



JOHANN BECKMANN AND THE "CONSIDERATION OF COMMODITIES AND TECHNOLOGY IN THEIR ENTIRETY"

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1. Introduction

It shall be stressed at the beginning of this paper that both Johann Beckmann and George Sarton have had a same fundamental aim in their view : i.e. "science and humanity".

The theme to treat concerns the past and the presence : the *past* in so far as Johann Beckmann could understand and treat the knowledge of science and the practise of real things and achievements at this time, the *presence* in so far as we can consider today the commodity science and technology in their entirety.

It is a fact that nowadays goods cannot be treated under the angle of economic and technical elements only, but that also cultural, social, historical, linguistic and political aspects must come into consideration and, last but not least, must be seen with their ecological and/or environmental implications, which became actually of highest importance. This conscious appreciation of *all possible implications* of technology, and commodities encountered at all stages of their existence (from production over usage and/or consumption to waste management), will be called the "ganzheitliche Betrachtung" which can be described in English as "contemplation in entirety".

It is clear that this "principle of completeness" reckon with the multidisciplinary of things; this is in clear contradistinction with the "economic principle", where partial and sectorial objectives are of most importance. Johann Beckmann held the view of multi disciplinary.

Johann Beckmann was a man who believed in universal education. He practised and promoted sciences which lead to concrete applications in the real daily life; he put "sciences" into practise for "people", in so far he was able to combine science and techniques in the perspective of entirety.

By observing Beckmann throughout his subsequent works we discover the ever new aspects and accents he considered to reach his goal of completeness.

In this perspective, the museum of science and technology of the state university of Ghent where I'm presenting Beckmann's and our ideas, receives under the directory of Prof. Dr. Lox a symbolic value : it aims also at demonstrating the synergetic effects of scientific disciplines and different techniques into the subsequent evolutive processes of sciences and technologies. This museum forms a real theatre human achievements : on one side comes Sarton's monumental work as a root in connection with the history of sciences, and otherwise Beckmann's work forms the pillar for the history of technology and all what has been realised. Both persons are represented together with their work at the entrance, symbolising the bridging completion of thoughts aiming at the representation of humanistic entirety.

The knowledge of natural products and resources was a fundamental conception of Beckmann : how products are harvested (agriculture), treated (technology) to become commodities (the economics of transport and trade) and the "industrial management" were considered by him under a common denominator as *one* "science for people".

Troitzsch argued in 1963 : "The rigid separation of natural and humanitarian sciences as it went systematically since the 19th century, in so far that nowadays it is common to speak about the two "cultures", was not yet in force in Beckmann's time. We are now tending to consider the interdependency of sciences. Too less attention has been paid up to now upon the fact that the main works of Johann Beckmann are written not only following a common systematic frame, but also with the fundamental idea of an over-

arching treatise of the usage of products which are offered by nature".

It is my aim to treat Johann Beckmann under two aspects : the description of his work and how it was influenced, how he lived, which requirements he had, and what has been set to work on by him. Secondly, I will try to recognise Beckmann's importance today, to discover how his creative activity progresses in modern technology.

2. Curriculum vitae of Johann Beckmann

Beckmann is a transcription of "Mann an der Beeke" which means "man at the brook". Johann Beckmann was born in 1793; his father was a tax collector and a postman in Hoya at the Weser (Northern West Germany). At the age of 20, he went to study theology at Göttingen, but started quickly to follow physics, fiscal sciences, classic and new languages. In 1762 he went for a study tour to the Duchy of Braunschweig and subsequently to the Netherlands. In Braunschweig he visited several manufacturings, mines and people.

Most interesting is the meeting with the renowned learned theologian Jerusalem in Braunschweig. It was Jerusalem who advised Beckmann to travel to the Netherlands, where he stayed "only" 44 days. A lot of interesting ideas and impressions were noticed in his diary; what luck that it was translated into Dutch in 1912. Later Beckmann became teacher at the lutherian College in St. Petersburg (1763-65) and afterwards studied for one year in Sweden under the direction of the wellknown Prof. Dr. Carl Linnaeus. In St. Petersburg. Beckmann taught mathematics, physics and natural sciences. He also met his Göttingen fellowstudent Schlözer, who became one of the most known critical historians and political publicists of the german "Enlightenment". Beckmann continuously stayed in correspondency with his friend Schlözer, but most important were the impressions from Linnaeus : they are found to have governed his way of thinking, working and scientific practise. The influence of Linnaeus lies on the base of Beckmann's life purpose : science for the benefit of people.

Johann Beckmann was nominated in 1766 "professor in philosophy" at the University of Göttingen and in 1770 "professor in economics". At that time the courses in economics were agriculturally oriented. Beckmann died in Göttingen at the age of 72 (1811). The scientific and creative works of Johann Beckmann are astonishing :

- he was the founder of the subject technology, pioneer of agricultural sciences and of the commodity science, and critical historian of social and technical discoveries.
- he learned mineralogy, accountancy, paleontology and fiscal administration.
- he wrote, besides the main subjects concerning commodity science and technology, works about Linnaeus and about personalities from remote ages, and also made compilation of the main regulations and made thousands of bookreviews.

Most astonishing is the fact that this work of over 30.000 pages was written under candle light with feather and in the period where personal transport was realised with the hoursecouch ! It is clear that Beckmann searched into the original works : he was fluent in following languages : Latin, Greek, English, French; he translated Swedish and Italian and had a good knowledge of Russian (See table of activities).

Table of activities : Subjects treated by Johann Beckmann

Topic	Main fields	Minor fields
Objects from nature		<ul style="list-style-type: none"> - natural sciences - natural history of antiquity - mineralogy - botanics - comparative anatomy
Techniques Administration Economics	<ul style="list-style-type: none"> - Technology - Commodity Science (Warenkunde) - Agronomics 	<ul style="list-style-type: none"> - Business science - small housekeeping - Cameralism, public administration - Poor's relief - Code-collections
History of social affairs and techniques	<ul style="list-style-type: none"> - History of social and of technical origins, discoveries and inventions 	<ul style="list-style-type: none"> - history of natural sciences - literature of travel descriptions - etymology - terminology

3. Johan Beckmann as human

If we summarize what contemporaries have told about Beckmann we come to this personal characterisation : he had a robust health, a great creativity, was a hard worker with a special sense of order and had a high working efficiency. He was not a revolutionist or atheist; it is difficult to recognise his religious thoughts. He was not a politician; was most reserved in his utterings.

He was kind to the poor and his house personnel; he was member of a lot of national and international academical associations and had in this way an extended correspondence all over the "world".

His financial affairs were extremely well managed : expenditures and revenues were noticed, following the principle of double book-keeping. His private current-account was object for a book "Anweisung die Rechnungen kleiner Haushaltungen zu führen".

