineer than those that currently graduate from existing forms of education. He will be characterized in the first place by his insight into the interests and the possibilities of techniques and organization that are beneficial to mankind and the environment. He not only knows how to, with these goals in mind, manage techniques or organizations, he also understands the "why", the necessity for Appropriate Technology.

The Appropriate Technology engineer is, in fact, a non-specialized expert. Expert, because he is capable of doing the same things as can the other type of engineer. Non-specialized, because he is capable of creating things with his own hands or, if not, is prepared learning how to do so. Non-specialized also, because he does not lend other engineers the right to evaluation of his work in the first instance, but reserves this right for the basic group that he works for. Non-specialized also means that this engineer is capable of listening to the non-engineer, and can translate their needs and wishes into technical-organizational variables of design.

Regardless of whether the education is intended for engineers or for elementary school students, subjects of knowledge and education directed at themes will be necessary.
The subjects of proficiency and exercises have to do with technical proficiency (how to build a thrifty stove) and organizational capabilities (how to organize the production of the stove) and also with emancipation (how to take care that everyone is doing the work one wants to, and is capable of, doing). Of the education leading to a degree in Appropriate Technology engineering a draft has been prepared that is based on the experiences gained from various projects. (Institute of Technology, Delft, The Netherlands, 1981).

For the moment, it does not appear likely that such an education will be forthcoming, even though in a number of countries there are programs under development thay may eventually lead to this type of eduction. Such proposed educational programs have in common the use of technology in a development strategy that is aimed at the utilization of the beneficial achievements such as may arise from the industrial technological culture, but not its disadvantages. Any engineer that wants this, must, of necessity be capable of working with funnel-knowledge (as a specialist) and in social networks (non-specialized).

4. Learning how to read and write and self-reliance - research for liberation

In this chapter, as well as in the previous chapters, a great deal has been asserted. In order to qualify as being scientific, such assertions require investigation and evaluation, thereafter either to be discarded or accepted provisionally. The assertions that have been made concerning technology and communities are decidedly not weak in the formation of theory. For those that have a need for it, they can be formulated simpler still or arranged in a more dignified fashion. The simplifications, that were made in order to express the content and working-methods of Appropriate Technology also indicate no real weakness. The real weaknes of Appropriate Technology lies in the transition of projects occurring only once, to activities adopted, multiplied and guided by the population, beneficial to mankind and the environment.
Just as learning how to read and write is an inevitable prerequisite for cognizance of information concerning culture, so is selfdevelopment, amongst others based on this information, inevitable in order to arrive at spiritual independence. Once this independence has been attained, it becomes possible to make choices, together with others. Choices for becoming free.
It is necessary to investigate, how precisely it came about that the beneficial

project "Revolving around the sun" has been terminated, while it could very well have served as an excellent example for many. How is it possible that the entire sector having to do with repair, maintenance, re-utilization and reclaiming of materials and raw materials, durable sources of energy and conservation of energy is hardly afforded any attention, while it is just these very branches that show great possibilities for flexible small-scale employment opportunity. And how about investigation into the possibilities for a healthier life through biological food (thus, more employment opportunity and self-reliance) and other forms of health-care and also, how about investigation into a constructed- and controlled environment, capable of stimulating self-reliance.

According to my viewpoint far too little of all this is happening, for reason that it is not clear to a great many people, whether scientists, politicians or population, that the dominating system of norms, values and points of departure leave little room for such forms of science and technology as are appropriate to a healthy future.

Research on behalf of liberation signifies on the one hand research into the relation between technology and the community, in particular its oppressing elements, and on the other hand, research into the possibilities for becoming free of these oppressing elements, especially in the case of women, who, in the third world are very important in the utilization and introduction of technology. In the foregoing, the elements of oppression have been clarified and it was asserted that only through simultaneous development of economical-, political- and spiritual independence, by means of selfsufficient techniques and selfgoverning organizations run by solidary emancipated groups, a development process can come into being that will lead to a healthy society. The innerdirected community requires its own techniques. For those techniques that are aimed at the small community, villages and sector and intended for people that, in fact, hardly require assistance in the utilization of these techniques, there is very little interest on the part of the (technical) universities and the companies in the private sector.

