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Environmental Policies and Development Planning in Contemporary China and Other Essays

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Preface

The essays collected in this volume were written, with one exception, since 1970 when I was again drawn into the discussion of social costs and environmental disruption.[1] Four of these essays have not appeared in English: The long monograph on China's environmental policies, the paper 'Environmental indicators as indicators of social use values', the essay entitled 'The disruption and protection of the environment: Economics and politics' and the concluding article 'Environmental crisis and political economy'.

What unifies these essays is the thesis that social costs and environmental disruption represent a major challenge not only to the social sciences and to conventional economic theory but also to the system of business enterprise. Both conventional theory and the capitalist market economy will have to undergo major changes if the problem of environmental disruption is to be mastered in a responsible fashion. Not only will it be necessary for economic theory to abandon its current practice of operating with essentially closed or semi-closed models; economic science will have to become a normative science and economic research will have to adapt itself to the inevitably interdisciplinary (and ecological) character of its subject matter. As far as the system of business enterprise and the market allocation of resources as well as the determination of inputs and outputs and the location of economic activities are concerned, they will have to be subjected increasingly to direct and quantitative controls, prescriptions and prohibitions and to non-market criteria of decision-making. The current energy crisis (1973) resulting from the curtailment of the output and export of petroleum from the oil producing countries, and the measures employed aiming at the reduction of energy

1. My earliest discussion of some of these issues dates back to my *Social costs of private enterprise* (1950) including its second and revised edition entitled *Social costs of business enterprise* which was published by Asia Publishing House, Bombay, in 1963. Both these books are now out of print and the first edition is accessible only in a paperback edition (Schocken Books, Inc., New York, 1971) as well as in numerous translations (German, Japanese, Polish, Spanish, Italian and French).

consumption provide a good illustration of the considerable savings and the social benefits which unregulated oligopolistic markets would be unable to achieve. They also show that once the emergency assumes serious proportions, societies cannot afford to rely only on indirect measures of control making use of the market mechanism of allocation because these would prove ineffective and insufficient but would also favor higher income groups and would thus violate the most fundamental principles of justice and equal treatment.

It is against the background of these considerations that the reader may find the discussion of environmental policies and development planning in contemporary China of interest as an example of the implementation of such policies in an economic and social system in which allocation, costs and profits are not determined and calculated in terms of exchange or market values but – as we interpret it – in terms of social-use values in accordance with socialist principles enunciated in some of the more neglected earlier works of Engels and Marx. While I am not offering the Chinese case as a 'model', I do believe that the Chinese experience in this as in many other respects is instructive and even relevant also for the industrialized world.

I wish to acknowledge many helpful comments from colleagues and students of environmental issues, which I have received in the course of the preparation of the different essays. I also express my thanks for the invitation by the Ecole Pratique des Hautes Etudes in Paris to conduct a seminar on Environment, Development and Planning during the winter semester 1972/73. The EPHE together with Dr. Clemens Heller of the Maison des Sciences de l'Homme has also been instrumental in making the arrangements for the publication of the work in collaboration with Mouton Publishers, Paris - The Hague. However, my major obligation is to my wife, Lore L. Kapp, who has taken part in the research, the writing and the editing of all manuscripts with a view to making them more readable and preparing them for the printer. My secretary, Miss Beatrix Madörin, has worked with great diligence and intelligence on the preparation of several drafts of most of the essays.

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Contents

Environmental policies and development planning in contemporary China*

INTRODUCTION

The present essay raises the issue of Socialism and the Environment. As such it should be of interest to all those who have long held the view that the degradation of the human environment is above all a socio-institutional and hence a political problem and is in fact promoted by the principles which guide the decision-making process in a market economy. Moreover, Chinese environmental policies are of interest to all students of less developed countries because they are formulated as part of the social and economic development of the country. In other words, the Chinese example illustrates at the same time the relationship between economic development, development planning and environmental policies. In addition, China's environmental policies throw new doubts on the meaning and measurement of economic growth and development by a policy of maximizing GNP regardless of its composition and of the social costs arising in the course of production.

It is true, China is still a poor and predominantly agricultural country; its process of industrialization has just begun. Its cities are few and the age of the automobile with its polluting effects has hardly started. However, China has a history of continued demographic and economic expansion. In addition, it has experienced the constant pressure of natural and war-time destruction. Thus, even without industrialization, China has been

* The author acknowledges with thanks several responses to an earlier draft of the essay by friends and colleagues without wishing to identify them in any way with specific conclusions arrived at with the exception of those cases where the biographical references indicate his reliance on data or deductions advanced by them. Among my colleagues I wish to mention particularly Charles Bettelheim and Ignacy Sachs of the École Pratique des Hautes Études (Sorbonne), Paris. I also gratefully acknowledge a number of suggestions from Prof. Willem F. Wertheim of the University of Amsterdam who called my attention to Pierre Gourou's 'Notes on China's uplands', 1948. My former assistant and friend Dr. Heiner Schweizer who had just published his important book *Sozialistische Agrartheorie und Praxis*, Bern, 1972, made several helpful suggestions shortly before his untimely death. Lore L. Kapp has carried as usual a substantial share of the research and drafting of the essay.

exposed to environmental disruptions particularly in the form of deforestation, erosion, floods and disastrous changes of the course of its river systems. As a country under foreign domination for more than 100 years, China was unable to determine the goals and direction of its economic and social development. Little if anything could be done with a view to transforming its agricultural system as a prerequisite of industrialization: sanitation, preventive medicine, community and industrial hygiene and protective labor legislation were lacking. In fact, these social components of the quality of life which were decisive for most of its population had been thoroughly neglected for hundreds of years. Colonial dependence and political disintegration have left China with a heritage of environmental degradation (both social and physical) which called for and received early attention by the new Chinese government.

It is true that China was able to draw upon the experiences and help (at that time fully acknowledged) of Soviet advisors and experts as well as upon modern science and technology. In addition, China could also rely upon indigenous experiences with protective measures of environmental control which go back to her earliest dynasties. Moreover, her traditional attitude towards nature and her earlier notion of man's 'duties' towards the earth were in striking contrast to modern Western notions of man's control and conquest of nature. The taoist component of Chinese culture has always held that man *and* society are integral parts of nature and hence marked by interdependencies which, if ignored by human action and innovation without adequate assessment of their consequences must give rise to grave perturbations of man's social and natural environment.[1]

In the course of our investigation we shall explore a number of key questions related to environmental and development planning in the People's Republic of China since liberation. The term environment will be interpreted in the broad sense in which it is used in the Chinese literature. That is to say, it includes both the social and the physical components of the human environment as it affects the quality of life in the wider sense of the term. More specifically, we shall attempt to raise and answer such questions as the following: In which way have Chinese development policies been concerned with the protection and improvement of the environment? What are the guiding principles and goals which provide the rationale for environmental planning? How are priorities

1. The fundamental explorations of this Taoist component of Chinese culture are those of J. Needham, *Science and civilization in China*, Vol. I and II, Cambridge, Cambridge University Press, 1956. For a particularly persuasive application of Needham's conclusions to the problems here under discussion, see Marthe Engelborghs-Bertels, 'La nature et les hommes en Chine', *Revue du centre d'étude des pays de l'Est et du centre national pour l'étude des Etats de l'Est*, 1971, no. 1-2, pp. 118-145, particularly pp. 138 *ff*.

evaluated and established? Which major instruments and practical policies have been applied for the protection and improvement of the social and physical environment? What role does popular participation play in environmental planning and how are environmental policies implemented and popularized? What relevance could traditional Chinese attitudes towards Nature possibly have on contemporary environmental policies? Finally, are the principles which seem to guide the Chinese approach to environmental planning likely to last and what is their relevance and possible validity for other developing and developed countries?

We shall attempt to provide first an outline of China's environmental problems and policies. Against this general background we endeavor to set forth what we consider to be the major guiding principles which seem to provide the rationale of China's environmental policies. A third part seeks to identify the principles which seem to determine the evaluation of objectives and priorities of environmental and development policies. A fourth part examines the problems and methods of implementing and popularizing environmental policies. In the concluding part we shall examine the applicability and possible relevance of the Chinese approach to environmental problems for other developing and developed countries.

1. CHINA'S ENVIRONMENTAL PROBLEMS AND POLICIES

Chinese agriculture has been exposed to natural catastrophes on a scale rarely encountered in other parts of the world. Floods and breaches of dams have changed the course of rivers, droughts and famines have threatened the life and livelihood of millions of people. The two great river systems (the Yangtse and the Yellow River) have repeatedly wiped out all or large parts of the population of villages and cities and affected thousands of square miles. Calamities of this kind are usually explained as the outcome of a combination of many factors, such as a highly variable rainfall, a vulnerable topography and specific soil conditions,[2] population pressure, and migrations[3] with the corresponding extension of agriculture and, finally, the corruption of a bureaucracy in charge of the construction and maintenance of dykes and water conservancy systems.

2. The loess soils in Northwest China are particularly vulnerable to water erosion and give rise to the deposit of silt in the lower ranges of the river thereby increasing both the frequency and height of floods.

3. These migrations to new lands were made possible by the selection of early ripening although less yielding varieties of rice with shorter production periods and other suitable crops (sweet potatoes, potatoes, maize, peanuts) which made crop rotation possible, enabled multiple cropping and harvesting before the annual midsummer floods. *Cf.* Ho Ping-ti, *Studies on the population of China 1368-1953*, Cambridge, 1959.

While all these factors are significant they have to be seen in the perspective of the evolution of China's agriculture before the establishment of the People's Republic. In other words, it is not sufficient to enumerate a multitude of factors responsible for the repeated calamities; what is needed is a historical and analytical examination of the reasons why China's economic and political system had reached an impasse which her institutions were unable to overcome and which made her agricultural economy highly vulnerable to natural catastrophes. In accounting for this impasse in the oldest civilization with a continuous political history we rely on the analysis of Gourou[4] and Wertheim[5] who not only raised the issue at a very early date but offered practical suggestions for a course of remedial action parts of which the People's Republic seems to have adopted from the very beginning.

As early as 1948 Gourou contrasted the intensive use of alluvial plains and river valleys in China with the practical non-utilization of hilly areas and slopes. 'Chinese peasants, who cultivate so little of their country, generally exploit the plains and valley floors and neglect hills and mountains. The typical Chinese landscape presents a contrast between intensively cultivated alluvial land and practically unused hills covered with tall grass and thickets.'[6] In fact throughout her long history China has concentrated its agriculture in those areas which could be cultivated with existing highly specialized irrigation techniques thus permitting the application of traditional methods of production and the transfer of institutions and modes of living to newly occupied lands. The outcome was the gradual evolution of a system of intensive agriculture without mechanization which neglected cattle raising on slopes and the systematic utilization of its forest and horticultural resources (as in Switzerland and parts of Central Europe). The result was a system of intensive agriculture which gave the Chinese landscape an appearance of a 'gardening agriculture' and accounts for the fact that China has the highest rate of inhabitants sustained per cultivated square kilometer (600 against 320 in Great Britain and 110 in USA).[7] In other words the Chinese peasantry seemed to have concentrated on the most easily available land (the best or low cost land in Ricardo's sense) and neglected the utilization of slopes and hill tops which were increasingly exposed to erosion through deforestation. Clearly a case of specialization in harmony with the classical theory

4. Pierre Gourou, 'Notes on China's uplands', *Pacific affairs*, 21 (3), 1948, pp. 227-228.

5. W. F. Wertheim, 'The better earth', *Comprendere*, 19, 1958, pp. 103-109. See also S. D. Richardson, *Forestry in Communist China*, Baltimore 1965, and Engelborghs-Bertels, *op. cit.*

6. Gourou, *op. cit.*, p. 228.

7. According to Richardson, *op.cit.*, p. 5 (quoted from Engelborghs-Bertels, *op.cit.*, p. 120.)

of the division of labor which failed to consider the social cost and the environmental damages and risks caused thereby.