Some private documents were recently offered to the International Johann Beckmann Association (I.J.B.G.-founded in 1987) by descendants living in Germany, Brasil and U.S.A. : interesting are his handwritten household book with expenditures, revenues and balances over the period 1803-1807 as shown in figure 1.

Beckmann also used his housekeeping books for memorising personal events. So here he noticed at the left side below : "on the 6th (of this month) I had a pleasure of accepting the visit of my former accurate auditor, the famous traveller von Humboldt (Alexander) after his return from America".

Handed to his birth-place Hoya/Weser was also his handwritten testimony : it has been translated into twelve languages ! This remarkable document projects some very personal qualities of character : "I wish to be buried without luxus and sensation... That my bones may become unrecognisable as quick as possible by mixing them with those from others...". The word "God" is not used in the text but he advised his survivors "to live honorably and as a christian...". Beckmann also expressed the wish that this personal

bible should remain in the family during some years, "in love from my parents". This wish has been fulfilled up to now : the Bible is still in hands of Beckmanns, living in Brasil.

4. Influences and spirit of the ages

Beckmann lived in a period where two fundamental movements were in course : Humanism and Enlightenment. Both revolutionary ideologies have in common the aim to liberate humans from their spiritual, associative and material fetters. It is a fact that physical sciences seem to lose the bindings with dogmatics and philosophy : at each time it is demonstrated in different graduations and accentuations that only one significant discovery can be more useful than an ivory tower. Closely allied with the spirit of "enlightenment" is the "cameralism", the German alternative of mercantilism. This movement aimed basically at improving the state and the general prosperity by the promotion of sciences, education and industry. In these tendencies we discover the fundamental need to bridge theory and practise. It is our conviction that Beckmann and also the french representatives of the enlightenment undergo this guiding influence.

5. Johann Beckmann, founder of Technology

As stated before, Beckmann was nominated as professor in philosophy in 1766 at the University Göttingen with the aim to found a professional chair of economy. Things evolved very quickly: after one year he presented his ideas about the economic (equal to the actual) agriculture and organized an "economic garden" with most important plants and even weeds !

So, he published in 1769 the "Grundsätze der teutschen Landwirtschaftslehre" (Fundamentals of the German Agriculture) which received six reprints : the book was one of the most-read textbooks of the time : it treated arable farming, plant-culture, cattle-raising, the processing of farm-products and also the administration and planning of farms. It is of extremely importance to notice that a professor of *economy* (or agriculture) became the founder of *technol-*

ogy : it is our conviction that both sciences, "economy" and "technology", deal with natural products : on the one hand the culture of plants (agriculture) and on the other hand their *processing*. In this point of view it seems to us that technology forms a logic extrapolation of the agricultural science. It may be recalled here that Beckmann taught at the age of 26 in St. Petersburg about "natural products" !

6. Johann Beckmann and his book "History of Inventions"

Johann Beckmann published from 1780 to 1790 one of his most famous works under the title : "Geschichte der Erfindungen" (History of Inventions, Discoveries and Origins) : It appeared in five subsequent volumes. The English translation appeared in 1846 and had four reprints in England. The english version contains an additional chapter entitled "Steam engine". Beckmann describes a lot of technical inventions, recipies and discoveries placed in the timely *social context* : this treatise is based upon the historical facts and documents and shows in this way an interesting evolution of applications of scientific discoveries and technical inventions in daily life, together with their social implications. One of the most interesting chapters concerns the "ribbon loom" : This machine is considered by Beckmann as one of those inventions by which more can be produced than necessary; he also mentioned the social implications in so far that qualified persons can become unemployed or fortemporarily oppressed. He writes : "The municipality of Danzig is said to have pushed aside the inventor of the "ribbon mill" by drowning or suffocation". Karl Marx has also treated this story of the ribbon loom : he wrote litterally "this machine, who caused so many difficulties, was preceding the spinning machine and moving machinery and also of the industrial revolution". Recently the books "History of Inventions" and "Project of General Technology" (Entwurf der Allgemeinen Technologie - 1806) have been translated from the original German version into Japanese (published in 1982) by a group of 45 people from the Japanese Patent Office. The aim was "to understand to judge in a better way the transfer of technological knowledge from Europe to Japan." (Tomita).

The 250th anniversary of J. Beckmann formed an interesting opportunity to edit a stamp, and this was realized by a studygroup from the Technical College of Madgeburg (G.D.R.) in 1989.



Figure 2 : Copy of the stamp dedicated to Johann Beckmann, edited in 1989 on occasion of the 250th anniversary of his birthday.

7. Johann Beckmann, professor in Commodity Science

Johann Beckmann was the first real professor in lecturing commodity science : nevertheless there are indications that already before him commodities were described demonstrating the importance of a good knowledge about the objects of trade. Ali-ad-Dimisqi (1174 Damaskus) treated this aspect in his book entitled "The book with indications about the beauty of trade and about the knowledge of good and bad products and their adult-relations". Francesco Baduci Pergolotti (Italy 1440) also treated in his "Prattica della mercature"

(practise of commodities) the characteristics of different commodities. N. Lemery (France, 1645-1715, chemist and doctor in medicine) published a material lexicon, and Paul Jacob Marperger (German cameralist, 1656-1730) argued that a course should be learned at all higher commercial schools by which "the products of trade could be treated in extenso". Ludovici (Leipzig, 1707-1778) founded in Leipzig the concept of a university-course about commodities. Beckmann entitled his text-book "Introduction to the Commodity Science or the Acquaintance of Important Foreign Products", most different from Ludovici's work entitled as "General and Special Commodity Science". Professor Grundke (G.D.R.) justly notifies that Beckmann's commodity book must be considered as the "birth-charter" of the commodity science. Indeed, all goods are treated with their properties, their manufacturing, their quality control and giving directions for use and trades; Beckmann systematically makes clear the terminology of words upon historical information. Ecological aspects could yet be found : e.g. under chapter "Ivory" he indicates aesthetic elements of goods and the irrationality of values especially for cases where humans exhaust animal life. "The birds learn the superiority of people : they fly to other places to avoid persecution. The man disturbed in this way the company of the beaver, the walrus and probably many other species". In this way it may be said that the commodity science is oriented by Beckmann towards "entirety". The influence of J. Beckmann was important : at different German universities the course "commodity science" has been lectured since. We may stress that Beckmann's ideas are still of use today : we find up to now commodity sciences taught at the economic faculties in Italy, Japan, Poland, Austria and others. In the Anglo-Saxon countries, commodity-science is not presented as such on the university programmes. Probably because the german word "Warenkunde" can't be translated by one word into the Anglo-Saxon languages. Nevertheless, since the international association was founded in 1976, several international Congresses were subsequently organised in Vienna, Gent, Krakow, Bari, St. Gallen, Tokyo and Seoul, all under the terminology of "Commodity Science", a term which by now has been adopted by the scientific community.

