

Simonis, Udo E.

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(FRIEDRICH EBERT FOUNDATION)

ECOLOGICAL MODERNISATION

**New Perspectives for
Industrial Societies**

U.E. Simonis

Foreword

Economic considerations have been guiding Governments all over the world, in industrialised as well as developing countries, while designing their development policies. Ecological considerations were broadly considered as of secondary importance. In fact, there was a broad understanding, that economy and ecology are in contradiction. Recently, this view has become more and more doubtful due to increasing ecological stress imposed on most economies.

Udo Ernst Simonis, a noted West German economist, proposes a new concept of development policy which serves both, the economic as well as the environmental goals. The empirical analysis of economic developments in a large number of countries reveals, that a "delinking" of economic growth on the one hand and environmental stress on the other hand is possible. The main factor behind this is structural change.

The empirical evidence suggests "ecological modernisation" as a strategy aimed at actively promoting ecologically sound structural change, prevention rather than cure and an integration of economic and environmental policies. In the annexure an immediate action programme is being proposed against the background of the Federal Republic of Germany.

This paper is the revised manuscript of several lectures delivered by the author during his visit to India in May 1987. With its publication the Friedrich Ebert Foundation, an independent research and training institution with its headoffice in Bonn, Federal Republic of Germany, would like to present it to the public. It is meant as a contribution to an on-going debate. The views expressed in this paper do not necessarily coincide with the Friedrich Ebert Foundation's opinion.

Stephan Paulus
Programme Coordinator
Friedrich Ebert Foundation
New Delhi

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0. Introduction

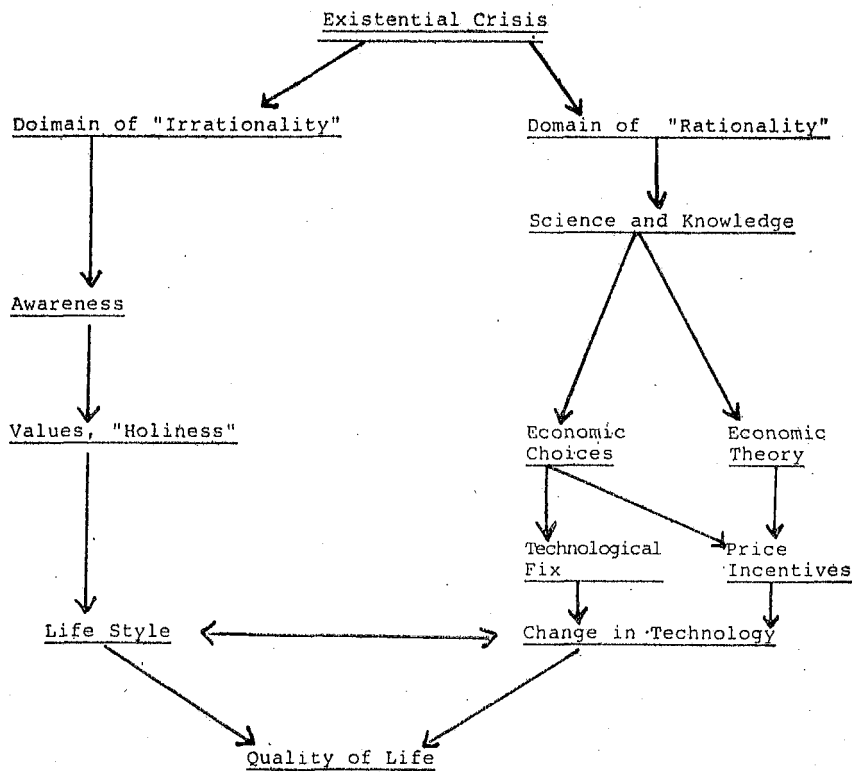
In a contribution to a Forum on Industry and the Environment held in New Delhi in December, 1986, Stephan Paulus gave the following definition of the concept of ecological modernization :

"Ecological modernization focuses on prevention, on innovation and structural change towards ecologically sound industrial development... It relies on clean technology, recycling, and renewable resources... To introduce such a concept into the economy, it is necessary to coordinate various policy areas, such as industrial, fiscal, energy, transport and environmental policies."¹

This is, of course, a fairly broad definition of a concept, proposed to achieve better harmony among economy, technology and ecology in industrial societies. In this paper I will, therefore, concentrate on only some aspects of such a concept. First, I would like to present some empirical evidence on the relationship between structural change and environmental quality. Second, I shall point to some of the deficiencies of environmental policy, particularly the problem of implementing preventive strategies. Third, I shall give some ideas on how to integrate environmental considerations into economic policy.

Before doing so, however, I would like to present a general judgment on the interaction of values and rationality. The manner in which environmental concerns may be harmonized with economic growth and technological change depends largely on a continuous mutual interaction between public opinion and values, on the one hand, and scientific, technological and economic possibilities, on the other hand. Experience shows that the greatest successes in harmonizing ecology and economy have come about when the interaction between these two domains has been mutually supportive. Efforts to reconcile economic growth with environmental quality thus must address issues of public opinion and societal lifestyles as well as discover new technologies or legal and economic mechanisms.

TABLE 1
The Two Domains of Policy Concern



1. Structural Change and Environmental Pollution

It is not so long ago that sheer quantity was considered to be a valid indicator of a nation's economic performance. "Tonnage ideology" and "quantitative growth" dominated in theory and practice, both in the East and the West. For a mature economy, such measures have rather become indicators of economic failure :

- In times of high costs for raw materials and energy, high consumption of such inputs is increasingly uneconomic;
- countries that have reduced their specific energy and raw materials consumption are today at the top of the international list of economic performance;

- resource economy (or "material economy") has become a major focus in the search for new ways to develop national economics.

In both East and West, economists, planners and engineers are seeking for a solution to the problem of how to substitute the traditional patterns of material consumption. At the same time, environmental priorities play a part in such a re-orientation of the economy. "Harmonizing ecology and economy" relies on the premise that a reduction in the resource input of production will lead to an ex ante reduction in the amount of emissions and wastes (and also to a reduction in the overall costs of production).

In the following I will present an empirical analysis of this re-orientation, on basis of a study recently undertaken at my institute. Using a small set of indicators, some 31 Western and Eastern industrialized countries of both OECD and COMECON were tested with regards to the relation between economic structure and environmental pollution.²

1.1 Identifying Structural Environmental Effects

In order to quantify the relation between economic structure and environmental pollution, one needs suitable information concerning the material side of production, for resource conservation by the national economy—and thus its ecological sustainability—can not be appropriately described in such global terms as income and employment generation, or final consumption. Regarding the question as to the extent of the transformation of raw materials into pollutants and wastes, the traditional national accounts and input-output tables offer some information. However, the way in which the economy undergoes qualitative change and the strategy of resource conservation is not sufficiently indicated by the production values reported in the national accounts. The best way out of this methodological dilemma is to select adequate indicators which may act as synonyms for certain basic characteristics of the production process.

The international availability of environmental indicators such as emission and immission data relating to certain "representative" pollutants has grown recently. These indicators concern certain environmental effects and impacts of production. Our research interest was for environmentally significant input factors.

In this respect, sufficient information exists about specific energy and water consumption or about the use of pesticides in agriculture.

Especially, the Annual Reports on the Environment by several advanced industrial nations, by UNEP and the OECD contain useful information on these topics, and also fairly comprehensive comparative statistics. Less substantial, however, has been the empirical research on the environmental significance of certain input factors in industrial production, or on the question of which indicators provide environmentally relevant information about the structure of national economies.

Given the present state of research, only a few such indicators can be tested in a cross-national comparison of Eastern and Western countries. These are four factors whose direct and indirect environmental significance is self-evident: energy, steel, cement and the weight of freight transport. Regarding their patterns of production and consumption these are "hard" factors, characteristic of a certain structure and stage of the economy.

1.2 Structural Change as Environmental Protection

The main hypothesis of the research was as follows:

Positive environmental effects of structural change of the economy are to be expected by actively de-linking economic growth from the consumption of environmentally significant inputs (resources). Such de-linking, achievable in particular via decreasing the input-coefficients in respect of these resources (or via increasing their effectiveness through better use) would

- result in a decrease of resource consumption;
- mean ex ante environmental protection, being cheaper than the ex post installation of pollution abatement equipment (end-of-pipe technology);
- be more effective, since end-of-pipe technologies are normally designed to treat single, "outstanding" pollutants, whereas integrated technologies touch upon several environmental effects (pollutants) at the same time;
- open up a full range of options for technological innovation or would itself be the result of it.

For certain types of environmental pollution, the effectiveness of structural policy has already been demonstrated empirically. For

example, the technical and structural changes in several advanced industrialized nations in respect to energy consumption had had greater positive environmental effects than end-of-pipe protection measures, especially regarding such critical emissions as sulphur dioxide (SO_2) and nitrogen oxide (NO_x). In the United States, for instance, energy conservation has led to greater environmental protection effects than the installation of desulfurization units. In Japan, where curative environmental protection measures had remarkable effects during the 1970s, energy conservation since 1979 (as a result of the second oil price hike) similarly was successful. These same effects can also be seen in other areas of environmental stress. For example, in Japan the effects of technical and structural changes in water usage were equivalent to those of end-of-pipe purification equipments.