While this expansion of agriculture must have appeared as a 'rational' procedure at the time and went, of course, hand in hand with the extension of irrigation works in the plains and river valleys it laid the basis for a socially harmful overconcentration on the production of cereals and tubers and a corresponding dependence on vegetable materials as well as an excessive concentration of population in the cultivated area. In actual fact 'Chinese civilization . . . thus arrived at an impasse: it has created an excessive density of rural population – excessive, because it is incompatible with a decent standard of living – which hinders agricultural development and, thus, an improvement in living standards'.[8] It was this overspecialization and lack of diversification of agricultural production which together with the resulting concentration of economic control over land and employment in the hands of a small group of landowners was the reason for the vulnerability to natural catastrophes and the general stagnation of the Chinese economy – a stationary and underdeveloped economy and a sick society which kept the Chinese masses at 'the zero degree of life'.[9] This 'zero degree of life' plunged one quarter of mankind 'into a nightmare existence of hunger and impoverishment'. These were the days when millions died from cold and starvation, and 'when the peasant who survived did so by eating roots and grass and selling the children he could not feed. The point reached by the great majority of China's people was the level of mere survival, a subhuman level far below anything ever experienced in the West in the darkest and hungriest days of the Great Depression'.[10] This marginal quality of life for the rural masses which was a 'life always on the knife edge of starvation' was the outcome of an undiversified and highly seasonal agricultural system with its inevitable under-employment or unemployment' . . . in which 'the landlord group . . . through its control of much of the country's arable land, possessed the power of life and death over the peasant'.[11]

Thus the impasse of China's agriculture was the result of the fact that the existing institutional set-up together with the domination by foreign powers prevented any possibility of changing or adapting an overspecialized system of production with a view to overcoming its stagnation and lack of diversification. Any large-scale modernization of China's industries particularly if the latter were to adopt modern highly mechanized methods

8. Gourou, *op.cit.*, p. 234.
9. The title of Tsang K'o-chia's bitter poem on 'A society where man eats man', translated in Kai-yu Hsu, *Twentieth century Chinese poetry: An anthology*, New York, 1963, p. 290.
10. Keith Buchanan, *The transformation of the Chinese earth*, London, 1970, p. 96.
11. *Ibid.*, p. 115.

of production were out of the question. Nor would mechanized farming on a cooperative basis have offered any solution, at least not in the short run. On the contrary, it would have increased underemployment and seasonal underutilization of China's most abundant factor of production. Was there a way out of this impasse? Some Western observers of the Chinese crisis had long been convinced that if there was a way out it would call for radical institutional changes in the land tenure system and far-reaching social reforms and that all measures which dealt only with symptoms were condemned to failure from the very beginning. Even Gourou who *on the eve* of the final overthrow of the Kuomingtang Government advocated large-scale reafforestation as 'the primary improvement scheme' in order to lessen the overspecialization of Chinese agriculture regarded such schemes in view of their implications both at the economic and the institutional level as 'highly speculative, if not phantastic, in nature. The importance of the forces in question is staggering. Success in this field would require a continuity of perspective and a freedom of action which are perhaps not to be found in the range of human capacities'.[12] What actually happened after the final overthrow of the Kuomingtang Regime was, however, something even more far-reaching than Gourou had advocated. The change of the political and social structure of the country opened the way to a 'Transformation of the Chinese Earth'. This is not to say that the Chinese peasant is no longer making a garden out of his grain field – as Gourou put it – but Chinese agriculture has been changed in the direction of greater diversification and less specialization. Large-scale reforestation has been one of the important elements of this change but it has not been the only one. In addition, there have been far-reaching measures of land and water conservancy, regional development and the creation of local industries, the provision of dependable although probably not sufficient supply of water; an improvement of public hygiene and measures of raising the level of public health through preventive medicine. This transformation of the natural and social environment has been accomplished within the context of a comprehensive plan of social transformation which was given top priority at a very early stage of China's economic planning even before the traditional 5-year-plans were elaborated. In fact, their long-term objectives explain why these plans and projects transcended even the scope and length of the traditional 5-year-plans. However, it is important to emphasize that the creation of new water control and irrigation schemes and comprehensive large-scale multipurpose river basin as well as reforestation projects and the establishment of state farms for the colonization of frontier regions such as Singkiang and Inner Mongolia are prepared and carried out under central auspices of ministries in Peking. Since 1960 central (state) autho-

12. Gourou, *op.cit.*, p. 236.

rities seem to reinforce their control over this sector while they have tended to decentralize the economic and political process since 1958. The Chinese government emphasizes the necessity of large-scale comprehensive plans in the field of irrigation and afforestation and rejects a policy of small irrigation projects as ineffective, inefficient and detrimental.[13] Needless to add, however, that as is generally the case in China, regional, provincial and local authorities and the communes have retained important functions both as far as the implementation and the elaboration of these plans and projects are concerned. We shall come back to these general aspects of Chinese planning in a later stage of our discussion.

a) *Land and water conservancy; Afforestation*

It is not our purpose, within the present context, to give a detailed account of all aspects of China's policies of land and water conservancy and of the measures which have brought about a 'Transformation of the Chinese Earth'. Only the general direction and principles of this policy of environmental control as part of a long-term development plan will be outlined briefly.

In its choice of techniques and selection of objectives the People's Republic has doubtless built upon earlier practices of water 'management' such as the construction of dykes and flood-retarding lakes on both flanks of the rivers with a view to diverting their flow and utilizing the stored water for irrigation by channelling it through canals and distributaries to areas without or with inadequate water supplies. Even the reclamation of marginal and submarginal land either through drainage or the construction of terraces is an old Chinese practice which antedates the establishment of the Chinese People's Republic.[14] Communist China has developed these traditional policies by supplementing these techniques through large-scale projects such as multipurpose river development schemes, afforestation projects, the construction of terraces in mountainous and hilly areas, the establishment of state farms for the colonization of border territories, intensive plant research, etc.

During the period of 1952 to 1957 considerable attention was given to the construction of large and small-scale irrigation works (dams, reservoirs, deep and shallow wells) in order to increase the cultivated area under irrigation. The Yellow River development scheme alone called for the construction of 46 dams in the river itself and of 24 reservoirs as well as the establishment of terraces in adjoining regions of the tributary rivers with a view to controlling the regular floods and to increasing the irrigated

13. Engelborghs-Bertels, *op.cit.*, p. 122.

14. In fact, evidence of this impressive technology of water conservancy and land reclamation can be found also outside the area of China proper in South-East Asia where Chinese migrations or cultural influences have left their traces.

cultivated areas within the basin and in order to provide electricity to isolated agricultural communities.[15] The Yangtse River project was designed to divert 142 million m^3 of water from its upper reaches with a view to supplementing the water supply of the Yellow River whose deficit of water was estimated at 470 million m^3. For this purpose the plan called for the construction of canals extending over 1600 to 6800 km across very difficult and uneven terrain.[16] A second phase of China's agricultural policies starting with the 12 year agricultural development plan based upon the principles worked out by a Commission of Experts of the Academy of Sciences and agronomists of the Ministry of Agriculture stressed the need to improve the quality of agricultural inputs with a view to raising yields rather than extending the development of new areas. This phase was accompanied by a political and educational campaign stressing improved techniques which was later taken up by the Cultural Revolution. While the effort to improve the quality of agricultural inputs was not abandoned the Cultural Revolution emphasized the need for a socialist education of man as the most strategic and 'precious' element in China's reconstruction. During this period begins also the systematic afforestation which the agricultural plan of 1956 had already outlined and an extension of the area for pastures and horticulture. The objectives of the afforestation schemes are not only, as is sometimes believed, the protection against the silt laden sand storms from the Northern deserts, climatic improvements and the creation of green belts (important in urban areas in order to improve the quality of the air through the creation of 'lungs' of the city) but also of building up forest reserves for present and future industrial purposes (such as pulp for paper, props for mines and railroads, timber for construction, fuel, etc.)[17] and the creation of the necessary habitat for game and fur-bearing animals in the North East. Needless to add the planting of fruit trees also serves direct consumers' needs. In short, the afforestation and fruit tree planting schemes are part of a long-term policy of environmental protection and improvement with direct benefits for the Chinese economy and the consumers.

The implementation of this policy of environmental protection and improvement as a part of the economic plan of the People's Republic does

15. Engelborghs-Bertels, *op.cit.*, p. 120. See also Teng Tse-hui, *Report on the multipurpose plan for permanently controlling the Yellow River and exploiting its water resources*, Peking, 1955. *Cf.* also Ministry of Irrigation and Power (India), *A visit to River Valley projects in China*, New Delhi, 1954.

16. For further details and particularly the difficulties caused by the withdrawal of Soviet technicians and the current state of completion see Engelborghs-Bertels, *op.cit.*, p. 121 *ff.*

17. Richardson (*op.cit.*, p. 170) cites the *People's daily* (24 April 1958) as source for estimates that industrial and fuel requirements amount to 150 million m^2 annually whereas the annual cuttings furnish only 40 million m^2. See also Engelborghs-Bertels, *op.cit.*, p. 124.

not rely on capital intensive technologies but is being carried out by the large-scale mobilization of human labor which in turn was greatly facilitated by far-reaching institutional reforms. While it is true that the mobilization of peasant labor has a long history in Chinese agriculture, the large-scale environmental improvement schemes in Communist China went far beyond the earlier water and irrigation works constructed and maintained over the centuries. Their implementation exceeded the capacity of small groups of peasants.[18] Neither individual peasants nor even the production brigades nor the early cooperatives could have developed the necessary 'pre-investments' for such an agricultural infrastructure. Only the Communes were sufficiently large and adapted to provide the basis for the necessary mobilization of large numbers of agricultural labor required to implement a policy of development and planned change of the natural environment. Even so it was only after many errors, repeated shifts and considerable upheavals as well as systematic experimentation[19] particularly in the field of education and political mobilization that it became possible to enlist the participation of large masses of peasant families necessary for putting these environmental policies into effect.