8. Johann Beckmann and Technology

The most widely known achievement of Johann Beckmann is the foundation of the science called "Technology". At the age of 33 (1772), Beckmann used for the first time the word "Technology" to describe "the science of manufacturing and the history of arts". In 1777 he published his famous book entitled "Anleitung Zur Technology" (Introduction to Technology).

Herein the word "technology" has been defined as "the science describing the processing of natural products or the knowledge of their manufacture". So we consider Beckmann not only as the promotor of the word "Technology" but also as the person who created the *object* (or thing) and its *form*. After this publication many "chairs of technology" were introduced at several universities and "technological" literature appeared very quickly. It is out of doubt that the actual presence of technology in the wide range of realisations depends directly upon the publication of this technological standard book, wherein, for the first time, several products such as paper, beer, porcelain are treated and classified in the way how they can be produced.

The general concept of the *1777 book* was described by Beckmann himself as follows :

- a. The handicrafts should be ordered not only following the used materials and the produced objects, but also following the common parts and analogies during their processing and the principles upon which these are based.
- b. the knowledge of handicraft, fabrics and manufactures is indispensable : what has been made, ordered, qualified handled, gained, used and performed should at least be known and understood".
- c. "when the basic knowledge fails, so shall the craftman be left upon his own or will he receive plans which cannot be performed".

The principles of ordering the treated subjects are shown in Fig. 6.

Anleitung
 zur
Technologie,
 oder
 zur Kenntniß
 der
**Handwerke, Fabriken und
 Manufacturen,**
 vornehmlich derer, die mit der
**Landwirthschaft, Polizey und
 Cameralwissenschaft**
 in nächster Verbindung stehn.

Mit
 Beyträgen
 zur
Kunstgeschichte.

Von
Johann Beckmann
 ordentlichem Professor der Oekonomie in Göttingen.

Mit einer Kupfertafel.

Göttingen,
 im Verlag der Wittwe Vandenhoeck. 1777.

Figure 3 : Front page of Johann Beckmann's book "Introduction to technology" Published in 1777.

die also ganz abgegangen sind, ist nicht ohne Nutzen. Nach Erfindung der Glaspiegel gieng die Kunst Metallspiegel zu machen, verlohren, die man in neuern Zeiten, nach Erfindung der Spiegelteleskope, mühsam wieder suchen mußte.

§. 14.

Natürliche Ordnungen
der
Handwerke und Künste.

Nulla ars non alterius artis aut mater aut propinqua est.
Tertull. de idololat. c. 8.

I.

1. Handwerk der Schlächter, Fleischer, Metzger, Knochenhauer.
2. Kochkunst.

2.

3. Bereitung der Käse, Butter.
4. Dehlschlägerey. Baumöhl, Rüböhl, u. s. w.
5. Thranfiederey.
6. Bereitung des Wallrath.
7. Bereitung der Hausenblasen, Hausenleim.
8. Leimfiederey.
9. Seifenfiederey.
10. Ritzfiederey.

3.

11. Bereitung der Nudeln.
12. Eblatendäckerey.
13. Bäckerkunst, Grobbäcker, Melzbäcker, Roggbäcker, Fastbäcker.
14. Honigkuchenbäckerey. Pfefferkuchen, Lebkuchen.
15. Bereitung der Chocolate.
16. Zuckerbäckerey, Conditerey.

4.

17. Bereitung der Weine.
18. Bierbrauerey.
19. Essigbrauerey. Wein- und Bier-Essig.
20. Branntwehnbrennerey. Franz- und Korn-Branntwein.
21. Bereitung der Liqueurs, Distäten.
22. Schwefelwasserbrennerey.
23. Vitriolöhlbrennerey und die übrigen Säuren.
24. Apothekerkunst.

5.

25. Boraxfiederey.
26. Pottaschfiederey.
27. Salpeterfiederey.
28. Kochsalzfiederey.
29. Alaunfiederey.
30. Vitriolfiederey.

Figure 4 : Reprint of the contents of the "Introduction to technology" : §14 : Natural arrangements of handicrafts and hand-arts (continued in figure 5)

<p>19.</p> <p>114. Weben der Haarsiebe.</p> <p>115. Leinweberey.</p> <p>116. Zwillichweberey, Drellweberey.</p> <p>117. Leinendamaweberey.</p> <p>118. Balist, Kammiertuch u. s. w.</p> <p>20.</p> <p>119. Tuch- und Zeugweberey.</p> <p>120. Bandwirkeren, Wortenwirkeren.</p> <p>121. Tapetenwirkeren.</p> <p>21.</p> <p>122. Kaltweberey.</p> <p>123. Sih, Parchent, Kanefas.</p> <p>124. Nesseltuchweberey.</p> <p>22.</p> <p>125. Seidenweberey. Halbseidenzeuge.</p> <p>126. Glatte, ganzseidene Zeuge: Cassent, Gros de Tour.</p> <p>127. Façonirte Zeuge, Atlas.</p> <p>128. Gezogene Zeuge, Damast.</p> <p>129. Brochirte Zeuge: Batavia, Stoffe, Drap d'or, Drap d'argent.</p> <p>130. Sammet, Plüsch, Wespel, Manchester, Velveretd.</p> <p>131. Seidenwortenwirker.</p>	<p>23.</p> <p>132. Walkerkunst.</p> <p>133. Filzmacher.</p> <p>134. Mattenmacherkunst.</p> <p>135. Hatmacherkunst.</p> <p>24.</p> <p>136. Paptermacherkunst.</p> <p>137. Bereitung der Sachen aus Papp.</p> <p>138. Dockenmacher, Puppen, Masken.</p> <p>139. Bereitung der Uhrgehäuse, Futterale, Scheidenmacher.</p> <p>140. Bereitung der Sachen aus Papier maché.</p> <p>141. Fachtelmacher.</p> <p>142. Buchbinder.</p> <p>25.</p> <p>143. Bereitung der Bleistifte.</p> <p>144. — des Siegellack.</p> <p>145. — der Gypsbilder.</p> <p>146. — der Pasten in Schwefel u. d.</p> <p>147. — der Bilder von Hausenblasen.</p> <p>148. — der künstlichen Blumen.</p> <p>149. — der unächten Perlen.</p> <p>150. Wachsponnsirrkunst.</p>
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Figure 5 : Reprint of the contents of the "Introduction to technology"

<i>Goods</i> <i>Method</i>	Cement	Bakery	Beer-brewing	Paper
heating	revolving oven	baker's oven	drying oven	-
grinding & breaking up	breaking device	mill	grinding	tearing
water	+	+	+	+
mash	concrete	paste	mash	mash

"Examples" 1777

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"Principles" 1777
(and Examples 1806)

Figure 6 : Beckmann's principles of ordering the treatise of goods in the 1777 book.