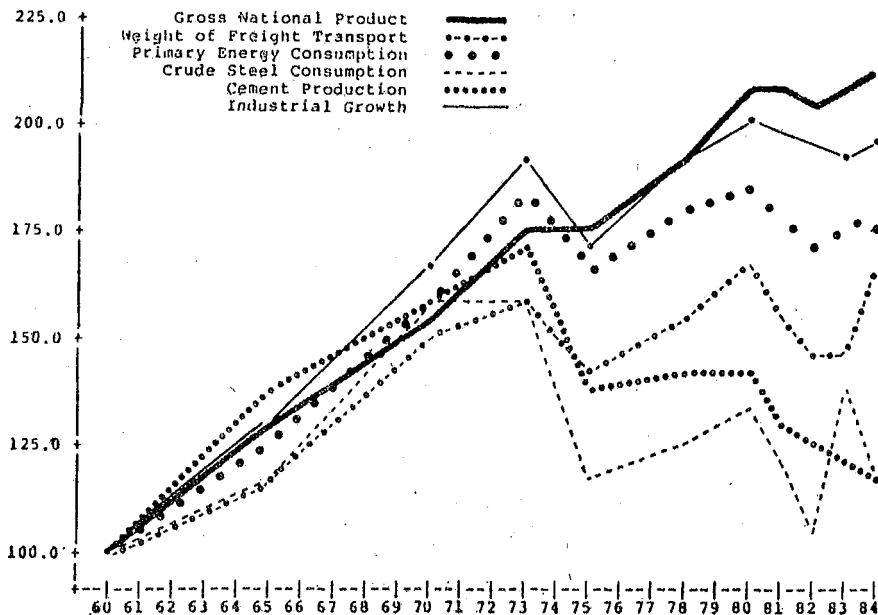
Aside from having economic advantages, modes of production that reduce the specific energy and raw materials consumption thus seem to be extremely significant for protecting the environment. Examples like these support the suggestion by environmental economists for introducing resource taxes as well as effluent charges, a policy which would have economic as well as environmental advantages.

1.3 Structural Change as a Process of De-linking— The Example of the Federal Republic of Germany

Structural change as a shift of labor, capital and skills to more intelligent uses can be conceived as a process of successive de-linking: In the course of time, the contribution of traditional (hard) factors to the national product (GNP) decreases, i.e. they change or lose their function in the process of development. Here, we are concerned with the environmentally significant input factors in this process, choosing those for which sufficient data are available for an international comparative analysis.

Taking the Federal Republic of Germany as an example, Figure 1 illustrates a five-fold de-linking from the growth of the national product (GNP). This de-linking of energy and steel consumption, cement production, weight of freight transport, and industrial production from the GNP became apparent during the 1970s, and had fully manifested itself by the end of that decade.

FIGURE 1
**Structural Economic Change in the Federal Republic
of Germany, 1960—1984**



In this way, structural change of the economy generated environmental gratis effects of various kinds :

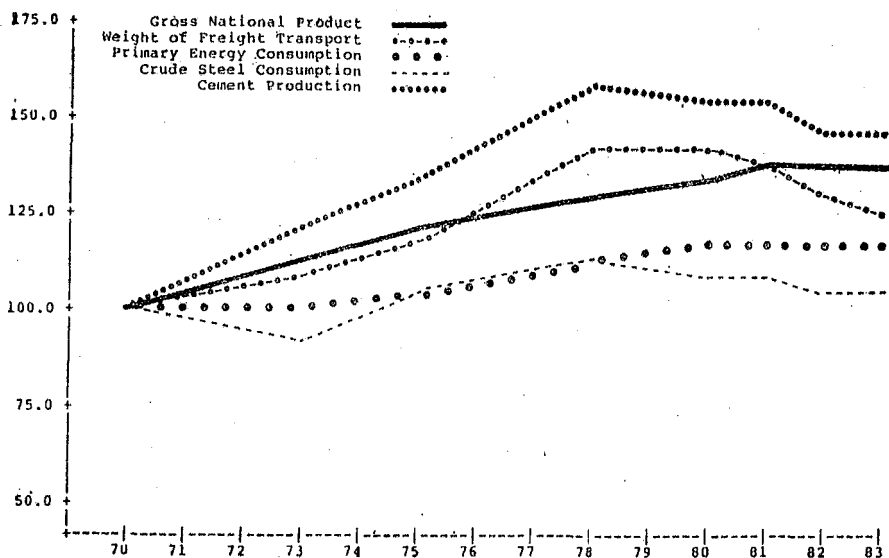
- The stagnating consumption of energy led to a reduction in emissions (pollutants).
- From the decline in the weight of freight transport it can be concluded that the volume of materials employed was reduced rather than increased, i.e., the respective productivity has risen.
- The fall in cement production represents a direct gratis effect as far as the emissions from cement factories are concerned; with regard to the (environmentally disputed) construction industry, this decrease coincided with the trend towards renovation of the housing stock, as compared to new construction in the 50s and 60s.
- The decrease in steel consumption accounts for a considerable reduction in emissions as far as production and processing are concerned; the drop is especially noticeable, and is partly due to increased recycling activities.

1.4 Environmental Protection through Resource Economy- The Example of the German Democratic Republic

Figure 2 shows that de-linking is also significant in the case of the German Democratic Republic (GDR), although it began later than in the Federal Republic of Germany (FRG). Unlike the FRG the GDR has continued to rely on the industrial sector as the main source of economic growth. From the environmental point of view, then, structural change is more relevant within the industrial sector than between the industrial and the service sector (i.e., intra-industry versus inter-sectoral change).

FIGURE 2

Structural Economic Change in the German Democratic Republic, 1970—1983



The GDR also provides an example of structural change in the sense of "material (or resource) economy". Material economy often is officially being defined as environmental protection, and is even considered the decisive form of environmental protection. However, a genuine relief for the environment can be registered only if an absolute reduction of the relevant material and energy inputs has been reached. The only relative relief for the environment in the GDR is,

nevertheless, anything but insignificant. Especially in a period of high growth of GNP a just small increase in primary energy consumption indicates effective de-linking processes, and can be considered a success in environmental protection.

1.5 Changes in Environmental Impacts—Some East-West Comparisons

In considering the environmental impacts of production and consumption, one can discern three aspects : (a) absolute environmental impact; (b) impact per capita, and (c) impact per unit of the national product (GNP).

With regard to the absolute environmental impact (a), it is the long-term change that is important. The absolute impact, however, is unsuitable for international comparison without reference to the size of a country, its population and output. Such comparison becomes feasible by using the impact per capita (b), and the impact per unit of GNP (c).

We have tested the level of environmental impacts in some 31 industrialized countries of OECD and COMECON between 1973 and 1983. For this purpose, we computed an aggregated environmental impact index, consisting of the impacts per capita regarding the consumption of primary energy, crude steel, freight transport weight (inland surface transport by rail and road), and cement production—giving equal weight to all these four indicators. The aggregation of these four indices (aggregated index) then allows to rank the countries studied. The results of our computations are presented in Figure 3 (for the year 1973), Figure 4 (for the year 1983), and Table 2(1973-1983).

1.5.1 Environmental Impacts—The Price for Prosperity ?

As Figure 3 shows, there was a significant connection between a country's per capita GNP in 1973 and the structural impacts on its environment (based on the four selected indicators). The correlation coefficient for the aggregated environmental impact index and the per capita GNP was 0.71 for all 31 countries. This means that in 1973 the national product of these industrial countries was still based primarily on "hard" production factors.

Countries with a high GNP per capita and with great structural environmental impacts (see Table 2) were the United States, Czechos-

FIGURE 3

Scale of Structural Environmental Impacts per Capita and GNP per Capita, 1973

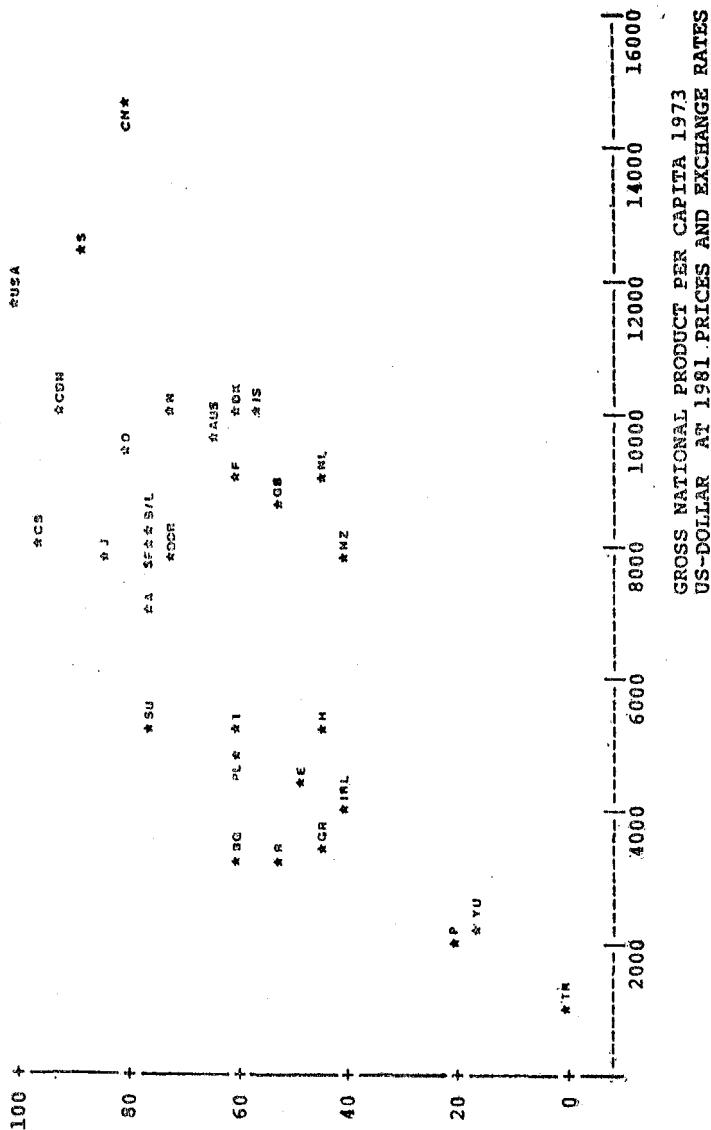
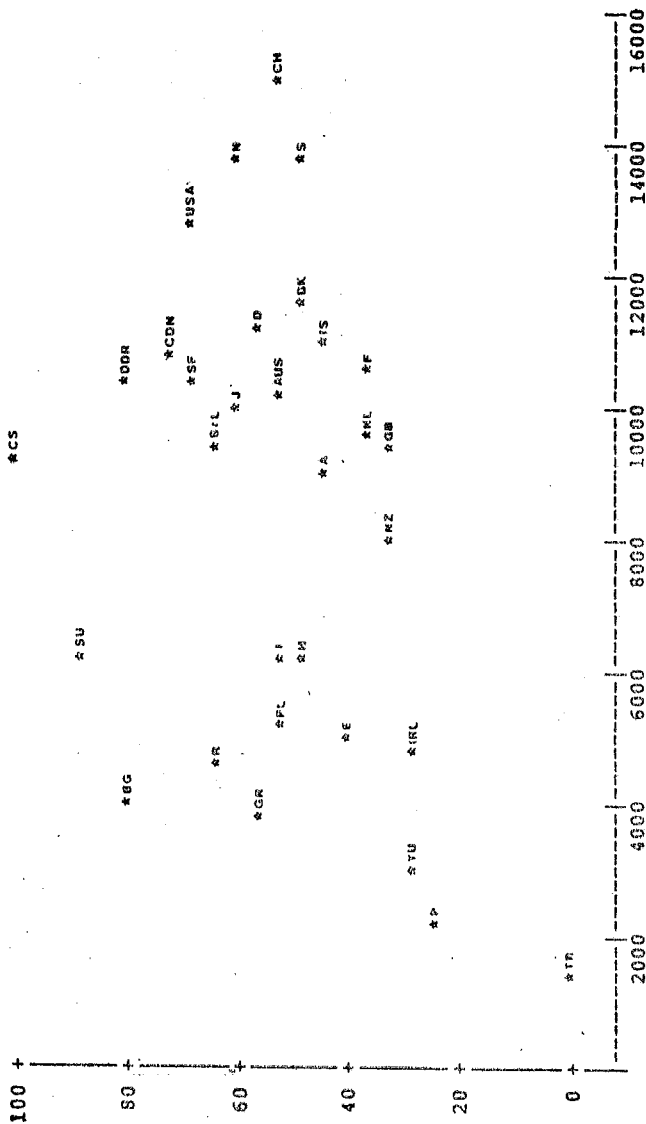