The benefits of transforming the Chinese earth can be illustrated in real or physical terms: According to Chinese data recorded by Edgar Snow[20] Communist China has built (in 12 years) more than a million small reservoirs and ponds and dug nine million wells. New canals and storage basins have increased the irrigated area by 120,000,000 acres. Large dams, reservoirs and lakes (extending to 194 miles in the case of San Men in the Yellow River basin) have increased China's irrigated area and energy capacity; they coordinate water storage with flood control and have helped to increase China's electric power capacity (to 110 million kwh for isolated communities in the case of the Yellow River system alone). As far as the afforestation and orchard planting schemes are concerned which, as we have pointed out, are in themselves multipurpose projects, Snow refers to a forest belt stretching for 360 miles in

18. Foreign experts in prerevolutionary China have been aware of the fact that farreaching social changes were needed in order to bring about an improvement in China's agricultural conditions. '... nearly everywhere technological change proved impossible without fundamental institutional change; ... indeed without social reform, the peasant could not take advantage of improved methods and his position actually deteriorated'; from Report of the Joint Chinese-American Committee on Rural Reconstruction quoted in M. C. Wright, 'Modern China in transition, 1900-1950', *The annals of the American academy of political and social science*, vol. 321, 1959, p. 5.

19. For an account of the type of experimentation and adaptation needed to bring about the necessary change of attitudes in the earlier phases of agricultural reconstruction, see William Hinton, *Fanshen: A documentary of revolution in a Chinese village*, New York, 1968.

20. Edgar Snow, *Red China to-day*, New York, 1970, ch. 61 and 62.

Northern Shensi and another tree belt more than half completed over a length of 720 miles. All over China more than 51,000,000 ha – an area twice as large as Great Britain – has been tree-planted and reforested between 1949 and 1960. A protective ring of forests around the deserts is being planned by means of a series of local projects which extend over a length of 1200 km in Manchuria, another in Northern Hopei traversing Inner Mongolia up to Shensi, a third extending over 600 km going from Shensi to Kansu and a fourth extending over 1600 km bordering the Tengri desert.[21]

The environmental and development policies based upon multipurpose regional development projects have led to the regularization of river flow, the reduction of the frequency and level of floods, the preventing of catastrophic destruction and loss of life; they have also stabilized agricultural yields. Formerly unused land, particularly in the upland regions has been brought under cultivation by the levelling of land and the building of terraces; the digging of shallow and deep wells and the construction of irrigation ditches has permitted the extension of irrigation and the systematic conversion of eroded slopes into tiered level fields capable of carrying crops[22] and has reduced or eliminated erosion and silting. In addition, there has been a diversification of land use and agricultural output through the planting of fruit-trees, the development of a live-stock and dairying industry[23] providing not only increasing employment throughout the year but at the same time broadening the nutritional base leading to an improvement of public health, the dissemination of rural industries concerned with the manufacture and repair of farm tools and machinery, brick and tile making and the processing of agricultural products.

The lack of data and regional differences preclude any estimates of the relative over-all importance of these rural industrial activities and their employment effect. But there can hardly be any doubt that even if

21. Richardson, *op.cit.*, pp. 122-123. For some of the errors and shifts of policies in the field of afforestation such as inadequate maintenance, forest fires, illegal cutting, wrong choice of (dry) sites and ill-adapted species, *cf.* Engelborghs-Bertels, *op.cit.*, pp. 125-126.

22. Keith Buchanan, 'Reshaping the Chinese earth', *Eastern horizon*, 5 (2), Nov. 1966, p. 29. 'Irrigation ditches are needed not only for irrigation but also for drainage, for one problem . . . is the accumulation of alkali in or on the surface of the soil and this can be countered only by careful integration of the irrigation and drainage systems.' *Ibid.*, p. 30.

23. Detailed data concerning the extent of cattle raising and breeding do not seem to be available. Earlier reports (by Wertheim, 1958) leave the impression that this weak spot of Chinese agriculture may still be neglected. 'The cattle are either left free in the hills or kept in stables. Meadows enclosed by barbed wire are not yet within the scope of Chinese rural society. The peasants of Southern China are, for the time being, paying more attention to pig and poultry raising, which does not call for supplementary land'. Wertheim, *op.cit.*, p. 5.

these activities are not as 'profitable' as they might have been had they been established in the industrial cities of China, they did help to prevent the exodus of the rural population to the cities. Rather, small industries were established where the labor force was, that is in the rural areas and the inverse flow of labor to the urban centers was reduced.[24]

The real costs of this transformation of the Chinese landscape must have been substantial and it is doubtless correct that the hours of human and animal labor necessary to wrest one day of sustenance from the soil are still high in China particularly in the marginal areas. However, while still austere, life has a security never known before.[25] There are apparently no aggregate data available as to the monetary costs involved in this transformation of the Chinese natural environment and it is doubtful whether such data would make much sense as a measure of costs. However, it is of interest to learn that one Commune had 'invested' in irrigation, terracing and levelling half a million men days each year since 1958, while at Tachai the creation of one acre of terraced land from the eroded hill-country farmed by the Brigade called for 1200 to 2400 man days. At the same time whereas agricultural employment during the 1950 was highly seasonal and wasteful (not more than 100 days per year), in the eroded uplands of the Tachai Brigade, today's average employment is said to have tripled to ca. 300 days per year in spite of a considerably increased total population.[26]

Of course such data raise questions of 'efficiency' and 'economic rationality' of which the Chinese leadership is not unaware. However, before taking up these fundamental issues we propose to proceed with our outline of the major fields in which Chinese development policies have been concerned with the protection and improvement of the environment.

b) *Regional development and location of industries*

To some extent the transformation of the Chinese Earth described in the preceding section is part of a policy of regional development. It aims at the creation of areas of stable yields protected against natural disasters and environmental disruption. At the same time it reflects a policy of national security based upon a nation-wide strategy of self-defense (in

24. W. Leontief who visited a commune at a distance of 200 km from Shanghai reported (in 1972) that small rural industries (baskets, fertilizers, agricultural machinery and electric bulbs) employed 25% of the available labor force and provided 50% of the total employment (*Le Monde*, Dec. 5, 1972). It would be difficult to deny the economic rationality of this policy of rural industrialization particularly if we contrast it with the social costs and environmental disruption of some of the urban agglomerations in other countries of Asia.

25. Keith Buchanan, 'Reshaping the Chinese earth', *Eastern horizon*, 5 (2), Nov. 1966, p. 29.

26. *Ibid.*, p. 30.

case of foreign attack) by creating regional centres of self-supporting, decentralized social, economic, governmental and administrative units.[27] The First Five Year Plan (1955) had already enunciated a policy of economic decentralization of industry in contrast to the inherited traditional pattern of concentrating productive facilities in a few coastal cities. The purpose of this policy was 'to avoid overconcentration of enterprises and to bring about a suitable measure of decentralization'.[28] By bringing industrial production close to raw materials and fuel and also to markets the plan aimed at improving gradually the economic level of backward areas and strengthening the potential of national defense.

This policy of regional development also corresponds to an early socialist idea of reducing the difference between town and country. As a result of this policy it has been possible to avoid some of the high social cost of urbanisation characteristic of the chaotic growth of many Western and Asian cities. The implementation of this policy has been relatively simple within the framework of national planning: During the First Five Year Plan 472 out of 694 large projects were located in the interior.[29] Considering contemporary Western and Asian experiences with urban concentrations as a major contributing factor to the degradation of the environment and the quality of life it would appear that China's emphasis on decentralization has been a wise and rational decision quite apart from the fact that Communes of a 100,000 people constitute a valid economic alternative both to urban industrial centers with several millions inhabitants and the small-scale peasant economy.

c) *Water supply and public hygiene in rural areas*

The lack of sufficient and safe drinking water particularly in rural areas constitutes a serious problem in many underdeveloped countries in Asia. China was no exception. The rural population depended upon drinking water without prior treatment; in arid areas drinking water often had to be carried over considerable distances (from wells). Hence the provision of easily available safe drinking water is a major improvement of the quality of life for the rural population. In contrast to many underdeveloped countries in which little attention has been given to the solution of this problem, China has carried out extensive water well improvements in rural and urban areas since the early days after liberation. In 1958 the first simplified village water supply station was established outside Tient-

27. This concept of the Commune as a basic economic and administrative unit differs from the Soviet Model of collectivization; it goes back to ideas first formulated in 1958. *Cf.* 'Several special characteristics of the People's Commune, 1958' quoted by Han Suyin, *China in the year 2001*, New York, 1967, p. 45.

28. Quoted by Yuan Li-wu, *The spatial economy of Communist China*, New York, 1967, p. 16.

29. *Economic and political weekly*, vol. VI, Annual No., 1963, p. 157.

sin. Water from this station is said to reach the standards of drinking water established by the government. Other cities (Peking, Shanghai) followed this example and the demand for clean water for drinking and domestic use has been increasing. 'Building these simplified running water supply systems will result (in) clean drinking water for the vast groups of peasants. Various kinds of diseases that spread through water are thus effectively prevented.'[30]

Directly related to the improvement of living conditions in rural areas has been a more critical attitude towards the traditional use of human excrements as manure and sewage water for the irrigation of rice fields which led to the contamination of underground water resulting in the spread of parasitic diseases. This problem has been the subject of scientific research in the epidemiological departments in 18 major cities and municipalities since the Scientific Planning Committee of the State Council ordered such studies to be undertaken in 1958.[31] The results of these studies indicated that 'under certain responsible conditions' including the introduction of certain fish [carp?] and the planting of duckweed, the self-purification of sewage water was greatly increased and oxygen consumption, floating matter and bacterial content in sewage water could be greatly reduced after five days; the breeding of mosquito larvae was reduced. It should be noted that this type of research which led to the drawing up of 'health regulation in the utilization of sewage water for irrigation'[32] goes back to the late fifties, i.e. to a time when other less developed countries were hardly concerned with water pollution and purification for irrigation purposes.

d) *Working conditions and community hygiene*

Working conditions for the great majority of the Chinese population have been marked by serious inadequacies and deficiencies in the past. Factories as well as housing were notoriously unsanitary and unhealthy. Laborers worked long hours under unsafe conditions and the lack of sanitary facilities caused widespread endemic diseases; child and women labor was common and so were accidents and occupational diseases. As a first step to deal with these social aspects of the quality of life China followed the example set by the Soviet Union. Apart from the formal introduction of the 8 hour working day and equal pay for equal labor for men and women China issued a body of social legislation which was modeled on the Soviet system of labor protection.

30. Wang Te-P'u et al, 'China's major scientific and technical achievements in community hygiene in the past decade', *People's health*, 1 (10), October 1959 (J.P.R.S. 2745, p. 25).
31. *Ibid.*, p. 25.
32. *Ibid.*, p. 26.