In 1806 Beckmann published a second technological standard work entitled "Entwurf der allgemeinen Technologie" (Project of a General Technology). In this work he tried to summarize the different aims and methodologies of goods. It may be stated that Beckmann's viewpoints are trivial and universal at the same time :

- one object can be made following different systems;
- one system can be used for different objects.

Both technical works must also be considered as *complementary to each other* because the 1777-edition treats also important general techniques and the 1806-edition contains (in contradistinction to the title) the description of a lot of separate handicrafts, each based upon a different "know-how" and/or "technology". We can demonstrate the systematic way Johann Beckmann followed to treat and to describe the general technology by following example.

Let us consider the life-cycle of the Commodity "bread" : First stage is the transformation of *grain* to *flour* by the miller; the work to make *bread* from it is done by the baker. The following phases as shown under *transport*, *storage* and preparing the bread will bring us to the final purpose "consumption for feeding".

The Beckmann consideration of general technology finishes in the stage of making flour; without doubt the next stages can be deduced from the basic concept of Johann Beckmann, because at several occasions he treats about the use people make of things. Prof. Hölz (Wien) recognises the following categories of the "purposes" in the description of general technology : a technical purpose, a techno-economic purpose and a techno-ecological purpose. It is also interesting to consider the ideas of the technic-philosopher Ropohl about Johan Beckmann. They are part of the following figure 9.

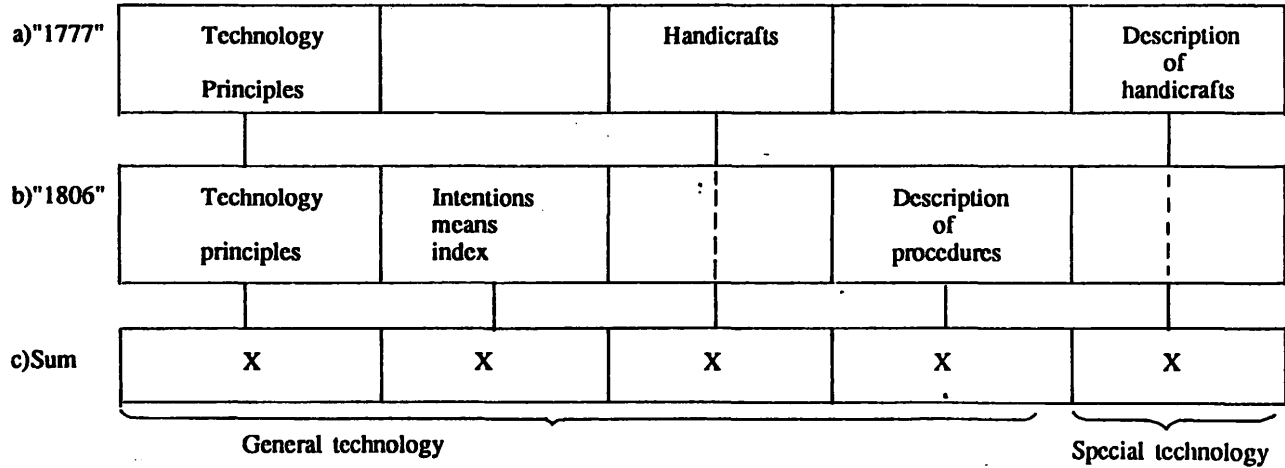


Figure 7 :Rearrangement of the two technological oriented works of Johann Beckmann : (edited in 1777 and in 1806)
 1777 : "Anleitung zur Technologie"
 1806 : "Entwurf der allgemeinen Technologie".

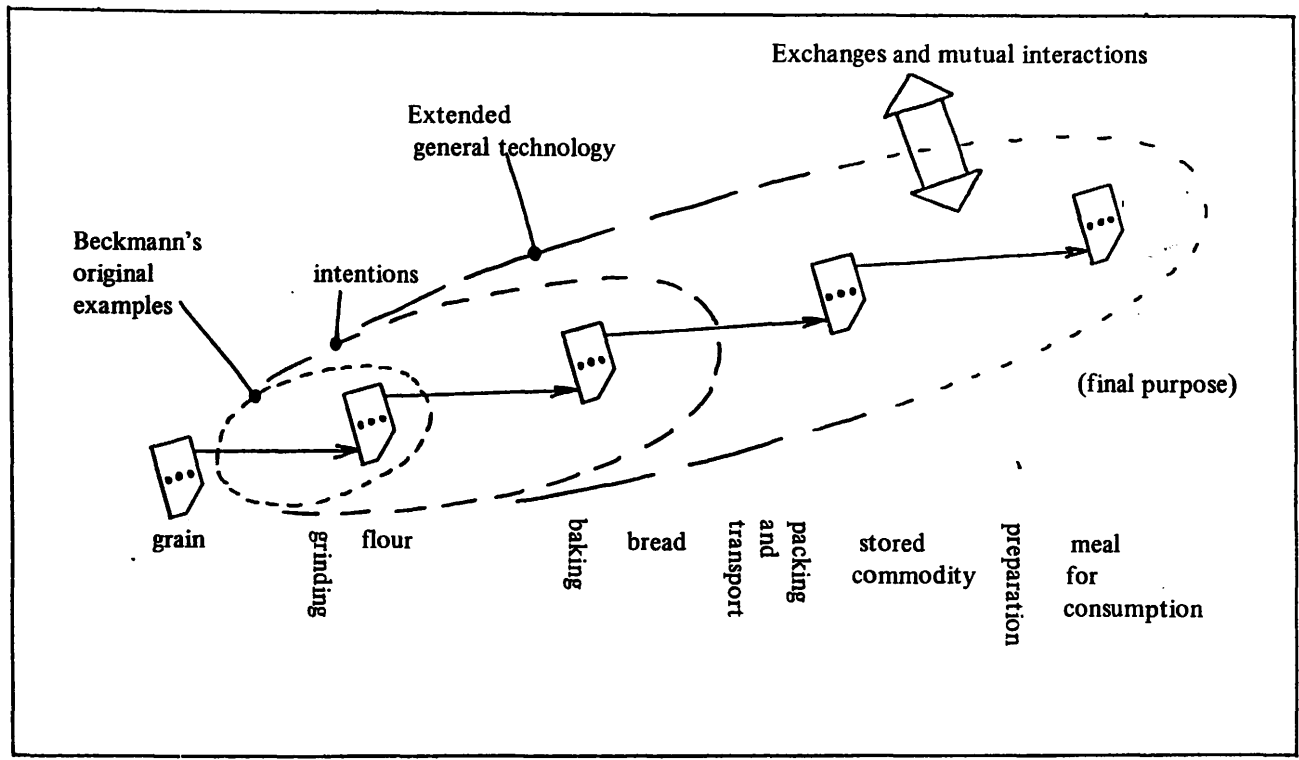


Figure 8-1 : The intention - mean chain following Johann Beckmann.