FIGURE 4

Scale of Structural Environmental Impacts per Capita and GNP per Capita, 1983



GROSS NATIONAL PRODUCT PER CAPITA 1983
US-DOLLAR AT 1981 PRICES AND EXCHANGE RATES

lovakia, Canada, Sweden, Japan, Switzerland, the FRG, and Finland (rank 1 to 8). In the lowest part of the scale were Greece, Hungary, the Netherlands, New Zealand, Ireland, Yugoslavia, Portugal, and Turkey (rank 24 to 31).

During the 1970s this relationship changed to a considerable extent. The correlation coefficient in 1983 was at only 0.33, significantly below that of 1973. (Figure 4 shows the diversified picture). That means, the process of structural change in several industrial countries pushed back the "hard" production factors in the economy. Accordingly, the ranking of the countries has changed over time.

Average placings for the indicators of cement production, weight of freight transport, crude steel and primary energy consumption Table 2 shows that several countries by 1983 had improved their international ranking considerably (see : minus signs). This was especially true of Austria and Switzerland (-10), Japan, and the Federal Republic of Germany (-6), but most especially of Sweden (-15).

In contrast, the ranking of several East European countries had deteriorated by 1983 (see : plus signs). This was especially true of Romania (+14), Bulgaria (+13), the GDR (+10), Hungary (+17), and the USSR (+7). Thus, Bulgaria, Romania, and the GDR have joined the group of the eight countries (out of the thirty-one in the sample) with the highest structural environmental impacts. Western industrialized countries show up in the fifth (Canada), sixth (United States), and seventh (Finland) positions. Japan and the FRG, despite their improvement in their ranking are still in the top half of the scale. The position of Greece has remarkably deteriorated (+12); while for Norway and the Netherlands there were only minor changes (+2) in their respective ranking.

The fact that advanced Western industrialized nations occupied leading positions regarding environmental impacts per capita in 1973 is not surprising. At that time Sweden, Japan, and the United States had only begun to recognize the need for sweeping environmental protection measures. The fact that Czechoslovakia was leading in 1983 indicates—by contrast—the problems of that country's economic structure. Energy consumption in the CSSR per unit of GNP is more than 50% higher than in other countries; similarly, the specific steel consumption is practically twice that of countries with comparable levels of GNP.

TABLE 2

**Ranking of Countries according to Structural
Impact per Capita, 1973-1983***

<i>Rank 1973</i>		<i>Rank 1983</i>		<i>Diff. 1973/83</i>
1	United States	1	Czechoslovakia	+ 1
2	Czechoslovakia	2	USSR	+ 7
3	Canada	3	German Dem. Rep.	+ 10
4	Sweden	4	Bulgaria	+ 13
5	Japan	5	Canada	— 2
6	Switzerland	6	United States	— 5
7	FRG	7	Finland	+ 1
8	Finland	8	Romania	+ 14
9	USSR	9	Belgium/Lux.	+ 1
10	Belgium/Lux.	10	Norway	+ 2
11	Austria	11	Japan	— 6
12	Norway	12	Greece	+ 12
13	German Dem. Rep.	13	FRG	— 6
14	Australia	14	Australia	0
15	Denmark	15	Poland	+ 1
16	Poland	16	Switzerland	— 10
17	Bulgaria	17	Italy	+ 1
18	Italy	18	Hungary	+ 7
19	France	19	Sweden	— 15
20	Iceland	20	Denmark	— 5
21	United Kingdom	21	Austria	— 10
22	Romania	22	Iceland	— 2
23	Spain	23	Spain	0
24	Greece	24	Netherlands	+ 2
25	Hungary	25	France	— 6
26	Netherlands	26	New Zealand	+ 1
27	New Zealand	27	United Kingdom	— 6
28	Ireland	28	Yugoslavia	+ 1
29	Yugoslavia	29	Ireland	— 1
30	Portugal	30	Portugal	0
31	Turkey	31	Turkey	0

*Ranking is based on the aggregate value of the "comprehensive indicator of structural impacts." Plus sign signify a decline in a country's position, while minus signs signify a country's improved ranking.

1.5.2 Environmental Impacts—Lessons on the Way to a Mature Economy

Above, the (positive) relation between structural environmental impacts per capita measured according to selected indicators (energy consumption; steel consumption; cement production; weight of freight transport) and the GNP was investigated. This relation became weaker during the 1970s. This observation must now be complemented with an examination of the impacts per unit of GNP.

Figure 5 shows that the environmental impacts per unit of GNP are lower the higher per capita GNP is. This (negative) relation is not surprising. With growing prosperity, the economy becomes based on other ("soft") input factors. This finding may be termed the "law of decreasing returns from hard production factors". In some countries, however, structural change in this sense did not begin to exert its full effect until the beginning of the 1980s, in others it has not yet begun at all; i.e., a certain variation exists as to the direction of structural change.

The conclusion of this research then may read as follows : The cross-section analysis for the year 1983 proves that a high level of environmental impacts per capita of population is no longer strictly connected with a high level of GNP. The most advanced industrial nations have for the most part moved into the range of medium environmental impact levels. From a certain point of time onwards, a nation's prosperity seems to grow primarily from non-industrial, soft production factors—and, as will be shown, from innovative environmental policies. This hypothesis, being known from the theory of post-industrialism, through our research has now been verified from an environmental perspective.

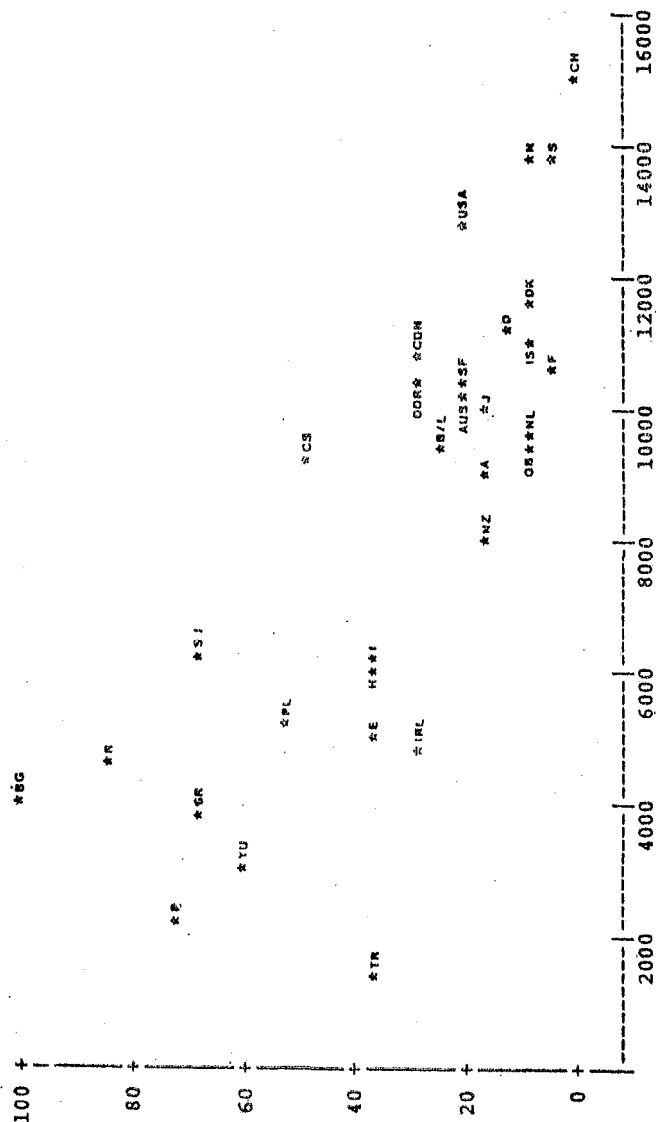
1.6 Typology of Environmentally Significant Structural Change

On the basis of our research it is possible to present a typology of environmentally significant structural change. Regarding the structural environmental impacts per capita, one can discern the following five groups of countries.