Several scientific institutes of Industrial Hygiene and Occupational Diseases were set up in central urban areas (e.g. in Tientsin, Shanghai, An-shan and Peking) in order to undertake the necessary research for the analysis of major industrial and occupational health risks and the elaboration of effective methods of preventing industrial hazards and of adequate labor standards, rules of inspection and enforcement and the training of the required personnel.[33]

These measures of Industrial Hygiene covered a wide range of health hazards and occupational diseases from silicosis and industrial poisonings such as lead, benzine, manganese, zinc oxide, etc. and even of insecticides (before 1959). However, the research conducted was not confined to general studies in toxology and chemical diagnosis; it included work on treatment, as well as remedial measures to be adopted in factories including the exploration of alternative techniques of production and substitutes in order to replace the use of noxious materials in industries and finally the development of improved detection instruments.[34]

Industrialization during the first decade since the founding of the Chinese People's Republic was, of course, accompanied by the growth of old and the establishment of new cities. From 1952 to 1957 the number of 'cities' in China is reported to have increased from 157 to 287. The selection of industrial sites within these cities and the sites of the cities themselves is said to have taken place according to health requirements and principles of functional zoning. Thus, in new and expanding old cities, factories were built on sides opposite to the prevailing wind direction; they were located down-river. 'Peking, Shanghai and Wuhan areas . . . have relocated their factories with toxic productions to the new zones planned for industries.'[35] Such prior planning was extended also to rural districts and to peasant Communes. Research conducted by the China Academy of Medical Sciences and the Peking Epidemiological Station led to proposals

33. E.g. The 'Statue of labor insurance and labor protection' (1951). The Ministries of Labor and Health issued several rules and regulations on an experimental basis such as the 'Factory safety and sanitation regulations', 'Regulations governing the safety measures in construction, installation industries', 'Rules on reporting injury and accidental death of workers and staff' and the 'Temporary standards of hygiene in factories and mines' (1952/3).

34. Liu Shih-chieh *et al*, 'Major achievements in labor hygiene and occupational disease control' in collection of papers on medical science in commemoration of the 10th anniversary of the founding of the People's Republic of China in *Preventive Medicine*, vol. I, Peking 1959, pp. 407-413 (JPRS 9551, 1961) and Liu Shih-chieh *et al*, 'China's major achievements in industrial hygiene and in the prevention and treatment of occupational diseases during the past decades' in *People's health*, 1 (10), Oct. 1959, pp. 896-903 (J.P.R.S. 2745, 1960). This latter article records also % data relating to the success of preventive measures in 19 national factories in Shanghai during 1958/1959, *Ibid.* p., 13.

35. *Ibid.*, p. 17. See also 'Industrial development and pollution control', *China reconstructs*, February 1973, pp. 2-3.

and the adoption of standards (in physical terms) for housing, for indoor temperatures, ventilation, height limits in rooms which have served as guidelines for planning departments. The cities of Peking, Shanghai and Mukden are said to have relocated all factories which were seriously contaminating the atmosphere to the countryside.

e) *Public health and preventive medicine*

Measures designed to prevent diseases and improve public health are an important part of Chinese policies of improving the quality of the human environment. Apart from the provision of water and measures of public hygiene in rural areas and the improvement of working conditions, China has embarked upon a program of public health protection and preventive medicine as one of the goals of her development planning.

A Ministry of Public Health was established as early as 1949. A 'Patriotic Health Movement' was started in 1952. In 1956 the government launched a campaign for the eradication of the 'four pests' and communicable diseases as part of an agricultural development program. It is important to emphasize that these campaigns too, were preceded by scientific surveys and research carried out by universities and provincial anti-epidemic stations. The purpose of these surveys was the identification of the major and most frequent diseases in various parts of China and of the most important sanitary and-medical deficiencies; they also served the purpose of exploring and defining the most effective ways and means of controlling and preventing diseases. Thus, the campaign for the eradication of the four pests (rats, flies, mosquitoes and bedbugs) served the double purpose of eliminating or reducing the number of carriers of contagious diseases and of setting up 'a vehicle for health education and a machinery for the dissemination of health propaganda in both urban and rural areas'.[36] These campaigns which were actually seasonal shock attacks designed to enlist mass participation were preceded by the training of manpower for health services including rural health centers for the provision of medical care adapted to local conditions. These health centers were responsible for all health activities of the commune and adjacent areas. 'Their major tasks included responsibility for out-patient and regional health work; the direction of mass campaigns; the investigation and control of contagious diseases; the inspection of public mess halls, nurseries, kindergartens and maternity hospitals; the delivery of medical care; and responsibility for all preventive work. By 1965, all of China's 2000 counties had at least one health centre or hospital'.[37] A special feature of these health campaigns was the enlistment of 500,000

36. Susan B. Rifkin, 'Health services in China', *Bulletin* (Inst. of Development Studies, University of Sussex), 4 (2/3), 1972, p. 34.

37. *Ibid.*, p. 35.

practitioners of traditional medicine and an attempt to combine traditional and modern medicine as well as the transfer of (even highly trained) medical personnel to the countryside for short periods of time. The latter had the specific task of training local para-medical personnel in order to enable them to treat the most frequent diseases of the region, or to refer more difficult cases to the nearest hospital. Part time schools were organized in the villages as well as local health services and mobile medical teams. In addition, these auxiliary workers (the socalled 'barefoot doctors') and the mobile health units also are responsible for the organization of health education and birth control and general sanitation programs including the improvement of the quality of drinking water.[38] The emphasis on rural medical work was an early feature of Chinese efforts in public health and preventive medicine. However it seems that these efforts tended to slacken in the course of time in favor of more capital intensive health programs in urban areas.[39] They were revived during the Cultural Revolution under the pressure of President Mao's personal initiative:

> Tell the Department of Public Health that it serves only fifty per cent of the population of the country. These fifty per cent consist of gentlemen; the broad peasant masses have no medical care – neither doctors nor medicine. The Department of Public Health does not belong to the people; it should be renamed the Department of Urban Public Health, Gentlemen's Public Health, or City Gentlemen's Public Health. Medical education should be reformed, because there is no need to read so many books ... Indeed the focus of medical and public health work should be transferred to the villages.[40]

In view of the continued inadequacies of rural health systems two further innovations were introduced: a cooperative medical system at the level of the commune calling for fixed contributions on the part of individual members of the production brigade and the provision entitling the patient to treatment and medicines at minimal costs and the sending of military medical teams into the countryside.[41]

The effectiveness of Chinese measures of public hygiene and preventive medicine cannot be ascertained in terms of medical care and health data. However, there is some indirect evidence to the effect that Chinese preventive medicine has indeed been rather effective. According to

38. *Ibid.*, p. 36/37 and Joshua Horn, *Away with all pests,* London, 1969, pp. 130-134. The transfer of urban medical personnel to the rural areas as members of mobile medical teams is said to be 'a permanent long range goal ... with one third of all urban medical people in the rural areas at any given time.' Susan B. Rifkin, *op.cit.*, p. 37.

39. *Current scene,* May 1, 1968, June 15, 1969 and December 15, 1969.

40. Jerome Ch'en (ed.), *Mao papers,* Oxford, 1970, pp. 100-101.

41. 'By June 1969, the Army had sent more than 4000 teams and 30,000 men into the countryside. In the one-year period ending July 1970 they had sent 6,700 teams with 80,000 members for rural health work.' Susan B. Rifkin, *op.cit.*, p. 37/38.

Western experts and more recently according to Chinese sources, China seems to have brought VD under control. Before 1949, 5% of China's urban population and 1-3% of the rural population had contracted syphilis – spread primarily by prostitutes. The first step consisted in banning prostitution. All brothels were closed and prostitutes were not only treated sympathetically but helped to find jobs and husbands. Great efforts were made by health authorities to identify symptoms and to have those who had contracted the disease tested by doctors and paramedics trained in diagnosis and treatment (including even door to door checks in urban areas!). Hand in hand with these medical efforts went a policy of public education using posters, radio-performances of one-act plays and the holding of public meetings. In this way VD was effectively controlled.[42] According to Sidel, 'there is evidence that the change in living conditions and the work of health-care teams have so reduced the incidence of malnutrition and of infectious diseases like small-pox, plague, cholera, typhus, and malaria that cancer and cardiovascular diseases are now the major causes of death in large cities in China, as in most Western countries.'[43]

f) *Measures against pollution*

There is no doubt that China has experienced the negative effects of industrialization in the form of water and air pollution. While over-all studies are lacking specific evidence of air and water pollution appears in the relevant literature and indirect evidence is available in the form of the current discussion of the causes of pollution and of appropriate measures of pollution control.

For instance there is the case of the Liaogan Chemical Plant in Shanghai which in 1949 employed 160 and in 1972 employs 2,700 workers and produces as much caustic soda in 3½ days as it produced in the entire year 1949.

As production expanded, wastes also increased until as much as 10,000 tons of water containing chemicals was discharged daily into Soochow Creek. The factory's exhaust poisoned the atmosphere with chlorine and vinyl chloride gases. The plant was rated as one of the factories in the vicinity causing the most harm to the environment.[44]

42. Horn, *op.cit.*, pp. 87-88. Dr. Victor Sidel of New York's Montefiore Hospital said after a recent visit to China: 'The evidence we were given was indirect – that the Chinese have given up premarital checks and tests of pregnant women for VD because the incidence was so low – but it supports the view that VD has indeed been eliminated', 'How China wiped out VD', *Newsweek*, 1972, p. 36, see also Edgar Snow, *Red China today*, *op.cit.*, pp. 27-30.

43. 'Medicine in China', *Medical world news*, pp. 51-62, Jan. 14, 1972, quoted from *Environment*, 14 (5), 1972, p. 39. *Cf.* also 'La Chine Populaire a éliminé le choléra, la variole et les maladies vénériennes', *Le Monde*, Aug. 9, 1972. (Interview with Dr. Chen Hai-feng, Ministry of Public Health, Peking).

44. 'A chemical plant fights pollution', *China reconstructs*, June 1972, pp. 11-13.

Likewise air pollution is a matter of concern particularly in the large industrial centers and cities. Its effect has been studied in considerable detail at least in some locations. Thus, 'a clinical examination of school-children conducted as part of an investigation on the effects of atmospheric contamination on the health of people living near the Shih-ching-chan steel and iron factory in Peking revealed definite liver enlargement which was attributed to the toxic effects of the small amount of sulphadioxide in the atmosphere'.[45] Results of studies

> in various places indicate that the atmosphere of inhabited areas is seriously contaminated by industries and enterprises ... In Mukden, e.g., with T'ieh-hsi industrial district as the center, investigations on the atmospheric contamination of the surrounding areas were carried out. The dust and sulphadioxide content of the air was determined. It was found that the average early dust fall in T'ieh-hsi industrial area (with a smelting factory as the center point) was about three and a half times higher than that in the control district. The day and night average concentration of sulphadioxide was nine times that of the control. In Fushun, determinations of dust and sulphadioxide were made in the inhabited district around the powerhouse. Similarly, it showed that dust could travel a distance of 1,500 meters from the source of contamination.[46]

We have already dealt with the prevention of water pollution in connection with the provision and improvement of drinking water from wells and the use of sewage water for irrigation purposes. In addition, efforts have been made to protect the sources of water against pollution by dredging rivers and lakes and by building underground sewage systems and water treatment plants to prevent contamination from industrial plants. As in other cases, surveys and research provided the basis for the anti-pollution measures. Water sampling tests, chemical (bacteriological) analysis and studies of the carrying and self-purification capacity of specific rivers as well as prevailing diseases among the inhabitants were carried out in Peking and Tientsin and Kansu Province as far back as 1954-56.[47] No precise evidence seems to be available as to the effectiveness of the practical steps taken during these early phases of water pollution control measures; however, the relevant literature contains general statements to the effect that 'pollution of water sources by sewage water from everyday living and from industries has fundamentally been prevented'.[48] Additional data on air pollution are not available which may be an indication that air pollution is either not yet an acute problem or that its elimination encounters greater difficulties.