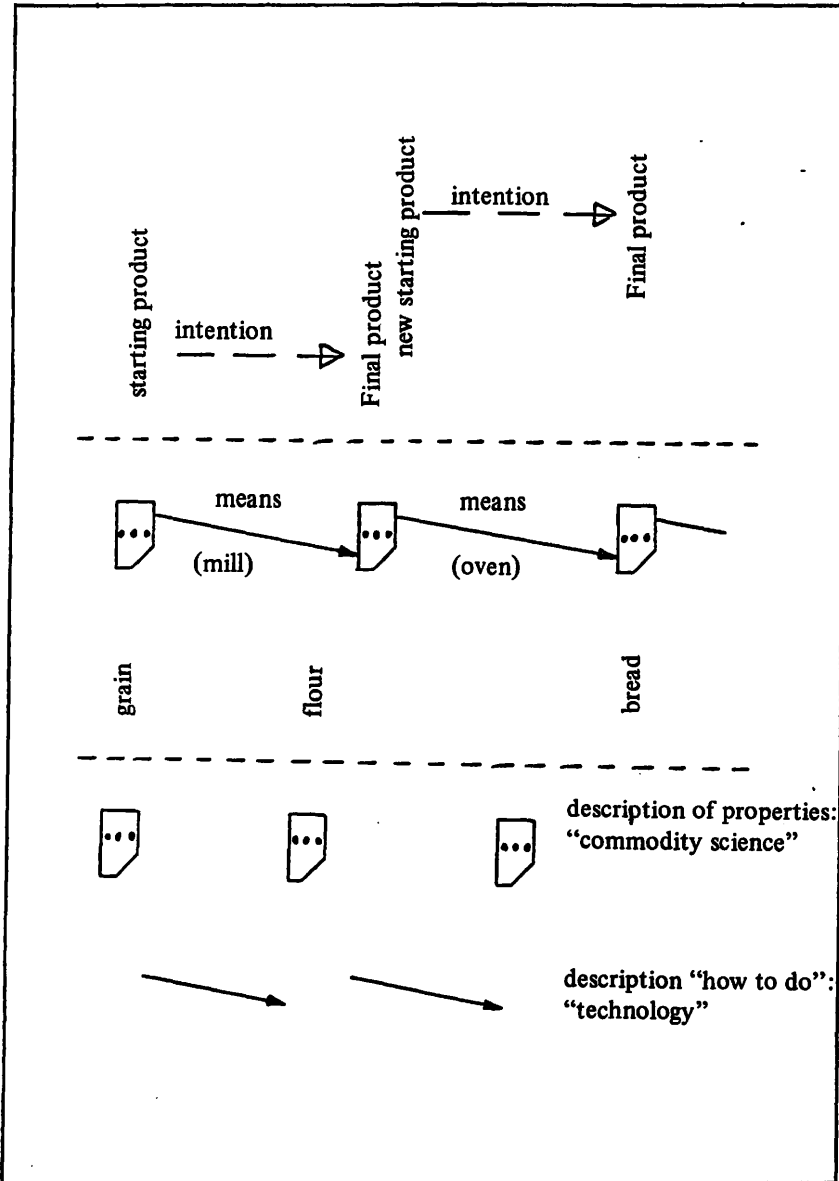


Figure 8-2 : Technology and commodity science as seen by Johann Beckmann.

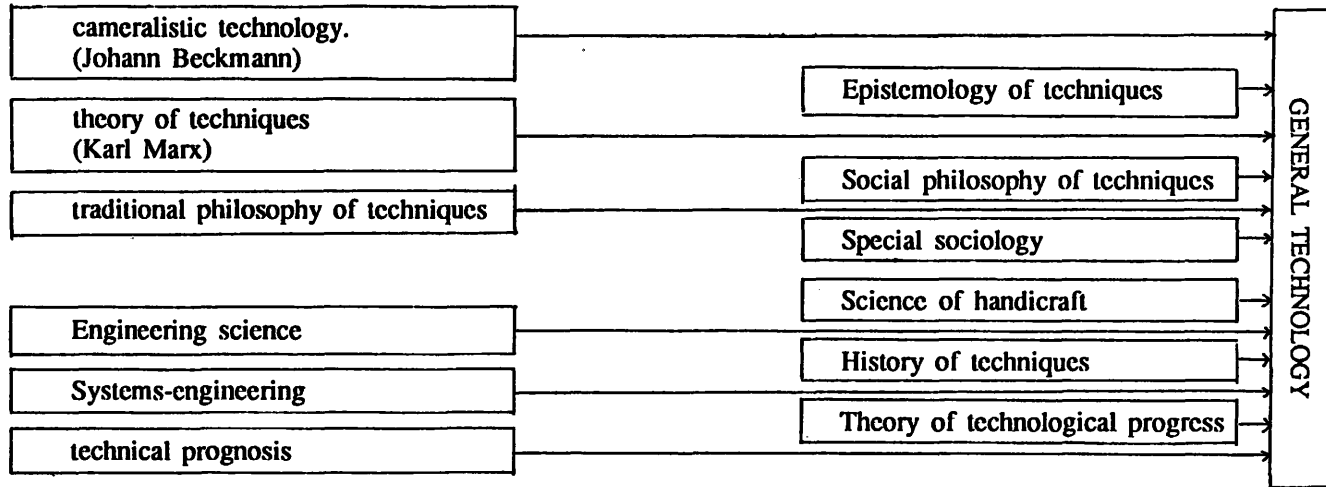


Figure 9 : Johann Beckmann's ideas concerning the concept of general technology following Ropohl.

The cameralistic technology (it is the technology as seen by Johann Beckmann) is shown at the left side. It is a part of the general technology as it is considered today. Ropohl argues that Johann Beckmann nevertheless gave directions to found a new model of general technology with the actual technical problems and theoretical knowledge : "The generalistic and in approach systematic character of Beckmann's work has induced us to propose "general technology" as a programmatic attestation for that comprehensive research and teaching of techniques to which this (Ropohl's) work will contribute" (Ropohl, 1983).

9. Technology, Engineering and commodities

Up to now the word "technology" was used in the meaning of "science of technics" : but technology stays also for the entire and complex reality of engineering.

The real meaning of the word technology is unfortunately not clearly defined : it is mostly used as synonym for engineering. If we summarise the viewpoints of Johann Beckmann about general and special technology and those of Ropohl concerning the real meaning of general technology, we come to the following consideration as shown in figure 10.