- countries with a generally low level of environmental impacts (e.g., Turkey);

FIGURE 5

Scale of Structural Environmental Impacts per Unit of GNP and GNP per Capita, 1983



GROSS NATIONAL PRODUCT PER CAPITA 1983
US-DOLLAR AT 1981 PRICES AND EXCHANGE RATES

- countries with a high level of environmental impacts and (nearly) no structural change (e.g., Czechoslovakia);
- countries with a high level of environmental impacts and remarkable structural change (e.g., the German Democratic Republic since 1979);
- countries with a high level of environmental impacts and rapid structural change, using predominantly curative (reactive) environmental protection measures (e.g., Sweden);
- countries with a low level of environmental impacts and rapid structural change, favouring preventive (anticipatory) environmental policy (e.g., the Netherlands).

Other categories are both conceivable and interesting, such as one differentiating between crisis torn (e.g., United Kingdom) and successful structural change (e.g., Sweden).

In the preceding discussion, the environmental gratis effects from active structural change of the economy were defined. It may be useful to elaborate a bit further on this aspect of ecological modernization.

Environmental gratis effects occur, when the rate of usage of the factors (inputs, resources) having in impact on the environment remains below the growth rate of the GNP. When comparing the rates of usage of the four selected input factors (energy consumption, steel consumption, cement production, weight of freight transport) with the growth rate of the GNP, three different patterns emerge :

- The factors having impacts on the environment decline absolutely; i.e., absolute structural improvements are induced, corresponding to absolute environmental gratis effects.
- The factors having impacts on the environment remain stable, or increase, but with a lower growth rate than the GNP; i.e., relative structural improvements, corresponding to relative environmental gratis effects.
- The factors having impacts on the environment increase at a higher growth rate than the GNP; i.e., structural deterioration, corresponding to degative environmental effects of economic growth.

In Table 3, 16 out of 31 countries in the sample are grouped according to these three patterns.

TABLE 3

**Environmental Effects of Structural Change—
Percentage Change, 1970-1983***

Group 1 : Absolute Structural Improvements

<i>Country</i>	<i>Consumption of Primary Energy</i>	<i>Crude Steel</i>	<i>Cement Production</i>	<i>Weight of Freight Transport</i>	<i>GNP ***</i>
Denmark	-17.4	5.0	-36.4	- 6.5	32.7
France	7.0	-35.4	-15.5	-14.2	46.3
FRG	8.2	-26.6	-22.8	- 1.9	32.7
Uniten Kingdom	- 3.9	-44.8	-22.0	-16.0	24.3
Sweden	-16.4	-40.7	-45.0	-25.3	20.3
USA**	- 1.9	-25.8	- 6.9	-17.3	39.5

Group 2 : Relative Structural Improvements

Austria**	9.5	-32.0	- 0.2	1.5	49.7
Finland	15.2	14.0	5.8	14.1	50.9
Japan	21.4	-14.7	41.4	7.5	76.7
Netherlands	53.7	-40.0	-18.9	11.4	31.6
Norway	34.8	-10.3	-39.6	27.7	62.5

Group 3 : Structural Deterioration

Bulgaria	56.6	37.9	53.8	76.7	36.9
Czechoslovakia	25.3	25.6	41.9	65.8	33.7
Greece**	120.1	126.5	191.3	16.7	56.2
Portugal**	107.0	101.8	155.1	4.7	49.7
Turkey	110.8	135.8	113.3	116.1	87.6

*Steel consumption data refer to the years 1970-1982 only.

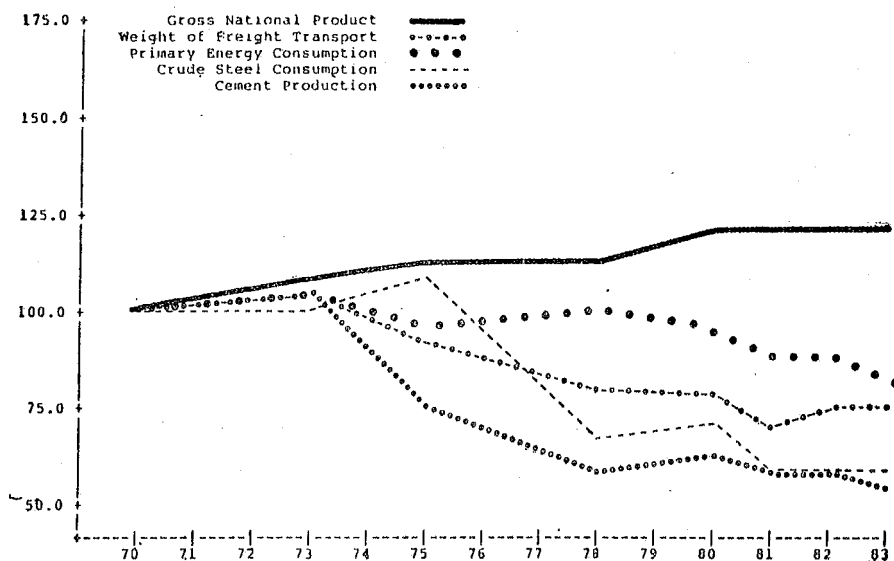
**Transport data only take railway transport into account.

***GNP data are on the basis of constant (1981) dollars.

Of all the industrialized countries in our sample, Sweden (see Figure 6) went through the most rapid structural change. The drastic reduction in cement production (-45%), the decreasing consumption of energy and steel (-16% , and -40% , respectively), and the decrease in the weight of freight transport (-25%) add up to notable environmental gratis effects.

FIGURE 6

Structural Economic Change in Sweden, 1970—1983



In Japan the process of de-linking (see Figure 7) was partly neutralized by the rapid growth in industrial production and thus only resulted in relative structural improvement. The conclusion may be drawn that countries with high rates of industrial growth must strongly rely on curative (reactive) environmental protection measures.

In Czechoslovakia, no significant de-linking of economic growth from the four impact factors was discernible; some of them even increased (see Figure 8). The development profile of Czechoslovakia, with sluggish structural change, is to some extent representative of the other countries of Eastern Europe.

Among the Western industrial nations, countries with low levels of GNP are characterized by quantitative (high-volume) growth. This is

FIGURE 7

Structural Economic Change in Japan, 1970—1983

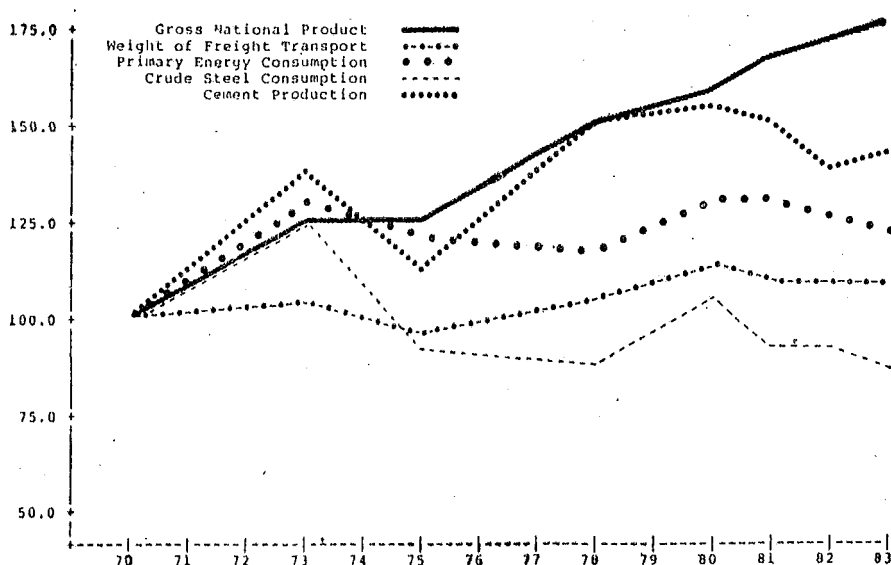
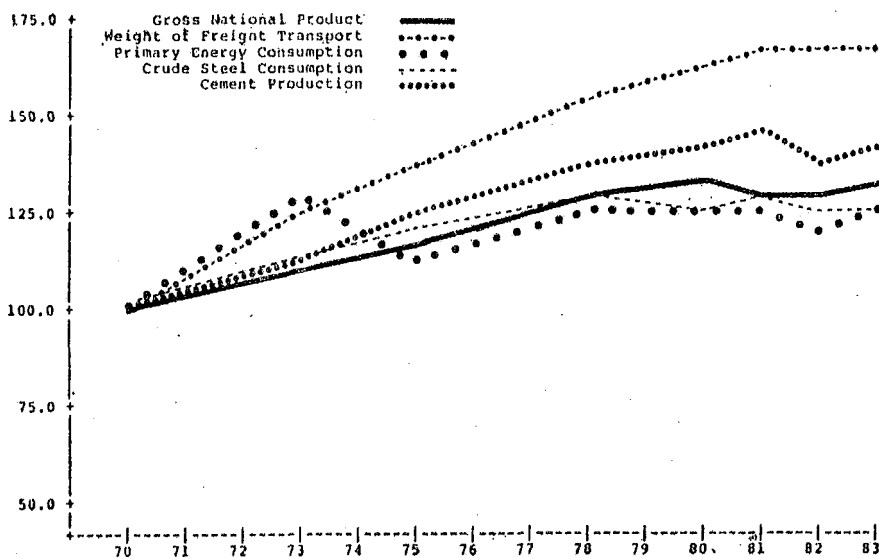


FIGURE 8

Structural Economic Change in the CSSR, 1970—1983



true for Turkey and Portugal, which are still in an early stage of industrialization, and also for Greece.

The group of countries in the sample characterized by "structural deterioration" consists for the most part of industrial late-comers. But with Czechoslovakia, it is a relatively old industrial nation which suffers high structural environmental impacts.

1.7 Conclusions

Despite certain analytical limitations of the empirical analysis, several advantages of an international comparison of the relationship between economic structure and environmental impacts become apparent :

- Structural change in form of de-linking material inputs and economic growth was evident in most but not all of the 31 industrialized countries studied. Fewer than half of these countries clung to the traditional modes of quantitative growth.
- Several countries enjoyed environmental gratis effects as a result of active structural change. In some cases, especially for Sweden, these effects were quite considerable.
- In other countries, the possible positive environmental effects of structural change were leveled out by the rapid industrial growth achieved. This was especially true in the case of Japan.
- The strong correlation between GNP and environmental impacts, still evident in 1973, had dissolved in the 1980s. The high income countries featured fairly rapid structural change.
- In the medium-income countries, a distinct pattern emerged in that there were cases of rapid quantitative growth and cases of qualitative growth. It is, therefore, not yet possible to speak of one dominant trend towards ecological modernization among the industrialized countries.