45. Wang Te-p'u *et al., op.cit.*, p. 20, quoted from Leo A. Orleans *et al.*, 'The Mao ethic and environmental quality', *Science*, vol. 170, Dec. 1970, p. 1175.
46. *Ibid.*, p. 19.
47. Wang Te-ching *et al., op.cit.*, pp. 5-9 and Wang Te-p'u *et al., op.cit.*, pp.22-27.
48. *Ibid.*, p. 25.

2. GUIDING PRINCIPLES OF CHINESE ENVIRONMENTAL POLICIES

The foregoing outline of China's major environmental problems is anything but complete. There are other environmental issues (e.g. noise and garbage disposal) which are being investigated in China. However, our exploration of China's major environmental problems provides a sufficient background for an analysis of the principles which seem to guide her environmental policies.

Perhaps the most fundamental point to be made in this context is that in contrast to Western approaches Chinese policies are based upon an explicit recognition of some of the institutional causes of environmental disruption. In addition, there is a specific way of looking at 'waste' which supports the principle of a comprehensive use of resources with a view to 'turning the harmful into the beneficial'. Finally, the Western student of Chinese environmental policies is impressed by a concern for man as the human factor of production in the sense of man as an end and not as a means. Chinese literature is full of references to 'people as the most precious element', and even sceptical Western readers cannot help feeling that the policies aiming at the improvement of the quality of life through land and water conservancy and China's stress on agriculture as the foundation of economic development as well as her early emphasis on problems of community hygiene have been oriented toward and centered around the satisfaction of essential human needs. China's priorities and her general approach to development planning seem to give human life and human survival and the quality of life a value which they do not always have in other developing and even developed countries.

a) *The Chinese interpretation of the causes of environmental disruption*

Chinese official pronouncements have repeatedly stressed that the institutional framework and the system of enterpreneurial accounting must be regarded as the main cause of environmental disruption:

> Under the capitalist system, because the capitalists seek enormous profits and because of severe anarchism in production, large quantities of waste liquid, gas and slag are allowed to pollute the air and rivers, drain into farm land, affect the people's health, damage marine resources and harm agricultural production. In the United States, Japan, in many other capitalist countries, industrial wastes have become insurmountable nuisances in society and unsolvable political problems for the ruling class, causing growing dissatisfaction and objection on the part of the working people.[49]

49. Hua Ching-yuan, 'In multipurpose utilization of materials, it is necessary to promote what is beneficial and eliminate what is harmful', in *Red flag* and reprinted in *People's daily*, September 7, 1971, p. Bl. (Peking Domestic Service, September 6, 1971, translated). At the Stockholm Conference this emphasis on the institutional factor as the main cause was further elaborated by pointing to 'mono-

For these reasons, incidentally, the Chinese consider it impossible to eliminate environmental disruption and its social costs in a capitalist market economy. In opposition to some current Western proposals of slowing down or arresting economic growth, the Chinese insist that conditions in developed and underdeveloped countries differ. Whereas some highly industrialized countries have seriously polluted their own environment and frequently affected that of other countries and have even impaired the environment on a worldwide scale, 'the urgent need for the developing countries at present is to develop their national economy, build a modern industry and a modern agriculture and achieve complete economic independence and, under this prerequisite, to improve their environment step by step'.[50] According to Chinese views it is axiomatic that man's environment is continuously being transformed due to production and the development of science and technology or, in other words, through the 'industrious labor' of man. This radically different position of the Chinese, as compared to the contemporary revival of neo-malthusian views in the West, is reflected in the following passage of China's 10 principles presented at the Stockholm Conference on the Declaration of the Human Environment:

> The history of man has proved that the pace of development of production, science and technology always surpasses the rate of population growth. In the course of social progress and with the development of production, science and technology, mankind can create an ever greater amount of wealth to meet the needs of its own subsistence and development and is entirely capable of improving its environment ever more effectively. It is wholly groundless to hold a pessimistic view in respect to the relationship between population growth and environment conservation. Of course, the natural growth of population will bring new problems to the protection of the environment. But such problems can all be solved if a government truly takes the interests of its people to heart and adopts such correct principles and measures as rational planning for the distribution of urban and rural population in the course of the development of the national economy, appropriate control of the urban population, greater effort to protect and improve city environment and popularization of family planning.[51]

It may come as a surprise to Western readers that the prevention of social costs and environmental disruption has even played a role in the ideological conflict between the 'two lines' advocated by the followers of Mao-tse Tung and those of Liu Shao-chi. In fact, one of the issues in this

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poly capitalist groups which seek superprofits under serious anarchy in production' as the real culprits who 'discharge at will and in disregard of the fate of the people harmful substances that pollute and poison the environment'. *Peking review*, June 27, 1972.

50. *Peking review*, June 27, 1972. (Statement of Chinese spokesman on Draft Resolution at the Conference in Stockholm).

51. *Ibid.*

struggle was apparently the method of economic planning including the formulation of environmental policies. However this is a broad subject which cannot be dealt with here.[52] Within the present context it must suffice to point out that the prevention of the impairment of the environment centers around the elimination of the 'three wastes' (i.e. waste liquid, waste gas and waste slag) within the framework of the production plan. In other words which is the primary task: to fulfil the production plan or to reduce the dangers from the three wastes? Is the elimination of the three wastes a secondary task which can be neglected? Is the elimination of the three dangers (to people's health, industrial production and agriculture) to be considered as an extra burden or a separate problem of secondary importance? In short, what are profits? What are losses? How are they to be determined? This is the specific manner in which the theoretical and practical issue of 'monetary calculation' vs 'economic calculation' is being raised in the Chinese discussion of environmental planning and policy-making. (We shall come back to this point in section 3).

Apparently, prior to the Cultural Revolution some managers and planners considered it as the primary task to fulfil the production plan while the elimination of the three dangers of environmental pollution was regarded as an extra burden which could be neglected or even ignored. They allowed the danger from the three wastes to become serious.

> As a result the waste gas affected the workers' health and corroded the equipment and buildings; cleaning up and disposing of waste slag also consumed a lot of manpower and material and waste liquid flowing into rivers polluted them ... In eliminating the danger from the 'three wastes', some enterprises are interested only in those jobs which require little labor, are easy and yield large profits. Any waste product that is of low value is considered unprofitable and not worth recovering. As a result the 'three wastes' can only take their natural course.[53]

This narrow managerial way of calculating costs and benefits in monetary (micro-economic) terms is now rejected as the road to continued and increasing environmental disruption and to rising social costs. Some of the 'three wastes' may be difficult to avoid but to consider them only within the context of the micro cost-benefit calculation of the individual industrial unit is contrary to the requirements of the people and to the welfare of future generations.[54]

52. For some preliminary Western accounts see Jack Gray, 'The economics of Maoism' in: Dick Wilson (ed.), *China after the Cultural Revolution*, 1969, and John Gurley, 'Capitalist and Maoist economic development', *Bulletin of concerned Asian scholars*, 2 (3), 1970, pp. 34-50 and Leo A. Orleans *et al.*, *op. cit.*, p. 1173.

53. Hua Ching-yuan, *op.cit.*, p. B3.

54. 'Socialist production must serve proletarian politics, and the function of all socialist enterprises must be geared to the entire revolutionary situation, to the requirements of people throughout the country and the welfare of future generations'. *Ibid.*, p. B2.

The 'correct' approach to the problem of measuring costs and benefits can be worked out only on the basis of practical experiences, scientific research and experimentation, as well as the mobilization of the initiative of workers to turn waste products and harmful materials into useful things. In effect, this approach rejects the belief that 'waste is waste' and cannot be turned to positive uses. What is called for is to follow President Mao's dictum: 'In observing a problem, a Marxist usually looks at the whole situation instead of only a part of it'.[55] In other words, the correct answer to the question of what are costs and benefits can be found only by discovering the 'laws' of dealing with and of improving the methods of recovering and re-using the 'wastes' and of eliminating the dangers resulting from the 'harms' by taking account of 'the whole situation'. 'In some cases, judging from appearances, the loss might be bigger than the profit to an individual factory. However, judged from the over-all situation, the profit [or benefit to society] might be bigger than the loss . . . If we are concerned only with petty profits and ignore the major issues, if we pay attention to the present and not to the future, if we only take care of our own unit instead of considering the overall situation and if we exert efforts only in proportion to the amount of [individual] gains expected, we must have been poisoned by Liu Shao-chi's theory of putting profits in command. Instead of eliminating the dangers from the 'three wastes', we may even lead our enterprises into the path of capitalism.'[56]

In other words, according to the Chinese point of view the problem of the 'three wastes' and the elimination of the 'three harms' is not only technically but also economically solvable. But it cannot be solved on the basis of a monetary calculation in terms of market prices (whether actual or calculated) because losses and gains, costs and benefits thus calculated would necessarily be judged from the narrow point of view of the individual factory. The real issue (i.e. the elimination of present and future harms to individuals and society as a whole) would be neglected or underestimated. That is to say for the Chinese planner both the prevention and the elimination of the 'three harms' caused by the 'three wastes' by means of a comprehensive re-utilization of waste materials is at the same time 'an important scientific and technical task' and 'a serious political assignment'.[57]

As far as priorities are concerned the Chinese seem to follow a pragmatic rule according to which it is first necessary 'to grasp the projects which are most harmful and wasteful and to gradually solve the problems of the "three wastes" in each specific trade and unit'.[58] As far as major

55. *Ibid.*, p. B4.
56. *Ibid.*, p. B4.
57. *Ibid.*, p. B5.
58. *Ibid.*, p. B5.

industrial and agricultural projects are concerned and particularly in developing the agricultural chemical industry (fertilizers and insecticides) the medium-sized and small cities and towns must attach importance to protecting farmland and water resources so as not to affect the development of agriculture and fisheries. In so far as damages have already occurred, immediate action must be taken to solve the problem.[59] It is understood that the prevention and/or re-use of the 'three wastes' is also a matter of developing and designing the appropriate capital equipment – a scientific and technical task to which attention must be paid in all industrial projects under construction.[60] Emphasis must be placed on the need to absorb available knowledge and successful experiences in the field as well as on the conduct of research.