Engineering or technical sciences includes a "for what purpose", namely *for what* do we need know-how, what can we reach with our knowledge. Engineering implicates also a "butt" "a toreach goal". The question is "*what* is the purpose and *to which* purpose will it lead" (hierarchy of purposes). Unfortunately, reality shows that "purpose" and possible further achievements of higher order or value remain forgotten. G. Sarton indicates this as "technical frivolities" and C.F. von Weizäcker argued in 1988 "The opinion that all what can be made should be really made, is a wish-dream reserved for childhood, it is like the misuse of the drug "power". Engineering means matured accuracy". Von Weizäcker clearly wants to express that engineering describes the "means for purposes". In my personal opinion and following a consideration in entirety includes an ethic evaluation of "availability" and of "usage". Thus : "Techniques is

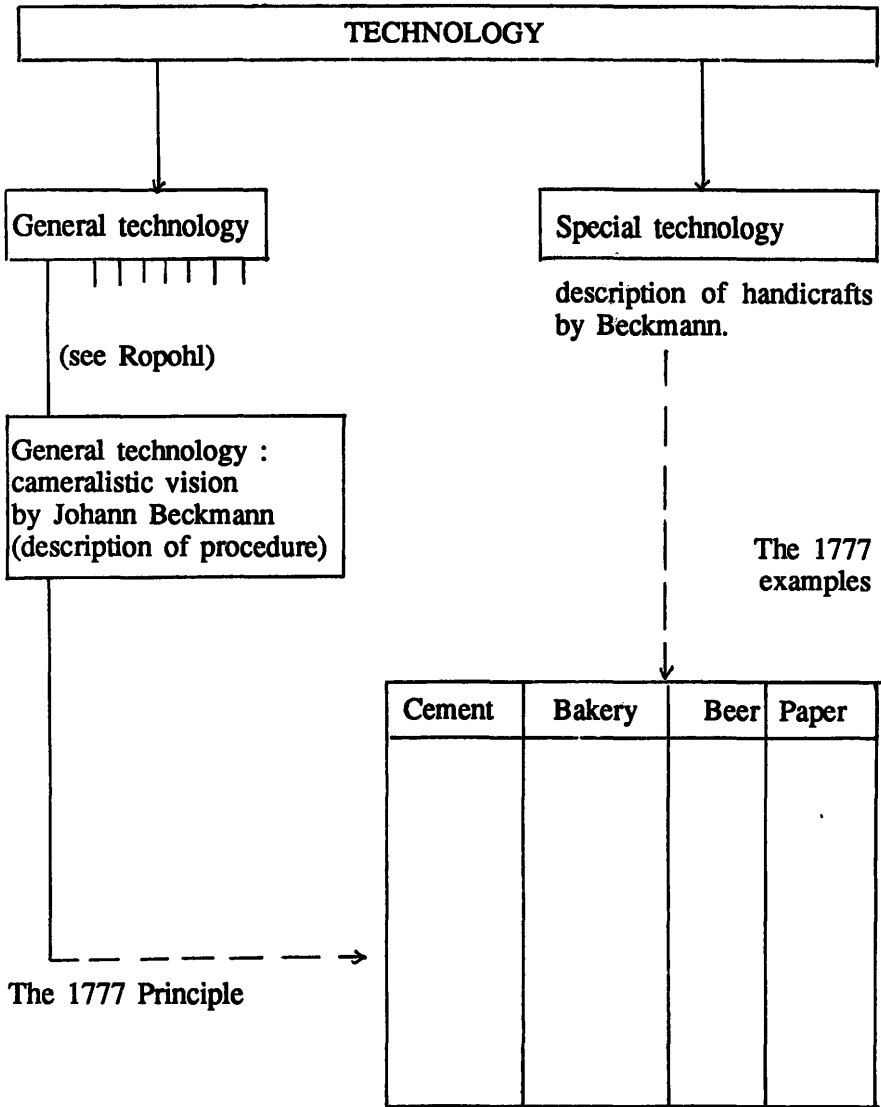


Figure 10 : The concept of "overall" technology with regard to the viewpoints of Johann Beckmann.

making means available for purposes". And as we see this : Techniques is giving at hand and application of means for

- Production
- Maintenance of Use-Value
- Waste Handling

of Artefacts (Products).

What is true for the notion engineering is also true for commodities : The description of goods in function of the means to fulfill human requirements can't be perfect and complete : it makes abstraction of a lot of interactions with nature and society. Consequently the definition of commodities in considering the principle of entirety could be : Commodity is a requirement-fulfilling thing; its social, ecological, economic, ethical and other implications must be considered as well. In conclusion we may state that "commodity science" is the "science of implications of commodities".

10. To present the problem under consideration in entirety

What follows are some notes on how problems should be seen in their entirety. As already mentioned, there is a need *to consider all relevant factors* — all implications of technology and commodity — of the artefact — that means all the influences of man and nature on the object and also the effect on themselves. Just as a highlight : let us look to all the problems concerning the *car*, we must not only consider its uses and costs but also its social, ethical, ecological and all its other consequences as for instance : the change of lifestyle, the construction of tanker fleets, petrol stations, road and signal devices, accidents, influence on psychological moods, health and environment. Yet another question is what will the consequence of the car be on the following generations ?

Here is another example : what does it mean when, for each other coffee-drinker "so and so" many coffee plants in monoculture must be taken care of ? — and in order to do this jungle must be destroyed. What does it mean, when in the third world arable land is usurped to produce food for European beef cattle ? — valuable biomass which the people there lack as a source of their own food production !

The consideration in entirety" does not only involve itself with the problem of needs and costs but takes all relevant factors together and tries to divide them into "useful" and "hamful", in order to obtain a sound value judgement with the help of a "commodity-scale" or a "commodity-balance". This is the main idea of the *entirety-principle*.

This "entirety-principle" is the overcoming of the pure consideration of use and costs — the "economic principle" which better should be called "economic principle".

Let us now single out some urgent problems of our time and try to examine them through the glasses of the entirety-principle. This is above all to demonstrate how universal the entirety-principle can become. Up until now the way of thinking about these problems has been more sectoral so that the view is in fact more-or-less obstructed, and important factors are cut out.

Only to mention very briefly : production, responsibility, trends, survival-catalogue, growth in economy, social discrepancies, awareness, orientation of life.

11. Analysis of the present time

The idea that everything which is produced by man and put on the market is *useful* and *sensible* is deeply rooted in our minds. It is already obvious in the language when products are described with the particularly positive expression "Good/Goods". It was a common view :

"More production equals Satisfaction of more needs".

Nowadays, we know that this satisfaction of needs has to be paid for with ecological and social damage, that we could use this equation only for as long as the human being was unable to endanger the whole world through his machinery. Beckmann was probably convinced of this fact, just as of the fact that the use of commodity production will surpass the damage. Nowadays development does not only have a supporting but a more and more destructing effect. So,

Das „ganzheitliche Prinzip“

als Aufwandsminimierung:

Es gilt,
den materiellen und immateriellen
Nutzen der Ware
mit einer in ihrem Lebensweg
insgesamt
kleinstmöglichen Menge an
Natur und menschlicher Substanz
zu erzielen –
dies unter Beachtung
gesundheitlicher, politischer,
ethischer und anderer
relevanter Belange.