And rightly so, certainly from the viewpoint of the short-term directed community-of-common-interest of scientists, politicians and business bonzes, but without justice from the viewpoint of the long-term directed perspectives for survival of mankind and the environment and the rights of those still to come and of those who's fundamental needs have not yet been fulfilled to any worthwhile degree.

EPILOGUE

The reality of Appropriate Technology - the end is out of sight.

We are all familiar with that feeling of panic, when you suddenly see a small child run out into the street practically right in front of a car and the tremendous sense of relief when the driver manages to apply the brakes just in the nick of time. The end is out of sight if we were to identify ourselves with this sort of occurrence too intensely. Or is it so, that precisely because we are to preoccupied with ourselves and to little with others that many great problems have come to be? For identification with the miracle of nature means, in any case, a growth, from within, of the awareness that we really shouldn't behave like the sorcerer's apprentice, who seeks to bring forth miracles but is incapable of mastering the consequences of his creations. It would be miraculous indeed if a technology were to be developed capable of bridging the contradistinction between technology and community, by serving as an instrument that provides people with the possibility of liberating themselves. Much has been gained with industrial technology. Much gained in the literal sense, in money and in products. But it seems that a great deal more has been lost, particularly in the place were we used to work, by delegating our ingenuity and skillfulness to the care of soulless machines. The skilled tradecraft, at one time the most beautiful expression of technique, has become chiefly a curiosity for that reason.

The history of industrial technology reveals the unequal battle between the power of those that own everything and the impotence of those that possess nothing, but are gradually delivered up to the machinations of the machine. The history of the western culture is also the history of the destruction of cultures, regardless of whether this is the destruction of the Skolt Lap culture or that of the Incas. The tragedy of the snowmobile revolution is that it led to a deprivation of liberty. A people that have become incorporated in the addiction of the western industrial state to money, fuel and products. This process of incorporation does not come about with good grace. The arsenal of weapons wielded by the western world has a power of conviction that is difficult to ignore. The poverty on the greater part of the people of the third world, is more likely to be the symptomatic effect of the illness of the western industrial culture than the consequence of a logical development: the result of a lack of ingenuity and diligence on the part of the "natives".

Development: the banner on the battleship of the industrial culture. What is the

object of all this? "Modernization", still more of the same or "development"; is this the answer to the question of gratification and fulfilment of the fundamental needs of those that are powerless? Behind the smokescreen of ever more beautiful words and ideals hides the problem that our leaders neither know the answer to the question of development nor, apparently, care to look for it. The same holds true for the critical scientists and engineers that are busily engaged in the construction of windmills, while they avoid a confrontation and dialogue with truck-drivers, mechanics and welders concerning the essence of development.
The future is a subject capable of rousing the interest of almost anyone. It would, however, appear to be ostrich-politics to leave the exploration of the future solely in the hands of people with a higher education.. Ostrich-politics also, because the people are not capable of perceiving the new clothes of the future-exploring emperor. The cloud of words that envelops the emperor, can no longer disguise his nakedness. He is rich and he will remain so and it is just these riches that form the obstacle for the development of the people. The giant cities that have come into being and that continue to grow in a rampant fashion, show all the misery of the slum sections and the lack of realization on the part of those in power that there are limits to what the people and the environment are capable of tolerating.