Despite the optimistic undertone of the Chinese literature on the subject it would be wrong to believe that the technical tasks and difficulties posed by the 'three wastes' and the elimination of the 'three harms' are underestimated.[61] Nor is there a failure to realize the need for an economical use of manpower and the assessment of costs *and* benefits. The Chinese literature actually warns against any extravagance in the use of manpower and calls for a comparison of inputs and outputs with a view to making 'maximum gains with minimum expenditures'.[62] However, input and output, costs and benefits of the prevention and elimination of the 'three harms' are not calculated in terms of monetary or market values but rather in socio-economic terms or use values. Unfortunately, the concrete details of this assessment are not set forth and it is uncertain to which extent these important theoretical and practical problems have actually found a solution in China at the present time. We shall come back to this important question in part 3 of our analysis.

Meanwhile it may be useful to repeat that Chinese experts are convinced that a solution of the environmental problem is possible. However, this conviction is not equivalent to a belief that industrialization, modern techniques, economic development and population growth will not change the natural and social environment of China. Chinese planners see no need to pursue a policy of 'zero growth', either with regard to material output or population. On the contrary: they reject any doctrine guided by the concept of definite limits of growth or of a stationary state. China

59. *Ibid.*, p. B5.

60. *Ibid.*, p. B5. 'Leading personnel at all levels on the industrial front must maintain a firm grip on this task, strengthen their guidance, work out over-all plans, carry out investigation and study in depth, and map out effective measures.'

61. 'It must be conceded that we might frequently encounter problems in eliminating the "three harms" because our lack of practical experience or scientific know-how prevents us from discovering the laws for dealing with the problems and arriving at the ideal solution.' *Ibid.*, p. B4.

62. *Ibid.*, p. B5.

considers it necessary and possible to pursue a policy of economic development which includes the protection and improvement of her natural and social environment. Within this context, it is important to note that China's development policies do not aim at maximizing output regardless of environmental or social costs. Chinese development planning is guided by other priorities than a concentration on rapid industrialization and specialization. Ecological criteria and social aims seem to play a significant role in her planning and decision-making. Hence, her criteria of rationality differ from those which have guided the process of industrialization and economic growth in the West.

b) *The comprehensive use of materials: 'Turning the harmful into the beneficial'*

As we have pointed out, the multipurpose use of resources is based upon a specific way of looking upon 'wastes'. In this sense and, as we shall see, for other reasons, the Chinese principle of 'the comprehensive use of resources' may well be considered as a fundamental guiding paradigm of environmental planning. Chinese experts would have no difficulty in accepting the view that man can neither create nor destroy matter or energy i.e. the first law of thermo dynamics and the principle of the conservation of energy. Indeed, the Chinese in a sense accept what has come to be known as the material balance approach and the related view that man's economic activities neither produce nor consume matter-energy but merely 'throw it out' (in the form of waste products). But whereas many economists seem to say that what is thrown out is valueless waste[63] which man cannot possibly use, the Chinese seem to take the position that there is no absolute valueless waste.

> In making one product, resources are partially transformed into this product and the rest becomes 'waste'... From the metaphysical point of view, waste cannot be got rid of. On the contrary, the materialist dialectical view holds that what is waste and what is not waste are relative terms. There is nothing in the world that is absolute waste. 'Waste' under one condition may be valuable under different ones. Waste material left from one product can become a good material for another product. After being transformed and utilized waste material can become a product or useful material.[64]

This way of looking upon waste is indeed a guiding principle for China's policy of multipurpose use of resources and supports and explains current campaigns for their 'comprehensive use or the transformation of waste.'

63. Nicholas Georgescu-Roegen, *The entropy law and the economic problem*, University of Alabama, 1970, p. 3. *Cf.* also A. V. Kneese *et al.*, *Economics and the environment: A materials balance approach*, Baltimore, 1970.

64. 'Multipurpose use: Important policy for industrial production (by the Writing Group of the Tientsin Revolutionary Committee)', *Peking review*, No. 6, 1971, p. 7.

Of course, this comprehensive use of materials may also be interpreted as an expression of the old and persistent attitude of frugality and a necessity of making the maximum use of scarce resources under conditions of poverty.[65] However, the insistence on the re-use of waste materials as a method of preventing environmental deterioration while doubtless related to earlier anti-waste campaigns goes far beyond anything China has undertaken in the past. In fact, the re-use of the 'three wastes' is being advocated as a method of transforming waste into wealth and as an important means of diversifying and increasing output. More than this: The principle of the comprehensive use of waste is in fact regarded as a necessity and a fundamental law of socialist development and even as a means of changing the traditional division of labor and the specialization of work. It is regarded at the same time as an anti-pollution measure, as a method of increasing production, as an approach to a new diversification and location of industry and an improvement of urban and rural sanitation. It is *multipurpose* in this comprehensive manner.

Before setting forth the different patterns of re-using waste materials it may be worthwhile to illustrate the principle as it seems to be applied in practice. In the form of a remedial measure after pollution has taken place the principle may call for large-scale dredging operations and the cleaning of polluted streams, rivers and lakes affected by the discharge of untreated industrial waste materials and the collection of human and animal waste not used for fertilizing fields. Thus, the Shanghai Revolutionary Committee launched a campaign (in 1968) to clean up the Huangpu and Suchow Rivers which had long been used as sewers by the city's paper, printing, chemical fibre, electroplating and tanning industries: '9,000 persons were mobilized – to form muckdredging and muck-transporting teams . . . After a hundred days of turbulent fighting more than 403,600 tons of malodorous organic mire had been dug out.'[66] In little more than a year Shanghai has recovered gases (sic) and slag, several hundred tons of dye-stuff, 8,000 tons of oils and thousands of tons of chemicals. In addition some 10,000 tons of metal were extracted. Waste slag made 200,000 tons of cement. Paper, electro-plating and leather industry wastes yielded hundreds of thousands of tons of fertilizers and the processed waste water now irrigates 6,650 acres of farmland.[67]

More recently, however, it seems that China is concentrating its major

65. As early as 1958 (i.e. during the great leap period) and probably earlier, Mao called for a struggle against 'waste' at all levels: 'Every cooperative, every shop, every office, every school, and every military unit must seriously conduct its own anti-wastefulness campaign and will continue to do so once every year'. Jerome Ch'en (ed.), *Mao papers, op.cit.*, p. 61.

66. Quoted from *The financial times*, April 1, 1971.

67. Charles Snyder, 'Tomorrow's challenge', *Far Eastern review*, October 31, 1970, p. 43.

efforts on the *prevention* of water and air pollution. Much attention has been given to the control of contamination by the construction of urban sewage systems and sewage treatment facilities and the proper disposal of human waste in the more densely populated areas,[68] the relocation of factories, the recovery and re-use of waste material and the decentralization of industries.

With respect to air pollution the Chinese approach calls for the installation of recovery and purification facilities in big and middle-sized factories[69] and the elaboration, imposition and enforcement of rules on emission, the location of new and the relocation of old factories 'on the opposite side of the city from which the wind usually blows'. Numerous factories are reported to have removed carbon and dust from their chimneys and 1,000 of these factories have ceased to emit black smoke. The workers of the People's Printing Press are said to have transformed three unoccupied rooms into depositories and recover each week ca. 20 tons of (coal) dust. Another factory at Changchien has succeeded in extracting a certain amount of precious metal worth more than 100,000 yuan per year.[70]

The comprehensive use of resources may take place either in the factory in which the waste originates or in separate specialized industries or in small-scale new plants or even home industries. In this way the traditional division of labor and the lines of demarcation between industries are said to be changed. 'A factory is divided into several, one raw material is used in many ways, a piece of machinery is used for many purposes, one worker is capable of many kinds of work apart from his specialization, and a factory can produce many things while engaging mainly in [the production of] one product. All this gets better results from limited manpower, equipment and resources.'[71] From the numerous examples listed in the literature it appears that several patterns of re-using waste materials are in process of development: (1) A large plant operating its own small plant to process its waste material; (2) A large plant operating several small plants to process its waste materials (into raw material and consumer goods); (3) Several large plants (e.g. in Shanghai) operating in cooperation one waste utilization plant using old, discarded, unused or rebuilt equipment turned over to them;[72] (4) Neighbourhoods, cities and villages

68. Leo A. Orleans and Richard P. Suttmeier, 'The Mao ethic and environmental quality', *Science*, vol. 170, p. 1174 and Wang To-ching *et al.*, *op.cit.*, p. 5-9. Wang Te-p'u *et al.*, *op.cit.*, p. 21.

69. Wang Te-p'u *et al.*, *op. cit.*, p. 21.

70. *People's daily* (Peking) quoted in *Le Monde*, May 5, 1972.

71. Chi Wei, 'Turning the harmful into the beneficial', *Peking review*, January 28, 1972, p. 7.

72. 'Honan's Chung-chon City operates more than 200 small plants to make full use of its waste liquid, gas, and residue', *Chung-Kuo Hsin-wen*, Nov. 9, 1970 (J.P.R.S. 52527 March 3, 1971).

operating small scale factories either processing scrap materials collected by retired workers, housewives and children or turning them over to other small and large scale factories and (5) firms specializing in acquiring waste products (such as the 'Lungha Waste Products Purchasing Station') and making such waste products available to other specialized factories for turning them into useful products.

While the principle of the comprehensive re-use was first confined to old factories, working with old equipment which called for a technical adjustment, it seems to have given rise in more recent time to the designing and building of new factories.[73]

Economists will inevitably raise the question of how far the re-use of waste products can actually be carried. That is to say, how far is it 'economical' to transform waste materials into useful things and are there not some harmful residual materials or indispossible wastes which cannot be used and recycled without negative effects for the environment or only at exhorbitant costs? All these questions are being raised in the Chinese literature. Thus, some factories were reported to make 'great efforts to do what is most profitable . . . and no efforts to do what is unprofitable'. They considered the handling of waste water as an extra burden. Others regarded the 'three wastes' as unavoidable or held the view that 'wastes are wastes' and nothing could be done about them. These views are rejected and refuted in the official literature (not always to the full satisfaction of the reader) as a sign of not viewing the situation as a whole[74] and as evidence of unscientific 'metaphysical' or 'undialectical' thinking. In short, the Chinese viewpoint may be summarized by the axiom 'that there are no wastes but only things that are left unused; there is nothing that cannot be used'.[75] Difficulties of transforming waste into its opposite are conceded to exist but are seen to be due to the comparatively backward state of techniques and scientific understanding, lack of research, failure to apply correct methods of thinking and inadequate methods of mobilizing the grass root knowledge of the workers who are actively engaged in production and the diffusion of such knowledge throughout society. For the Chinese 'there is no limit to people's ability to know and transform the objective world. Thus, there is no limit to utilizing the "three wastes" . . . there is no absolute waste which cannot be utilized. Continued scientific experiments have yielded important material from remaining wastes'.[76] Evidentally, the Chinese experts have not yet taken into consideration that there are indisposable wastes e.g.

73. Chi Wei, *op.cit.*, p. 6.
74. 'Whether something is profitable or without profit must be judged from the interest of the whole . . .'. *Ibid.*, p. 6.
75. Hua Ching-yuan, *op.cit.*, p. B2.
76. Chi Wei, *op.cit.*, p. 7.

radioactive materials and have therefore failed to raise the question of how to dispose of the indisposable.