The “Ganzheit Principle”¹

with regard to minimising effort:

We must
obtain
the material and immaterial
benefit from the commodity
with a minimum of
nature and human substance
throughout
the commodity life –
with due regard to
health, political,
ethical and other
relevant aspects.

¹ The English words totality, entirety, wholeness, integrity do not meet the meaning of “Ganzheit” completely. In philosophy “Ganzheitslehre” has been translated into “Holismus”, but

according to the authors’ feeling this term and the adjective “holistic” are not common in English. So we here follow the practice in psychology where “Ganzheit” has been adopted into the English vocabulary.

Figure 11 :The principle of entirety.

the equation concerning goods production versus satisfaction must now be written (following the entirety principle as :

"More production equals satisfaction and inauguration of more needs, together with more damaging of nature and society".

The final balance of this "entire viewpoint" can be formulated as :

"Satisfaction of needs *minus* the encountered damages equals *life-quality* today and/or tomorrow".

All this shows that the formerly quite harmless ambivalence of sciences, technology and economy has become highly critical.

Today we have to consider this all as

- a hom, offering in never ending supply, the most beautiful sought-after things
- Pandora's box, a never drying source, out of which come dreadful things pouring over the Earth. Unfortunately it seems as if the negative factors are increasing more than the positive factors. This we demonstrated already in 1981 (Fig. 12) :

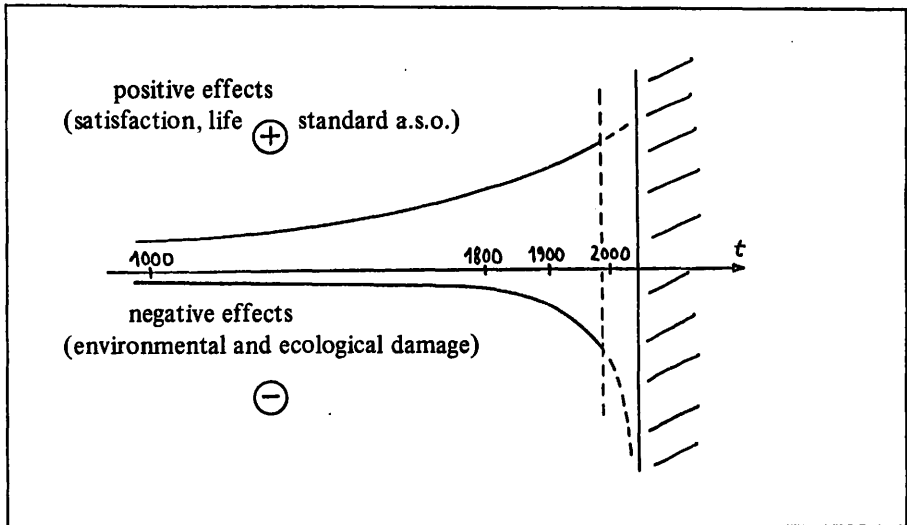


Figure 12 : How will things move ahead ? Or : will the balance of satisfactions and damages evolve in a positive or a negative way ?

12. Trends

The picture shown above fortunately does not completely correspond to reality, because in the past years a change in the forecasted trend has obviously begun, in so far as the public and politics have gradually become alarmed about the ecological damages. Therefore many smaller and larger measures have been initiated to counteract the development which threatens existence.

Let us consider only a few examples :

- Politics is hardly possible without the environmental aspects.
- Increasingly, the media informs on environmental damages and consequences.
- Nuclear energy is seen more and more critically.
- Next to the "polluter pays" jurisdiction increasingly acknowledges the principle of "precaution".
- A more modest way of life in alternative groups has been highlighted.
- A change in consciousness towards collective responsibility, also for the sake of posterity, has emerged.

Numerous measures and considerations which appeared to be out of the question five or ten years ago are, taken for granted. It seems that people are prepared to accept necessary but unpopular measures. The realisation is growing in dealing with commodity and technology, not only short-sighted consideration of their usage counts, but also ecological, social and ethical matters are now of importance — for us and for the sake of our progeny !

13. What is to be done ?

The main thing is that we get an impression of the character, of the dimension or the direction of our reactions. We have to distinguish between four different areas of action.

A) Techno-economy

C) Politics

B) Ecology

D) Consciousness

The synergism of these four areas of activities towards the future is shown in picture 13.

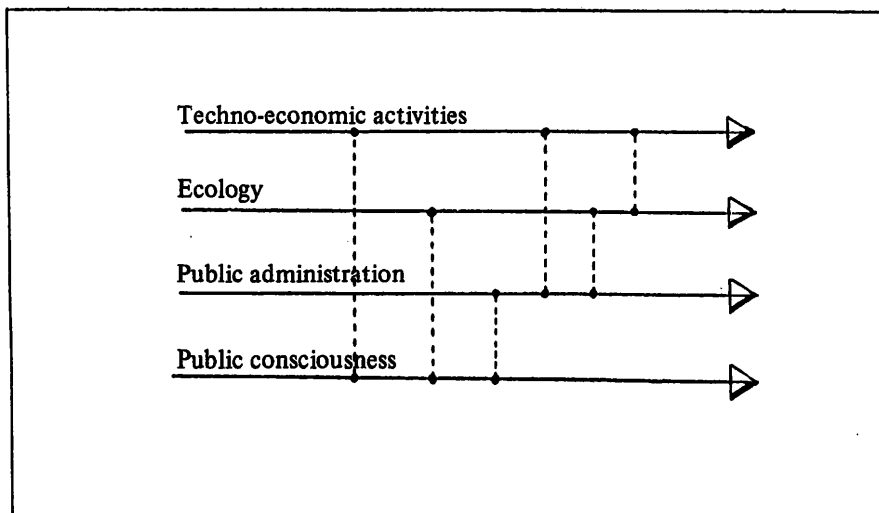


Figure 13 :The interactions between the different areas of action.

The change can only be successful if all four groups interact. Emphasis to this idea follows.

1. The turning away from the dominance of the economic system. A turn towards integral thinking and judgement. Economy has to integrate higher, non-economic factors in its objectives. The "economic principle" must be replaced by the "entirety-principle".
2. Another consequence is the turning away from the economic growth, from the dogma that a lack of economic growth, zero growth or even negative growth would necessarily lead to collapse, unemployment and social riots. But up to what point do we want to grow ? Obviously nobody realizes the parallels to capital investment with compound interest. We should think about more often where this with 3% interest to in the next 30 or 50 years. In 25 years this is 200% compared to the first year : this might have been allowed from 1945 to 1970.

But what can zero growth, which many people long for, accomplish ? Zero growth means that in a given year exactly the same amount is produced as in the previous year.