It is up to those in power to liberate themselves from their robber's attire; they themselves would also benefit from an improved form of stuartship. This stripping of nature, the destruction of non-industrial cultures and the exploitation of basic groups may lead to short-term gratification of the lust for yet more power, however, on the long-term it will almost certainly lead to selfdestruction. The history of the search for other ways of development than those of large industry is as old as is the process of industrialization itself. Experiments with co-operate forms of organization, sometimes combined with the system of selfsufficiency and liberation movements, which to a certain degree also included the unions, have been established right from the very start of the industrial revolution. But it is, apparently, not a simple matter to offer an alternative to the tremendous incontestable material gratification that capitalism offers to its workers. Perhaps it is the aim of the dominating system to create a state of spiritual-, economic- and political dependence, in which state-capitalism and free enterprise capitalism differ only in the degree of oppression of the working class.
Perhaps also, the development of possibilities for selfreliance, selfadministration and selfdevelopment may, eventually, lead to economic- political- and spiritual liberation. A technology for liberation, such as Appropriate Technology can only

succeed if it is supported by the basis of society for which it is, in fact, intended; this in contrast to the intention of industrial technology. Intended to serve as an instrument and means for the gratification and fulfilment of existential-, relational- and growth requirements. At the same time, Appropriate Technology is also intended as a way of development out of a dead-end street of addiction to money and products and wasteage of mankind and the environment, which is characteristic of the industrial state. Knowledge, skill and creativity are, possibly, insufficient to guarantee progress along the soft road; also artisticity is needed to warrant the quality of techniques and products.

The awareness that the true quality of life cannot be measured is as important as the awareness that the proponents of Appropriate Technology are no paper tigers, but people that are willing to develop technology as an instrument for the creation of a healthy community. This utopia, the image of a future of a society with Appropriate Technology is a very general image; however, the problems in the third world are more at the level of the primary living requirements, the existential needs, while the problems in the industrial states are more in the area of a disturbance in human relations and spiritual development.

To strike out in a different direction is difficult; it takes time to change. To prepare a program, a plan, does not suffice in itself. As in the case of a fabric, at first the pattern needs to be designed and, thereafter, the pattern will be produced by a natural interaction of technique and organization. It is also necessary that the plan, the code, contains an attainable ideal, capable of being realized within a reasonable period of time. The end is out of sight if we are ignorant concerning the beginning. Man is like an ant on the common plane of everyday existence and if he does not manage to rise above this plan and gain insight into the realities of his existence, than the pattern of his daily life will move according to a plan that is not his own. The plan should be his plan, conceived together with other workers, because there is not a single politician, industrialist or professor that can do anything without the worker. The content of employment opportunity for those in leading functions can also be determined by the workers, while, for the moment, it is the other way around.

The high bill run up by our economic system is being paid for by the worker, the pensioner and the unemployed. There seems to be more room for man in proportion to the height he has reached on the social ladder; however, the evaluation of social usefulness can also be done by the people at the base of society. If this could be accomplished the world would look like a very different place indeed.

The practice of everyday demands food that is healthy, pure drinkingwater and

less expensive energy; it demands thriftiness and clarity and an art of medicine that makes the people more important than the pills. Appropriate Technology is undesirable if one fails to perceive the importance of a healthy- and just society and it is uneconomical if the only thought is for short-term profits.
Obviously, it is not possible to, without insight into the essence of education as a school for living, strike out on the soft road toward social change. It may be stated without reservation, that the knowledge currently taught in the school system, is for the greater part in direct conflict with true insight into what life is. Alienation by specialization can be deflected by allowing to come into being, networks of knowledge that stand in relation to social subjects. To a certain degree is the artisan capable of doing more than an engineer, while the engineer has greater knowledge.
If every engineer were to become a non-specialized expert, he would be capable of stimulating research aimed at spiritual-, technical- and organizational development by aiding solidary groups in selfgoverning network-organizations with self-sufficient production techniques.
The end is still out of sight; however, a beginning has been discovered. The simultaneous transition from aware individuals to liberated groups, from mass-production to production for the masses and from funnel-organizations to network-organizations, have become manifest here and there. Like a morning flower in the evening twilight of the industrial culture.

W. Riedijk
Berlin, June 1983
Delft, The Netherlands, 1984
Rijswijk, The Netherlands, 1985.

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