3. PLANNING AND PRIORITIES: MONETARY CALCULATION VS ASSESSMENT OF SOCIAL USE VALUES

In this section we are concerned with the key question of the planning process: The formulation of objectives and priorities. In other words, how are substantive aims chosen and priorities set in China? Not only is this the most important question of planning under socialism but it is also the most unexplored and obscure problem both with regard to economic planning in general and the formulation of environmental policies in particular. This is true for capitalist countries; it is no less true with regard to socialist planning. The following analysis can be no more than an attempt to outline the general direction in which a solution of this central problem may be found.

Suffice it to say that Engels and Marx seemed to suggest a theoretical approach without, however, providing a detailed operational answer to the practical question of determining the relative importance of alternative socio-economic objectives and values. At their time they considered such an attempt as 'utopian' or at least not ripe for detailed analysis. However, they did advance some general if rudimentary ideas which were not taken up until quite recently either by Marxist or Non-Marxist economists. Some Marxist economists have in fact pursued a line of reasoning which is based fundamentally on a market approach to decision-making and planning. These endeavors center around the notion of a system of 'market socialism' which provides the foundation for most versions of the doctrine of an ultimate convergence between capitalist and socialist principles of decision-making. We do not think that these attempts can serve as an adequate basis for the theory and practice of socialist planning. The early ideas of Engels and Marx on the principles of socialist planning and decision-making need to be further developed.

To this effect and in view of the key importance of these questions after more than 50 years of practical experience in socialist countries we shall attempt to analyse Chinese practices and theories with a view to deducing from them whatever new light they may throw on the problem. In the course of our discussion we shall consider particularly some of the issues raised by the contrast between a monetary calculation and an assessment of social use values.

a) *Engels and Marx on social use values as the basis of economic decision-making*

How did Engels and Marx envisage the principles which were to guide the

preparation of the economic plan in a socialist economy? Neither Marx nor Engels held the view that markets or supply and demand or for that matter market values could provide the fundamental criteria for the guidance of production and the evaluation of the importance of different commodities and hence of the priorities of socialist planning. The founders of Marxism did not believe that prices, as a function of effective demand and supply or ability to pay, could be accepted as signals and criteria for socialist decision-making. What did they believe and how did they envisage the making of the fundamental planning decisions in a socialist society? Did they believe that the socially necessary labor would continue to determine exchange-values as one might infer from a superficial reading of the labor theory of value which they considered to be the law of value in capitalist economies? The answer to this question is clearly negative.

Engels and Marx seemed to have envisaged nothing less than the elimination of exchange values in a fully developed socialist society. Engels actually anticipated not only the possibility of the elimination of exchange values but of the transformation of output into [saleable] commodities and of the exchange of commodities altogether.[77] In fact, Engels was the first to announce that

> from the moment when society enters into possession of the means of production and uses them in direct association for production ... society will not assign [exchange] values to products. ... It will have to arrange its plan of production in accordance with its means of production, which include, in particular, its labour power. The useful effects of the various articles of consumption, compared with one another and with the quantity of labour required for their production will in the end determine the plan ... without the intervention of the much vaunted [exchange] value.[78]

Without entering into any further details Engels was convinced, as early as 1844, that the balancing of useful effects and expenditure of labor would be the central method of and criterion for decision-making in socialist planning and all that would be left in a communist society, of the politico- economic concept of value.[79]

Marx held similar views. Indeed he carried the analysis one step further. He explicitly pointed out that use values and not exchange values are 'the source of real wealth'[80] and that the real measure of wealth in a socialist society would be no longer the socially necessary labor but 'dis-

77. Engels actually spoke of the possibility of eliminating 'the exchange of commodities and the transformation of output into commodities and hence into exchange values. *Anti-Dühring,* MEW, Bd. 20, p. 288.

78. Friedrich Engels, *Anti-Dühring,* Moscow, 1954, pp. 429-430.

79. *Ibid.,* p. 430n (the note by Engels refers to his *Umrisse zu einer Kritik der Nationalökonomie,* 1944).

80. *Kritik des Gothaer Programms,* MEW, Bd. 19, p. 15.

posable time'.[81] For having ceased to be the source of wealth labor must also cease to be the measure of exchange value and consequently the latter ceases also to be the measure of use value.[82]

In other words, for Marx and Engels it seemed to be axiomatic that the criteria of socialist planning would be the 'useful effects' of different goods and services 'balanced against the required expenditures of labor' (Engels) or the free i.e. disposable time (Marx) – disposable that is to the individual to do what he pleases in accordance with his inclinations and potentialities.

By stating that 'useful effects' or free 'disposable time' are the measure of real wealth and thus of the quality of life Engels and Marx must have been convinced to have specified at least in general terms the alternative criteria for the planning and decision-making process in a socialist planned society. Few marxist writers have taken up these hints while many have simply followed the general trend toward a subjective theory of value and price. The great exceptions were Otto Neurath[83] and Max Weber,[84] today Charles Bettelheim[85] and Paul Sweezy[86] in their discussion of the theoretical and practical problems of economic calculation in the period of transition to a socialist economy. While this discussion is still under way it helps to elucidate the guiding principles of planning in China and probably other socialist countries. The formulation of environmental policies, the evaluation of environmental goals and the establishment of priorities require a substantive economic calculus in terms of social use values (politically evaluated) for which the formal calculus in monetary exchange values fails to provide a real measure – not only in socialist societies but also in capitalist economies. Hence the 'revolutionary' aspect of the environmental issue both as a theoretical and a practical problem. In short, we suggest that environmental values are social use values for which markets provide neither a direct measure nor an adequate indirect indicator. Environmental values confront socialist and market economies

81. *Grundrisse der Kritik der politischen Ökonomie*, 1859, p. 592.

82. 'Sobald die Arbeit in unmittelbarer Form aufgehört hat, die grosse Quelle des Reichtums zu sein, hört und muss aufhören die Arbeitszeit sein Mass zu sein, daher der Tauschwert das Mass des Gebrauchswerts'. *Ibid.*, p. 593.

83. Otto Neurath, *Wirtschaftsplan und Naturalrechnung, Von der sozialistischen Lebensordnung und vom kommenden Menschen*, Berlin, E. Laub, 1925, und *Durch die Kriegswirtschaft zur Naturalwirtschaft*, München, Gallaway, 1919. Neurath's ideas were discussed sympathetically by Max Weber who used them as a basis for his juxtaposition of 'formal' and 'substantive' rationality.

84. Max Weber, *Wirtschaft und Gesellschaft*, Tübingen, 1922.

85. Charles Bettelheim, *Calcul économique et formes de propriété*, Paris, Maspéro, 1970.

86. P. M. Sweezy, 'On studying the transition process', *Monthly review*, 23 (9), 1972, pp. 1-13.

with exactly that situation which Engels and Marx considered to be characteristic of the socialist economy in which 'the transformation of output into exchangeable commodities' would be eliminated and 'where exchange value would cease to be the measure of wealth' and use values would become 'the source of real wealth'. In both types of societies the problem posed by environmental values calls for a solution in terms of a factual assessment of the positive and negative effects of production in real terms to be balanced against real opportunity costs measured either in expenditures of labor or conversely in 'disposable time'.[87]

b) *Factual assessment and policy making*

Before turning our attention to the evaluation of environmental goals and the setting of priorities we must deal briefly with the role of 'facts' and factual assessment in Chinese policy making. Of course this is a fundamental issue which cannot be treated here in all its complexity. We shall attempt only to highlight certain features which distinguish Chinese procedures of decision-making from those practiced in the West partly under the influence of traditional economic theory. Whereas the latter assumes that it can derive principles of decision-making and choice from an abstract structure of general rules of economic rationality more or less independent of the structure of essential human needs, the Chinese procedure is the exact opposite. In fact, its principles of decision-making seem to be highly 'empirical' and pragmatic and are based upon a contextual assessment of concrete conditions and a study of the problem to be solved. We have already referred to President Mao's dictum: 'In observing a problem a Marxist usually looks at the whole situation instead of only a part of it' (*supra* p. 30). The underlying principles of Chinese decision-making seem to be based upon the belief that it is possible to 'solve' problems by viewing them within the context of the situation in which they occur. In this way, that is through the interplay of detailed empirical information about concrete conditions (e.g. assessment of achievements and deficiencies) it is possible to formulate requirements, objectives, priorities. Knowledge (science) and action (practice) are in this sense interdependent. New concrete situations will give rise to new problems which will lead to new information and a modification of the perception of the participants who deal with the situation. Factual investigations and empirical research play a central role in the formulation of environmental

87. For a more detailed analysis compare K. William Kapp, 'Les indicateurs d'environnement: Origines, fonctions, signification à long terme', Contribution au Symposium International sur la Méthodologie et l'Analyse socio-économique de l'Environnement, Grenoble, December 12-15, 1972. The papers presented at this symposium are published in: *Analyse socio-économique de l'environnement: Problème de méthode*, Paris – The Hague, Mouton, 1973, 248 p. *Cf.* also ch. 6 *infra.*

policies and economic planning.[88] Indeed, according to Mao, the elaboration of a development program requires the application of the following three steps and methods of work: over-all planning, regular inspection and annual reviews and comparisons.

> By them, both the over-all situation and the details will receive appropriate attention, experiences can be summed up and outstanding achievements can be made known in time; ... The method of timing is: the previous winter determines what can be done in this year, this year determines what can be done in the next two years, and the first three years determine what can be done in a quinquennium. ... There must be at least four inspections per annum – once each season at the Centre and the provincial level whereas [the number of inspections] at a lower level is to be decided according to [local] conditions. Monthly inspection is necessary before an important task gets into a smooth running order. ... How to review and compare? Province with province, city with city, county with county, commune with commune, factory with factory, mine with mine, and work site with work site. Agreed rules of comparison are not absolutely necessary.[89]

This reliance on current factual conditions as a point of departure for policy making deserves some comment. While it is not a denial of the need for principles of action it seems to be a refusal to formulate such principles of actions in terms of a subjective formalistic concept of rationality. What needs to be done depends upon and can be derived from an appraisal of the actual situation as it presents itself and its factual historical diagnosis rather than in the light of abstract rationalistic rules derived from a formalized theory of rational action or praxeology. Ends are derived, explored and chosen together with the selection of means in the light of the examination of the situation or, in other words, of the direct appraisal of the concrete social and hence human condition. The result of this simultaneous exploration and derivation of 'ends' and 'means' – of desired outcomes and appropriate courses of action (i.e. the effective

88. Of course, this reliance on prior research is also the result of an acute awareness of the lack of adequate data and experience and the realization of a long-standing gap in scientific training and factual information inherited from pre-revolutionary times. In addition, her recurrent exposure to natural catastrophes of major proportions in the past is also conducive to a pre-occupation with empirical investigations prior to decision-making. These are additional factors which explain the strong empirical bent and the prevailing tendency to base action on thorough knowledge and factual investigation.