2. Preventive Environmental Policy

Theoretically speaking, environmental policy can be defined as "the sum of objectives and measures designed to regulate society's interaction with the environment as a natural system; it comprises aspects of restoration, conservation, and structural adjustment³". Practice,

however, does not conform to such a broad definition. Only selected parts of the interaction between society and environment become the subject of policy. So far, environmental policy has mostly been designed as react-and-cure strategies concerning the control of air and water quality, noise and waste disposal, with emphasis on the restoration and conservation aspect.

For a variety of reasons, this conventional environmental policy was, and is, still meaningful and very much necessary. It has a number of deficits, however, some of which are cited in the following, along with some suggestions for overcoming them through preventive environmental policy, i.e., anticipate-and-prevent strategies.

2.1 Environmental Damage—Environmental Expenditures

Since the beginning of the 1970s, when systematic records first began to keep track of the funds allocated for environmental protection, in the industrialized countries the sum of the respective public and private investments has reached large proportions. In the Federal Republic of Germany (FRG), for instance, this sum has come to the handsome total of about 200 billion Deutschmarks (or about 100 billion US-dollars). The industrial society thus appears to be paying through the nose—backpayments for the negative environmental costs of production accumulated in the past⁴.

Table 4 shows the total and sectoral environmental protection investments for the manufacturing sector of the economy of the FRG, for the years 1975 to 1983, in current and constant (1980) prices, and also the respective growth rates for three time periods.

Table 5 shows the total environmental protection expenditures (investments and current expenditures) for both the manufacturing sector and the state, again in current and constant prices.

Figures like these, however, are ambivalent. On the one hand, they give cause for proud political statements about the successes of environmental protection, according to the motto "the more, the better". On the other hand, they are—presumably—the absolute minimum of what is necessary to secure the very basis for society's long-term existence. At the same time, they symbolize a serious structural deficit of industrial society. Environmental protection expenditures are made when damage to the natural environment is

TABLE 4
Environmental Protection Investments in four Environmental Media,
Manufacturing Sector, FRG, 1975-1983

Year	Total		Waste Treatment		Water Sanitation		Noise Abatement		Air Purification	
	current prices	prices of 1980	current prices of 1980	current prices of 1980	current prices of 1980	current prices of 1980	current prices of 1980	current prices of 1980	current prices of 1980	current prices of 1980
			Mill. DM							
1975	2480	3090	170	210	900	1110	200	240	1210	1530
1976	2390	2830	200	230	820	960	220	260	1150	1380
1977	2250	2560	200	230	740	850	210	230	1100	1250
1978	2150	2370	170	180	680	750	200	220	1100	1220
1979	2080	2190	160	160	760	800	200	210	960	1020
1980	2650	2650	210	210	910	910	240	240	1290	1290
1981	2940	2800	250	240	950	910	210	200	1530	1450
1982	3560	3220	390	360	1130	1030	230	210	1810	1620
1983	3690	3230	290	260	1100	990	230	200	2070	1780
Average annual growth rates in %										
1975/83	+ 5.1	+ 0.6	+ 6.9	+ 2.7	+ 2.5	-1.4	+1.8	-2.3	+ 6.9	+ 1.9
1975/79	- 4.3	- 8.2	- 1.5	- 6.6	-4.1	-7.9	0.0	-3.3	- 5.6	- 9.6
1979/83	+15.4	+10.2	+16.0	+12.9	+9.7	+5.5	+3.6	-1.2	+21.2	+14.9

Source : IIUG Project

TABLE 5
Environmental Protection Expenditures, FRG 1975-1983

Year	Manufacturing Sector			State			Manufacturing Sector		
	current prices	prices of 1980	current prices	current prices	prices of 1980	prices of 1980	current prices	prices of 1980	prices of 1980
Mill. DM									
1975	5680	7140	7740	10200	13420	17340			
1976	6000	7190	8550	10940	14550	18130			
1977	6180	7180	8410	10340	14590	17520			
1978	6390	7200	9780	11470	16170	18670			
1979	6740	7190	11350	12380	18090	19570			
1980	7810	7810	12750	12750	20560	20560			
1981	8860	8150	12510	11940	21370	20090			
1982	10110	8780	11890	11130	22000	19910			
1983	10600	9010	11640	10720	22240	19730			
Average annual growth rates in %									
1975/83	+ 1.8	+3.0	+ 5.2	+0.6	+6.5	+1.6			
1975/80	+ 6.6	+1.8	+10.5	+ 4.6	+8.9	+3.5			
1980/83	+10.7	+4.9	- 3.0	- 5.6	+2.7	-1.4			

Source : IIUG Project

unmistakable and can no longer be denied. Belated, they are repairs to the process of economic growth, signs of a curative environmental policy—a "post-fact" policy that reacts to damages (and must react to them) but does not, or cannot, prevent them.

Therefore, it seems to be in order to present an estimation on the actual yearly environmental damage in the FRG. This means not to look at the actual environmental protection expenditures but at the probable actual damage to the environment. According to such a recent estimation, the annual damage to the natural environment in the FRG is in the order of 6% of GNP, and not 3% as the OECD had estimated for the industrial countries a few years ago (see Table 6).

The figures in Table 6 are based on different estimation methods, using data on actual damage costs and fictitious estimations according to willingness-to-pay studies.⁵ The results therefore must be taken with some care. Still, the table gives an idea that despite high annual environmental protection expenditures still enormously high annual environmental damages occur. That is, the damage to the environment is much higher than the increased private and government expenditures for environmental protection may make believe. And this situation may not only be true for Germany but for many other countries as well.

There are more shortcomings of conventional environmental policy. To name a few: Conventional environmental policy usually identifies the given problem very late; the measures it employs occasionally take place so late that the ecosystems affected can no longer be saved. As it is pursued as a media-specific policy, i.e., regulating air, water and soil quality, noise and waste, it also runs the risk of lacking coordination between its specific goals, measures and institutions. And this may result in shifting a problem from one environmental medium to another, e.g., from air to water or soil, and from one place to another, as is the case with long-range, trans-boundary pollution.

In addition, conventional environmental policy often becomes entangled in a debate on principles. If immediate measures simply must be taken, in the process of political bargaining the argument gets shifted from the "polluter pays-principle"—which is advocated in general—to the "taxpayer-pays-principle", thus switching the distribution of the burden of environmental protection from the individual polluter to the community, to government or society at large.

TABLE 6
Annual Environmental Damage in the FRG,
Estimation, Billion DM

<i>Damages</i>	<i>Damage Costs</i>
AIR POLLUTION	approx 48.0
— health damages	— over 2.3—5.8
— material damages	— over 2.3
— damages to outdoor vegetation	— over 1.0
— forest damages	— over 5.5—8.8
WATER POLLUTION	much over 17.6
— damages to rivers and lakes	— over 14.3
— damages to the North and Baltic Seas	— over 0.3
— damages to groundwater	— over 3.0
SOIL POLLUTION	over 5.2
— Chernobyl accident costs	— over 2.4
— hazardous waste disposal	— over 1.7
— expenditures for preservation of biotops and species	— over 1.0
NOISE	over 32.7
— decline in property value	— over 29.3
— decline in productivity	— over 3.0
— "noise compensation"	— over 0.4

Source : L. Wicke et al. : Die ökologischen Milliarden. Munchen 1986.

Thus, innovations in planning and implementation are needed. The concept of preventive environmental policy—it seems—can counter the shortcomings of conventional environmental policy. But in order to reach a better balance between react-and-cure strategies and anticipate-and-prevent strategies, or even a full switch to preventive policy, several conceptual as well as practical constraints have to be overcome.⁶

A first constraint has to do with the particular history of an environmental impact, with the state of affairs existing when the question of choosing the best strategy arises. In cases of yesterday's wastes (Altlasten), where damage has already occurred (e.g., when a polluting industrial plant has closed down), a curative strategy is clearly the only conceivable option. In cases where no damage has occurred as yet but where some damage may be expected in the future (e.g., an investment project impinging upon an environmentally sensitive area), the choice between preventive or curative strategy is basically open. In such a situation, the anticipatory principle is clearly intended to encourage the first option.

As practice is always a mixture between the existing and the new (plants, projects etc.), instances of purely reactive policy, or purely anticipatory policy are useful conceptual references, but in fact may be rather exceptional. Therefore, most policies actually will include a mixture of prevention and cure. The focus of the argument in favour of preventive environmental policy will then turn towards seeking a better balance between the anticipatory and the reactive component within each policy action. It then will not be advisable to reject a strategy of one type outright and to embrace the second indiscriminately. Rather, the direction of policy formulation and implementation should be shifted, to the extent possible, away from the reactive model and towards the anticipatory one. But how to do so?

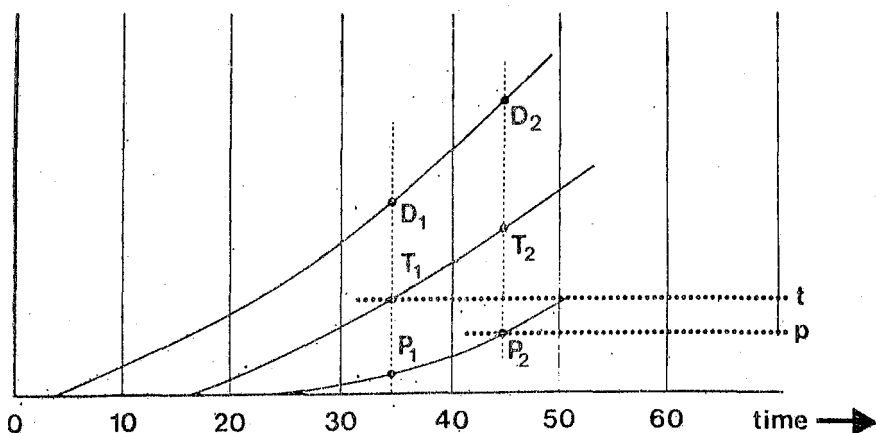
2.2 Basic Conditions for Preventive Environmental Policy

According to Scimemi and Winsemius one can look at three factors as concomitant policy relevant processes in time : the accumulation of environmental damage; the acquisition of technical knowledge; and the development of public awareness. The time sequence of these processes, especially the relative timing of their critical stages, has a decisive effect on the whole issue of preventive environmental policy. To illustrate the relationship between these three factors,

Scimemi has redrawn a diagram suggested by Winsemius, using three separate functions : Level of Damage, Level of Technical Knowledge, Level of Public Awareness.⁷ The relative position and the shape of these functions depends, of course, on the specific circumstances (country, environmental sector, time etc.) under consideration. A common case (the common case ?) illustrated in Figure 9.