- If 1000 km of new road are built one year, another 1000 km will be built during the following year — that makes 2000 km of new road — since the first 1000 km will not disappear or be destroyed !
- If one million new cars are built in one year, another million will be built the following year. That means : even with zero growth, the accumulation of means of production and of consumer goods continues. In fact, the volume grows with zero growth quite considerably. Reckon : if a child grows 5 cm this year and another 5 cm the following year, none would call this zero growth. Only the economic perspective can do this trick ! These examples of economic growth clearly show the way in which limited, non-entire-thinking can lead to confusion.

14. Social discrepancies

In many industrialized countries we see a growing number of destitute-enclosed people : the discrepancy between possessing and non-possessing grows and grows (the so-called "New poverty").

So critical social discrepancies appear where people are starving and at the same time where a thin upper strata of society lives in luxury. On closer examination we will see that these are surprisingly the so-called "industrial nations" and the "developing world". We will hardly find reason for famine and extreme poverty in natural and geographical conditions but in social-political- and ideological conditions. The reference to the way of existence as "being" as an alternative to "having" (according to Erich Fromm) is no help to the starving and enclosed people. In which social and cultural values of the commodity wonderworld should these people believe ? In the self-controlling power of supply and demand ? — in the economic growth with use of more and more machinery instead of people ? — in the hope of more export or relief from debts on the part of creditorcountries ? These possibilities are of no importance to them because they are far away from realisation : - these people may be indifferent towards the ozone-problem, greenhouse-effect, pollution of

the ocean, because they do not carry any guilt. On the whole, ideas and creativity are demanded; but above all, the will to change ! It is necessary that the "rich and the powerful" permit this before it is too late, and that the "poor" summon up the necessary hope, determination and energy. The age of the *commodity-consumption* must be relieved by the age of *reciprocal help*.

15. Consciousness and life-orientation

What value the theme of consciousness and orientation in life has, is implicated in the fact that even the authors of both reports of the Club of Rome have realized "that a radical psychological change in "man" represents the only alternative to economic catastrophe. Mesearovic and Pestel demand a new world-awareness... a new ethic in the use of material-treasures... a feeling of identification with the next generations... not to do everything what can be done !

Erich Fromm distinguishes between two fundamentally different ways of existence : the one "of having" and the other of "being". Consumption is a form of having, may be the most important one in today's superfluous society. Consumption is ambivalent : it reduces our fears since the consumed goods cannot be taken away from us any more, but it also makes us consume more and more, because the goods, once consumed, no more satisfy us. I *am* what I *have* and what I *consume* is the actual consciousness.

The "being-way" of living is almost unknown to many of us compared to the "having-way", since "having" is the dominant way of thinking in our society. Someone who lives the "being-way" does not have to be afraid of the question : who *am* I, if I am what I *have*, and then *lose* everything I *have* ? If I *am* what I *am*, and not what I *have*, nobody can rob me of my possession, nobody can threaten my sense of identity. "You do not lose what you give" - you lose what you hold on to" ! Being goes together with the will to give, to share and to sacrifice. It is an undeniable fact, that human beings are determined for the "being" just as well as our biological survival instinct favours the "having" way of living. It is a sad comment on civilisation, that war and suffering mobilize more

willingness to sacrifice than peaceful life, and that in times of peace only egoism seem to flourish.

16. The New Responsibility

In the modern highly, specialised world, the individual is not operating for himself and in his immediate social surroundings, but in *collectives*. Everybody is a beneficiary and at the same time a victim of techno-economic activity.

Consequently, the individual does not have immediate responsibility for the artefact anymore but only an indirect responsibility : The responsibility has presumably been transferred to the collectives or societies (factories, authorities, etc.) which are operating for themselves and cooperating with one another. The responsibility as a whole is lost where the individual or the organisers become an insignificant fraction of it. Where the responsibility is atomised there is *non-responsibility* or a real *irresponsibility*.

In view of these facts *responsibility obtains the rank of pure survival strategy* ! (Banse, Buttler, Hörz, 1989). Without a new responsibility in conformity with the approaching dangerous challenges the rising risks can never be mastered.

Genuine responsibility is duty to all living, is "respect of life" (Albert Schweitzer). G. Banse (Berlin, G.D.R.) understands responsibility as "*obligation to the promotion of humanity*". So the new responsibility means exactly what the so often misunderstood Kantian Categorical Imperative expresses : "Act (always) in such a way, that the maximum of your will could always and at any time serve as principle for a general legislation". This imperative is an extreme *moral demand* — but *never* permission for acting, without regard to other human beings and to creature.

If then responsibility is not only a matter for securing real technical and scientific progress, but much more is "conditio sine qua non" for securing existence and future of global life, then the question is : Is mankind at all able to master such a gigantic step ? Our answer is yes — the French Revolution, the Russian October Revolution, the Independence Wars in the U.S.A. and last but not

least the dramatic events of nowadays in the Eastern Block — all this demonstrates that decisive changes can succeed very quickly when the pressure or sufferings has become unbearable.

Carrying through the "new responsibility" starts with the *willing* to recognize the dangers ! Opposed to this in the human tendency to steady repressing and diminishing, a way of thinking and of consciousness which is favoured, moreover, by the opinion that making obvious the dangers might imperil the "progress".

To summarize : Mankind *can* win the epochal changeover — if they *want* this ! The profit of removing the dangers is gigantic, and compared to this the corresponding expense is inevitable ! Thus, investing into the "*new consciousness*" is the utmost profitable enterprise. All the new high-technologies, excursions into space and military pseudo-securities lose colour against these investments into the real assurance of human future !

These thoughts surely lie in the thinking-line of Beckmann and Sarton. Sarton was convinced : "I believe that I am only a fragment of humanity, yet that I must try to look at things from the point of view of the *whole*, and not of the fragment". That is indeed entirety-thinking ! Beckmann could still trust in the mission of technology to lighten the lot and happiness of mankind. This hope is evident in all his creation : science and technology are useful for the benefit of mankind — in a material and a spiritual sense. Sarton experienced the terror of two world wars and the consequences of excessive rationalisation and mechanisation. This is the reason he warned : This machine-age must go !

What Beckmann could not foresee and Sarton experience, is the fact that technology and science gave mankind the power over the earth not only to lighten its lot, but also the power to give rise to the mondial holocaust.

But Sarton said : "When one reads such a book as Gibbon's "Decline and Fall", one cannot help shuddering half of the time, and wondering how on earth did the "good people", the forwardlooking ones, the "dreamers" ever triumph over the unprincipled barbarians, over the ruffians, gangsters and murderers, who in every level of

society, from top to bottom, were weakening the Empire, and undermining like termites the whole fabric of civilization ? ... *And yet they* (the good people) *did*".

I am greatly indebted to many personalities :

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