FIGURE 9

**Factors of the Environmental Policy Life Cycle :
Damage, Technical Knowledge, Public Awareness**



Line D_1 — D_2 indicates the accumulation of environmental damage over time. The accumulation of damage, be it natural or man-made, starts at a given point in history, in the diagram somewhere between time 0 and time 10. At that time, neither the scientific community nor the public is yet aware that anything of importance is happening. Line T_1 — T_2 indicates the process of gathering technical knowledge. This process does not start until some time after damage has begun to accumulate (in the diagram somewhere between time 10 and 20), and proceeds gradually.

During that phase the public is still unaware of the hazard. Somewhere between time 20 and 30, while technical knowledge increases further, public awareness starts to rise, as indicated by the line P_1 — P_2 .

Within these concomitant processes, one stage becomes important. Somewhere between time 30 and 40, as illustrated, the technical

understanding of the issue reaches a critical level, t , thus ensuring the first of the two conditions required for effective policy action, technical rationality. Furthermore, between time 40 and 50 public awareness also reaches a critical level, p ; at that time the second condition of effective decision-making, political viability, is fulfilled. It is only at that stage that action will be undertaken to avoid the occurrence of further damage.

Anyone who has taken the trouble to follow recent developments in environmental policies at the national or the international level, will be able to recall a number of instances where the process evolved very much in conformity with this interpretation. In this sense, and despite its somewhat schematic nature, this diagram may thus be considered to be a true representation of real events.

What are now the opportunities to influence the basic conditions of policy action in favour of preventive environmental policy? A look at Figure 9 helps one to visualise five basic options:

- Delaying damage accumulation (i.e., sliding the D_1-D_2 curve towards the right);
- accelerating technical knowledge (i.e., sliding the T_1-T_2 curve towards the left and/or raising its slope);
- increasing public awareness (i.e., sliding the P_1-P_2 curve towards the left and/or raising its slope);
- reducing the minimum requirements in terms of technical knowledge (i.e., lowering the level of threshold t);
- reducing the minimum requirements in terms of public awareness (i.e., lowering the level of threshold p).

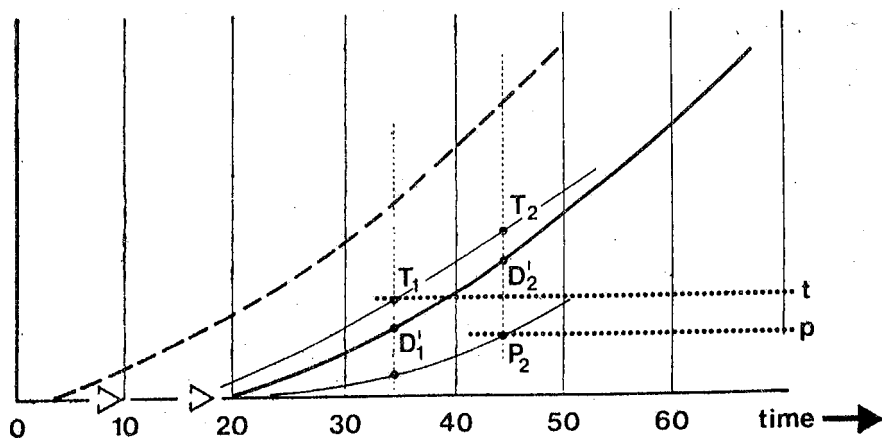
These various options all have the effect of making policy decisions possible at a stage when the level of environmental damage is still relatively low or even non-existent. (For an illustration see Figures 10, 11, and 12). In the following, I will briefly discuss these options and indicate some of the difficulties associated with each of them.

2.2.1 Delaying Damage Accumulation

This option is illustrated in Figure 10 (where the original D_1-D_2 line is moved to position $D_1'-D_2'$). It presupposes the ability to delibera-

tely delay damage to accumulate while counting on scientific research and technical knowledge, or public awareness (or both) to advance at a significant pace (based on laboratory work, education, teaching mass-media effects, etc.).

FIGURE 10
Delaying Damage Accumulation

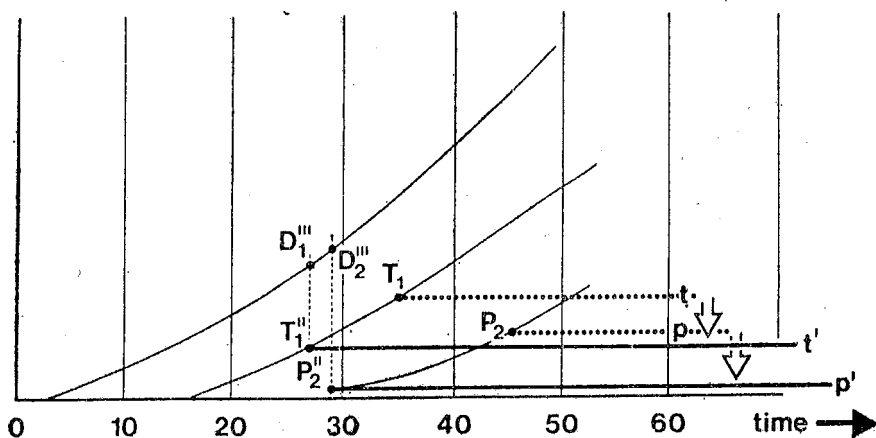


How realistic is this option? Although it is sometimes possible to postpone the commencement of a polluting activity, it will generally be much harder to interrupt such activity after it has started. Second, to retard damage accumulation normally entails costs or the loss of economic advantages for the proponent as well as for society at large. Furthermore, it may ignore or underestimate the positive links that exist between environmental damage, technical knowledge, and public awareness; damage felt or suffered may drastically speed up the process of increasing knowledge and awareness.

2.2.2 Accelerating the Generation of Technical Knowledge and/or the Development of Public Awareness

These two options are illustrated in Figure 11 (where both the T_1 — T_2 and the P_1 — P_2 lines have been bent upwards).

FIGURE 11
Accelerating the Generation of Technical Knowledge
and/or the Development of Public Awareness



Acceleration of knowledge and awareness can be prompted through a variety of approaches and methods and depends a great deal on the specific environmental issue at hand. Environmental Impact Assessments (EIA) are being increasingly applied, especially for private and public investment projects. They entail concentrated efforts to learn as much as possible about possible environmental impacts, and are intended to allow appropriate action to be taken before any damage has occurred. In that sense, EIA can be classified as typically anticipatory instruments or part and parcel of preventive environmental policy.⁸

Over the last years considerable headway has been made to institutionalise and standardise EIA procedures, both nationally and internationally. This development may not have greatly enhanced the scientific information contained in the assessments.¹³ Their value is, rather, that an appropriately structured and legitimised process, mandating public participation, might ensure both the amount of technical knowledge and the level of public awareness needed to make preventive environmental policy possible. The direct involvement of the public in the EIA procedure, as well as the official character of the assessment, may help to minimise the time lag that might otherwise develop between obtaining the required technical information and its public acceptance as being adequate and credible, including the decision to stop a polluting project or not to start it at all.

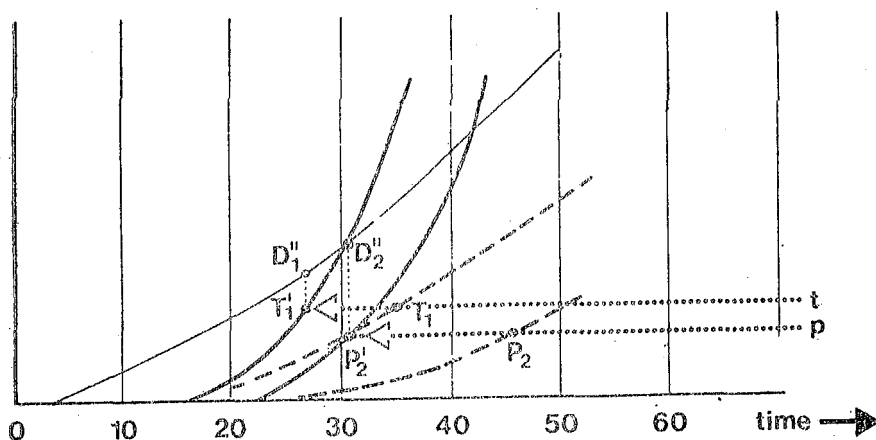
Because the technique of environmental impact assessments is particularly fitting for specific projects it allows for the "accelerating effort" to be targeted, and also permits the burden of such efforts to be imposed upon the project initiators themselves, thus conforming to a basic principle of preventive environmental policy, i.e., the polluter-pays-principle.

2.2.3 Lowering the Thresholds for Technical Knowledge and/or Public Awareness

These two options are illustrated in Figure 12 (where threshold lines t and p have been lowered to levels t' and p' , respectively).

FIGURE 12

Lowering the Thresholds for Technical Knowledge and/or Public Awareness



What about the minimum requirement levels regarding technical knowledge and public participation, and how should such thresholds be established? The decision, on how much knowledge/awareness is enough normally falls upon the political decision-maker (the government, the environmental protection agency), even if the scientific community (or parts of it) is ready to say "we know enough". Therefore, one frequently observes a stalemate in decision-making on a certain environmental issue because of differences in the judgement of how much knowledge/awareness is enough. Eventually, this leeway can deliberately be exploited by opposing agencies, parties, or nations,

representing diverging interests in a dispute over the appropriateness or the timeliness of attacking a given environmental problem. In Europe, for instance, you may find that two countries, A and B, may still come to opposite conclusions on whether or not knowledge is sufficient to warrant vigorous air pollution control measures, as is currently the case with the dispute between the FRG and the UK on the acid rain problem. It should not be too astonishing to find that the positions of such two countries are reversed when asbestos rather than sulphur is at issue. Here, the commercial relationship may work in the opposite direction. What is "enough knowledge" for one country (agency, party) may not be enough for the other. (While certain countries are arguing against prompt action to reduce SO_2 emissions from power plants, allegedly because of a scarcity of data on the resulting damages, the same countries may be arguing for an immediate stop to whaling because information on the size of the whale population is said to be scarce). The normal outcome of such a situation is a compromise over the emission standards to be implemented, i.e., they will be weaker than technically feasible because knowledge on cause-effect-relationships is said to be insufficient. Cases in point are the emission standards for SO_2 and NO_x in the air pollution sector, or the nitrate standard in the water pollution sector. The dilemma of setting uniform and strict emission standards, (i.e., to agree on lowering threshold t in Figure 12) therefore is serious. Meanwhile the forests may continue to die, and the water may continue to get contaminated. The conclusion therefore is, that standard setting must be seen as a continuous process. With growing knowledge on environmental damages the thresholds for action must be continuously lowered, i.e., standard setting must be dynamized.

The problem of determining thresholds for public awareness and public participation can be described very much along the same lines. A given level of public support may be deemed sufficient for action by the political decision-maker (government agency) who enjoys confidence by his constituency and who has established a high standard of credibility and responsibility. The same level may not be enough (or may not be felt to be enough) if the decision-maker lacks these qualities.

2.3 Conclusions

A constructive approach towards defining preventive environmental policies and to strive for a better balance between reactive and curative

strategies is to identify the difficulties and not to ignore existing constraints. The first such difficulty is to prove that preventive decisions are indeed timely. A second difficulty is linked with the very crucial advantage of preventive decisions : their implementation before damage occurs, that is before the painful (but sometimes fruitful) educational experience of suffering the consequences of pollution. A third difficulty stems from the fact that any short of prevention depends, to a greater or lesser extent, on society's capability for forecasting. It would be futile to pretend that preventive environmental policy were immune from such constraints. (The evaluation of the long-term climatic effects of CO₂ emissions is a just one case in point.) On the other hand, the advantages of prevention in terms of resource savings, sparing of efforts, and anticipating definite damages are often far greater than the disadvantages of marginal forecasting failures. This need to come to terms with the future is not unique to environmental policy. However, emphasising preventive environmental policy is especially requested in order to bring the environment in line with public action in other domains where collective interests are at stake. One such domain we have to address when discussing the possibilities and constraints of the concept of ecological modernization is, of course, economic policy.

3. Ecology and Economic Policy

3.1 Interrelations and Conflicts between Economy and Ecology

Ecology in essence means the necessary and feasible harmony between man and nature, society and environment. Economy, however, in general means disharmony with nature. Use is made of nature both directly and indirectly when raw materials are processed into products, and nature is polluted by the emissions and wastage generated by this production. These are, then, the two processes in which nature remains the loser. She exchanges natural raw materials for produced waste materials. Besides labor and capital, nature is truly a quiescent exploited third production factor. How can nature's position in the "economy game" be improved, her rights guaranteed and her protection provided ?⁹

The use of raw materials and the generation of emissions and wastes are, of course, old issues. Scientific and technological development, however, have made it increasingly possible to exploit the depletable

resources, and have lead to an increasing accumulation of harmful emissions and non-decomposable wastes. Nature is no longer able to absorb all of these substances, many of which are not only toxic for nature but for human beings as well.

Efforts to hide harmful emissions and toxic wastes—in dumping sites, in intermediate or permanent storage places, to spread them—through high smokestacks, or to dump them—into the water, have at best been temporarily successful because many emissions and wastes are “mobile poisons”; they do not stop at administrative borders. One result of this process is what can be called the “linearization of ecological cycles”, i.e., the natural diversity is reduced, the robustness of the ecosystems declines, ecological symbioses and equilibria break down. As a consequence, the absorption capacity of the natural environment decreases and environmental pollution increases.

Accordingly, the conflict between economy and ecology can be attributed to two (actually or possibly ?) incompatible basic principles: The ecological principle of “stability”, as a precondition for the sustainability of ecological systems, and the economic principle of growth”, as the inherent logic of the economic systems—more precisely : the principles of business profitability, national economic growth, and expansion on the world markets.

Given the (actual and the pending) ecological crisis, the question on whether these economic principles can be changed, reshaped and finally brought into harmony with ecological principles, on which level, in what way, and at what time, is, of course, a controversial question for both theory and practice. The answer depends, first, upon the respective individual and societal constellation of interests. The answer also depends upon the ability of and the willingness for social innovations, and especially on (a) how one uses the possibilities for an ecological self-regulation of the economy, and (b) how one implements the possibilities for an ecological re-orientation of economic policy.

3.2 Ecological Self-Regulation of the Economy ?

To start with a general statement : Most certainly only a small fraction of the environmental problems would exist if the economic contexts would have remained so comprehensible, that producers and consumers would personally be able to recognize and perceive the conse-

quences of their decisions towards depleting resources and polluting nature. Or, in other words: if business profitability, economic growth, and the expansion on world markets could not be guaranteed or increased by externalizing some of the ensuing costs. This is the old but still relevant—because unresolved—problem of the external effects of production.

Scientific and technological development has been, and still is, coupled with negative external effects, i.e., the shifting of costs to third parties, society, future generations, and nature. With respect to environmental problems, all these components of external effects are interrelated.

Let us take the pollution of the "ecosystem forest" as a recent example of public debate in Europe :

- First, this example shows the shifting of a part of the costs of production, here in the form of not sufficiently reduced air pollutants, into nature, which is resistant only to a limited degree : the forests are dying.
- Second, this example shows the shifting of costs onto the succeeding generations, in the sense of a future with less forests, or only a long-term regaining of the reproduction capacity of the soil.
- Third, this example shows the shifting of costs onto third parties (i.e., partial expropriation of private forest owners) and onto society in the sense that economic and technical decisions of individual polluters (especially emissions from power plants, cars, and trans-boundary pollution) impair the well-being and the physical health of the population.

The economic system thus evidently makes incorrect calculations with respect to the "ecosystem forest". Both business accounting and national accounting do not provide sufficient and adequate signals which may prevent pollution levels that are no longer tolerable for the ecological system. Conventional accounting shows favorable balances for the production of energy, for automobile producers, and for pollutant exporters (just to stay with the three polluting agents mentioned above), although the "ecosystem forest" is definitely being damaged by the emissions of these economic sectors. Loss here, profit there, compensation does not take place nor is it planned.

One of the pending tasks can therefore easily be described: "Internalize the external effects of production"! This means shifting the costs back to the economic units that cause the problems, and including the "ecological component" into all investment decision-making. Undoubtedly, decreasing the external effects of production on society, nature, and future generations would be an important strategic element for regaining harmony between economy and ecology. But, how to proceed in practice?

To understand the economy as an integrated cycle, or as recycling in the broadest sense, would mean to reduce systematically the use of depletable resources and the generation of polluting wastes—and this is in contradiction to an economy being organized for quick throughput. In practice, recycling is still at an incipient stage (with glass and paper wastes, old tires, and used batteries) and not a systematic economic undertaking. The step from simply disposing wastes towards an integrated waste management has not yet been made. Certainly, this is in part because many waste products cannot be recycled at all or only at high costs. But it is also true because the right price and cost signals have not been set. Systematically preventing waste generation and actively conserving energy are not sufficiently being promoted. And lastly, it has to do with the structural deficits of the accounting procedures which do not entail adequate criteria for measuring diminishing stocks. The result may be a contradictory trend: increasing monetary income—decreasing natural stock.

Approaches towards ecological accounting at the factory level and integration of environmental aspects into the national accounting system are promising and have been sufficiently tested. With ecological accounting the amount of energy, materials, wastes, and land used are computed and, by simulating the given shortage, accounting units are determined which then enter the accounts. Thus a measure is developed which not only may guide private investment decision-making, but also may provide a public information instrument which can contribute to determining and promoting qualitative economic processes.

In addition to the above-mentioned principle of integrated cycles, a second ecological principle is no longer valid in modern industrial society, that of the sustainability of resource use. Traditionally, forest owners have followed the principle "Do not cut down more wood

than can be regrown." Meanwhile, this principle has been undermined : Externally produced "acid rain" collides with internal resource conservation. Sustaining the yield of private forest capital is being replaced by indirect expropriation in form of the publically recognized "death of forests". Nature fights back by dying. How should society respond ?

One basic principle to be re-established for sectors and units of the economy is that of responsibility or liability. With respect to environmental problems, the legal system, and also economic behaviour, in most countries is marked by the strict proof of causality. Only when the injured (damaged party) can prove who caused the damage (polluting party) then the polluter is held liable for compensation. Instead, in some countries—for example in Japan—the pure statistical probability is sufficient for obligating industry to compensate for damages (collective liability). Once this approach was established (by the courts, and through legislation) it helped to improve environmental quality through ecological self-regulation of business activities. In addition it strengthened the anticipate-and-prevent strategy in environmental policy, and shifted the technical solutions for environmental problems from ex-post to ex-ante solutions, i.e., from controlling or end-of-pipe technology towards low emission or integrated technology. To implement the principle of responsibility (or liability) in practice small steps or big leaps could be taken: continuous reporting on wastes; automatic monitoring of emissions; collective funds; strict environmental liability; etc.

3.3 Ecological Re-Orientation of Economic Policy ?

Confronted with serious environmental damage, conventional economic policy is increasingly being challenged. Its guiding principles, goals, instruments, and institutions are being questioned, and a new concept is emerging: ecological economic policy.

Conventional economic policy is based on the guiding principle of maximizing flows: volume of production, income, profits, turnover. Kenneth Boulding fifteen years ago called this the "throughput economy". Instead, he demanded the "spaceship economy". Writing today, he probably would speak of the "ecological economy". This paradigm is based on a different guiding principle: "Increasing efficiency and maintaining substance!" Aspects such as environmental compatibility and resource conservation become important,

and structural change of products and technologies according to ecological considerations becomes the task.

With respect to the goals, it seems necessary to redefine and supplement the conventional economic policy goals, especially to re-assess the growth target and to include "environmental stability" into the catalogue of economic policy goals.¹⁰

The conventional policy goal indicators were developed at a time when environmental pollution was already a problem but not yet a public issue, and since then they have not really been readjusted. Economic growth is still being measured in terms of goods and income categories (GNP—Gross National Product), the ecological cycle not being considered. Economic growth is defined as an increase of income, while the effects of this on the stock and the quality of the resources (natural capital) are not considered. And, finally, in the conventional concept of growth, all monetary transactions are summed up independent of their specific function. Increasingly more expenditures are included which per se cannot be positively assessed but are solely being spent for the necessary compensation for damages previously caused by the economic process ("compensatory or defensive expenditures").

Better qualified goal indicators for economic policy can be established in various ways: through computations of the compensatory expenditures, i.e., assessment of an environmentally related net product (ENP—Eco National Product); through combined growth, employment and distribution indices; through an integrated system of economic and environmental indicators etc.

Regarding the instruments, conventional economic policy relies strongly on two main instruments, variations of interest rates and of tax rates. From an ecological point of view, new taxes and charges are required which, to some extent, may replace the traditional taxes. Highly relevant in a situation of unemployment and environmental pollution would be the introduction of resource taxes (as e.g., an energy tax) and emission charges (as e.g., a charge on sulphur dioxide emissions) and the decrease of wage taxes. Such a structural tax reform could help to change the existing incentive structure in the economy towards increasing resource efficiency and employment opportunities.

Economic policy manifests itself in and works through particular institutions. Therefore, the ecological orientation of economic policy also requires establishing new institutions and abolishing or redefining old ones.

As a rule, environmental problems are not confined to the parameters of private ownership nor do they remain within given state borderlines, and environmental protection falls within the realm of competence of local, national, as well as supranational institutions. Thus neither the existing civil law, nor the national governmental jurisdiction can provide adequate answers to the actual and the pending environmental crisis. A structural reform of institutions seems to be required by which economic institutions would have to incorporate ecological perspectives, and environmental institutions would have to improve their competence, and by which environmental impact assessments would become part and parcel of all economic decision-making.

4. Conclusions

According to what was said in the three preceeding chapters, "ecological modernization" obviously is a demanding concept, both methodologically and practically. Its implementation requires a restructuring of the economy, a re-orientation of environmental policy, and a replenishing of economic policy. To "raise a loan with the ecology", i.e., to rely on ecological principles, that is what matters: Ecological structural change of the economy, preventive environmental policy, and ecological orientation of economic policy seem to be the strategic elements to reconcile the interests of man and nature, society and environment.

Appendix

IMMEDIATE ACTION PROGRAMME FOR THE ENVIRONMENT*

The two great tasks of the 1980s and '90s will be the elimination of mass unemployment and the ecological modernization of our industrial society. West Germany's economic and social recovery after World War II, the Wirtschaftswunder, was a result of a national consolidated effort. An issue of nearly equal importance confronts us today: our environment is in a state of emergency; to save our environment, a series of steps for immediate action must be taken.

1. Establish a special fund for "Employment and Environment"

The initial and decisive step towards ecological recovery of our industrial society will be to repair the environmental damage with which we are faced. The establishment of a special fund for "Employment and Environment" with the Kreditanstalt für Wiederaufbau will help dispose of accumulated hazardous wastes (Altlasten) by providing low-interest loans for environmental protection investment to private and public organizations, associations, corporations and business, and grants for environmental investments of outstanding importance. To finance these loans and grants, a surtax will be levied on electricity and natural gas consumption and on mineral oil products.

The special fund for "Employment and Environment" is not aimed at weakening the polluter-pays-principles, nor can it be used to refinance the normal tasks of public authorities. It is to be used in cases where:

* *Social Democratic Party (SPD), Commission on Economic and Fiscal Policy: "Ecological and Social Modernization of the Economy", Bonn 1986, pp. 43-45; my translation.*

- the elimination of ecological emergencies necessitate it,
- environmental damage was caused by polluters who can no longer be determined,
- public, especially local, environmental protection investments can be quickly applied,
- the state of technology can be rapidly improved by the development and implementation of new environmentally compatible products and production processes,
- the polluter-pays-principle leads to an unreasonable or unacceptable burden for individual regions, small and medium-sized organisations, or low-income groups.

The special fund for "Employment and Environment" will provide a permanent fund for environmental protection investments, independent of the annual budget, and without necessitating a raise in net credit on the federal or state level.

2. Environmental regulation remains necessary

Rules and regulations are essential environmental policy instruments. They should aim not only at controlling the pollution level, but also at setting more stringent standards to steadily decrease the emissions. Environmental regulations should not be restricted to the present state of technology but must promote technological advancement. A step-wise introduction of more stringent standards is to be implemented.

3. Environmental impact assessments for public and private projects

Public and private development projects having an impact on ecosystems and/or on human living conditions must submit to an environmental impact assessment. Possible harmful impacts are to be described and evaluated in the planning phases of such projects. The final decision whether or not to accept a proposed project must depend upon the findings of such investigations.

4. Develop a preventive chemical policy

The chemical industry is a very efficient sector of our economy and has provided us with products which have brought about major

advancements in human health and nutrition. However, the risks involved in the manufacture and use of chemical products become more and more obvious. Therefore, the laws for the protection of our air, soil and water must be amended with a view to hazardous chemical substances. To establish a preventive chemical policy is now of utmost importance. This policy should seek to amend the basic chemical law (Chemikaliengesetz) to cover hazardous substances (Altstoffe), testing and withdrawal of highly toxic by-products, protecting the consumer from toxic household chemicals, improving safety of the working place, restricting use or prohibition of dangerous chlorinated hydrocarbons and heavy metals.

5. Introduce emission taxes

The effluent charge in the field of water protection (Abwasserabgabe) has proved successful. However, it must be strengthened as an instrument and introduced into the other environmental sectors. The catastrophe of dying forests clearly shows the urgent need for the introduction of emission taxes (on sulphur dioxide, nitrogen oxide etc.) which should be set high enough to give the polluter an incentive to invest in pollution abatement technology. The proceeds from such emission taxes should be used to develop and improve environmental technology.

6. Change the environmental liability law

The civil law of compensation should be amended through the principle of strict liability, such that proof against the polluter is easier to establish and that the burden of proof is placed on the polluting rather than the damaged party. Not only will this increase the possibilities of receiving compensation; it will also provide incentives for polluters to cease their environmentally harmful activities.

7. Fighting environmental crime

There are many deficits in our legal system concerning environmental protection. We demand to eliminate the legal gaps that hinder efforts to stamp out environmental crime. The police, district attorney's offices and the courts must be better equipped technically and better staffed. We need a strong network of police departments and district attorneys' offices specializing in environmental crime. We need to add separate criminal law divisions to our regional court

system, which will specialize in environmental law and be appropriately staffed with competent jurors.

8. Public authorities must set an example

Public authorities must set an example for resolute environmental protection. They should use their influence to establish rates and tariffs for public utilities and state-owned businesses beneficial to the environment. Wherever possible, public authorities should try to integrate environmental considerations into their daily decision-making.

9. Protect our water

We need a programme of immediate action to develop an environmentally safe water supply system, to promote economical water usage and to protect our groundwater. This includes the support of technologies aimed at reducing water consumption, the modernization and construction of sewage treatment plants, and a drastic reduction in the discharge of pollutants into the water bodies.

10. Develop a waste management programme

We propose to focus on integrated waste management rather than on waste disposal. The possibilities for recycling waste have so far hardly been tapped. In addition to the disposal of hazardous wastes, we should increase recycling through environmentally sound sewage disposal systems and recycling plants, especially for household waste. In addition, taxes or surcharges should be levied on certain products in order to eliminate or at least drastically decrease the use of one-way packaging.

NOTES

1. **S. Paulus** : Economic Concepts for Industry Related Environmental Policies, in : Proceedings—Fore Runner Forum on Industry and Environment, FES, IIT-Bombay, New Delhi, 1986.
2. The following data are taken from **M. Janicke, H. Monch, T. Ranneberg, U.E. Simonis** : *Improving Environmental Quality through Structural Change*, IIUG discussion paper 87-1, Berlin : IIUG, 1987.
3. International Institute for Environment and Society : *Research Program 1983-1987*, Berlin : IIUG, 1982, p. 6.
4. The following tables are from **C. Leipert, U.E. Simonis** : Umweltschaden—Umweltschutz, in : *Geographische Rundschau*, 6, 1987, pp. 300-306.
5. **See L. Wicke et al.** : *Die ökologischen Milliarden*, Munchen, 1986, p. 123.
6. **See U.E. Simonis** : Preventive Environmental Policy. Prerequisites, Trends and Prospects, in : *Ekistics*, 313, July/August 1985, pp. 369-372.
7. In the following I strongly rely on the arguments put forward by **G. Scimemi** : *Environmental Policies and Anticipatory Strategies*, IIUG preprint 87-1, Berlin : IIUG, 1987.
8. **Cf. P. Wathern** : *The Environmental Impact Assessment Directive of the European Communities*, IIUG preprint 86-11, Berlin : IIUG, 1986.
9. **Cf. U.E. Simonis** : Economic Activities, Social Problems and Environmental Quality, in : *Universitas*, Vol. 26, 4, 1984.
10. **Cf. C. Leipert** : *Social Costs of Economic Growth as a Growth Stimulus. The Need for a New Indicator of Net Production*, IIUG preprint 85-15, Berlin : IIUG, 1985.

The Author

Udo Ernst Simonis is Professor of Economics at the Technical University of Berlin (West) and Director of the International Institute for Environment and Society, Science Centre Berlin (West).