89. Mao Tse-tung, 'Sixty points on working methods', in Jerome Ch'en (ed.), *Mao papers, op.cit.*, p. 59. Here again it is of interest to add that these ideas were first formulated during the Yenan period in Mao's analysis entitled 'Economic and financial problems of the anti-Japanese War' (1942) of which only the basic outline (Section 1) has appeared in translation (Vol. III of the Selected Works of Mao Tse-tung, p. 111). A Chinese edition of the entire work appeared in Hong-Kong (1949) and an incomplete draft translation of the work was kindly made available to the author by Mr. Andrew Watson, Department of International Economic Studies, University of Glasgow.

mobilization of available means) is being rediscovered in the West as an element of a 'humanistic wisdom'[90] or, within another context, as the policy of 'successive incremental improvements'[91] in contrast to the rationalistic subjectivism of traditional economic theory. Suffice it to add merely that in this way the difficulties arising from the inevitable complexity of social interdependencies, undesirable side-effects, value conflicts and uncertainty of the future are not ignored, nor is the need for setting objectives and for coordinated action and overall planning neglected in favor of a policy of 'muddling through'. Similarly the measure of performance, and the search for the effective use of means (i.e. courses of action) is facilitated by continuous observation and inspection in relation to the desired objectives. At the same time the Chinese reliance on factual investigation and regular inspection seems to permit an element of participation and hence decentralization of decision-making which may take the place of some of the functions traditionally claimed for a policy of following the signals of the market.

Actually the current empiricism in China seems to be even more fundamental and far-reaching. For Mao actually defines the scientific approach as 'seeking truth from facts'[92] and truth in this context carries a definite normative element immediately relevant for action not unlike Marx' early views that the analysis of the 'facts' ('reality') is capable of yielding normative conclusions ('Sollenspostulate').[93] Nevertheless, it would be a mistake to believe that Mao and the Chinese leadership are naïve empiricists. As all policy makers the Chinese planners are guided by historico-political considerations as well as by explicit value premises. Their fundamental choices are influenced by basic notions of the 'good society' and views concerning China's needs in the light of an evaluation of her contemporary position in the world, including her military requirements. In particular, Chinese planners are convinced that the 'three differences' between industry and agriculture, between urban and rural life, between manual and intellectual activities and in fact all inherited inequalities are 'bad' and need to be radically reduced if not to be overcome.

However, within this broad framework there are good reasons to believe that Chinese planners proceed in a highly pragmatic way in determining their aims and their priorities without reference to *a priori* general principles or formal norms of rational action. Indeed such norms are likely

90. As Habermas interprets Vico's early critique of Descartes. See Jürgen Habermas, *Theorie und Praxis*, Neuwied, 1963, p. 255.

91. D. Baybrooke and C. E. Lindblom, *A strategy of decision: Policy evaluation as a social process*, London, 1963.

92. Mao Tse-tung, *On new democracy* (1940), Peking, 1967, p. 2.

93. Karl Marx, 'Letter to Ruge', Sept. 1843. *Cf.* MEGA, Bd. 1, erster Halbband, p. 573.

to lead decision-makers astray because the formal principles are without substantive content and cannot be directly applied to concrete and changing situations. In order to deal with a problematic situation and to transform it into a situation which is no longer problematical it is necessary above all to define the problem and this requires first a systematic assessment of the facts of the case.[94]

The nature and scope of China's scientific research prior to the formulation of environmental policies may be illustrated by the following examples. In order to develop and apply suitable precautionary measures in the construction of dams, bridges, buildings and railways the planning agency needed a map of the frequency and intensity of earthquakes in every part of China. In pre-revolutionary China there were only two seismographic stations. The resulting lack of data was apparently overcome by putting 150 historians to work for two years reviewing the whole literature of China with the result that 10,000 useful references on earthquakes between 1189 BC and 'today' (1958?) were brought to light.[95]

As early as 1960 a total of 10 specialized research institutes existed for the study of industrial accidents and hygiene including occupational diseases. These institutions are located in central ministries. In addition, industrial health centers and departments in the various provinces, municipalities, universities, large factories and schools are training special personnel for scientific research work.[96] Surveys, clinical examinations and experiments with improved techniques involving large numbers of workers (up to 34,000) were conducted in factories and mines in order to obtain a clearer understanding of the causes of accidents and occupational diseases. The conclusions served as the basis for the formulation of labor standards, laws and preventive measures. This decentralized empirical research made it possible to take account of the fact that there are considerable climatic differences which influence the conditions of work and

94. It would lead us too far afield to show that these ideas are based upon Mao's general conception of the relationship between knowledge, (science) and practice (action), a conception which represents to a certain extent a sinification of Marxist and Hegelian notions according to which all action designed to solve a problem and to transform a situation requires empirical knowledge (*cf.* our study 'Environmental indicators . . .', *infra* p. 127); These ideas were formulated by Mao during the Yenan period (1936-1946); they are very similar to John Dewey's experimental pragmatic method of science and his objection to a logic of general notions and their application to specific concrete and complex situations (see Benjamin Schwarz, 'Thoughts of Mao Tse-tung', *New York review*, February 1973, p. 28). On Dewey's impact and final denunciation of his philosophy see J. Dewey, *Lectures on China, 1919-1920*, ed. by R. W. Clopton and Buin-Chen Ou, 1973, particularly pp. 1-30.

95. *Cf.* the report of the President of the International Union of Geodesy and Geophysics, J. Tuzo Wilson, 'Red China's hidden capital of science', *The Saturday review*, Nov. 8, 1958.

96. Liu Shih-chieh, *op.cit.*, p. 2 (IPRS 2745).

hence the treatment and prevention of certain occupational diseases in different regions throughout China's 18 provinces.[97]

A special feature of Chinese research methods worth mentioning is the fact that medical research workers, for instance, 'must take the path to face production, workers and reality. They must frequently carry their luggage and equipment to work [and] eat and live together with mining and factory workers, to make mines and factories their principal basis of scientific research'.[98]

Of course, it would be a mistake to believe that the necessary knowledge was always adequate prior to the implementation of environmental projects. Thus, for example, in connection with the irrigation and water conservancy works discussed earlier, inadequate feasability studies and research left considerable gaps of knowledge which led to serious errors and social losses similar to those observed in other developing countries. For instance, distributories from reservoirs to fields were not ready in time to make use of water stored behind dams and barrages.

> Not enough care was taken to complete detailed studies of topography, silt content, river flow and water patterns. An excessive number of irrigation canals were constructed in relation to the necessary drainage canals. Since many irrigation canals were too small, they created problems for future farm mechanization without providing adequate protection in times of flood.[99]

c) *The evaluation of environmental goals*

In the light of the preceding discussion of China's environmental problems and policies it should be evident that the protection and improvement of the social and physical environment is one of the goals of economic development. Unlike other developing countries China does not define wealth or welfare as a 'basket' of exchangeable commodities but rather as an *ensemble* of social use values. In other words, development includes and must be measured by the satisfaction of essential individual and collective needs. Environmental goals are defined and assessed by the Chinese

97. 'Research on the energy metabolism of workers operating on major duties in steel industry has been carried out in various districts. Results unanimously indicate that the estimated energy metabolism is lower in Chinese workers than the values generally reported in foreign literatures.' *Ibid.*, p. 7.

98. Ch'e Hua, 'Chinese scientific research on labor protection', *Chung-Kuo Hsin -wen* (Canton), April 2, 1966 (36983) p. 109.

99. Bruce Mc Farlane, 'Economic policy and growth in Communist China', Institute for International Economic Studies, University of Stockholm, 1972, p. 11. (Mc Farlane quotes Mao's speech at the 10th Plenum of Sept. 27, 1962 (translated in Selection from *China mainland magazines*, No 26, p. 38). Other errors and inadequacies of research in irrigation and forestry projects (inadequate appraisal of average rainfall and wrong choice of location of dams, insufficient maintenance of forests with subsequent high rates of cutting and erosion in reforested areas, inadequate knowledge of soil conditions, inadequate selection of trees [poplars]) are mentioned by Engelborghs-Bertels, *op.cit.*, pp. 125-126.

leadership outside the market nexus on the basis of an appraisal of substantive human requirements which, it is true, are not fixed but differ in space and time. In fact, although without 'marketable value' these environmental goals are regarded as integral elements of the quality of society. This emphasis on the qualitative aspects of development is not a denial of the importance of material wealth; on the contrary, the elimination of ecological risks, the reduction of the frequency of natural calamities, improved conditions of health, industrial and community hygiene, the cleaning of rivers, the re-use of waste materials contribute directly to the improvement of the material level of living, quite apart from the fact that they go hand in hand with and are the preconditions for the achievement of higher levels of production and productivity. In short, the Chinese concept of growth and development is a denial of the traditional Western concept of growth defined either as an increase of purchasable commodities or of the capacity to produce goods and services irrespective of their social use values. The determination of priorities takes place outside the market on the basis of a socio-political evaluation and hence independently of 'revealed preferences' which would always reflect the unequal ability of individuals (with unequal income) to pay. Because priorities are set without reference to the ability to pay a more equal provision and distribution of social benefits can be achieved. It is hardly necessary to add that this result reflects the new distribution of power in Chinese society and the transformation of the 'production relationships' in Marxist Chinese terminology.

Expressed differently, the Chinese approach to development and planning is a denial of the adequacy and usefulness of GNP as a measure of growth and development. In Chinese economic planning, growth and environmental improvement are related.

In contrast to traditional Western notions the Chinese concept of growth and development includes the improvement of the social and physical environment. There are good reasons to do so because the remaking of the Chinese Earth has its impact on productivity as well as on living and social conditions.[100] In this sense, it would appear that the Chinese approach contests not only the Western (capitalist) concept of growth including its key indicator (GNP) but also the monetary calculus which is the basis for the calculation of GNP. A system of social accounting able to measure adequately social use value would show a much higher rate of 'growth' than measurements in terms of the traditional GNP. In fact, it is characteristic of GNP to underestimate the performance of a socio-economic system which succeeds in improving the quality of the human environment by increasing the volume of collective goods and services

100. For a fuller discussion of China's multidimensional concept of growth and development, see Bruce Mc Farlane, *op.cit.*, pp. 1-14.

offered free of charge to all. China has apparently not developed or does not consider it possible to develop a single indicator to express its progress as far as the improvement of the satisfaction of fundamental needs are concerned but it evidently considers such progress and improvements as highly important. This incidentally may also be one of the reasons why China has stopped the publication of any single indicator of economic growth. Seen in this light, it is easy to understand why any policy of 'zero growth' would be rejected by China as a negation of social progress.[101]

China does not evaluate the quality of the social and physical environment or the costs of its improvement in terms of what people are willing or able to pay for the necessary capital construction but in terms of the social value and importance (socio-politically evaluated) in relation to the available and necessary outlay of labor (also socially evaluated). Individual and public health are appraised rather in terms of physical standards (i.e. not in monetary terms) and are then brought into relation to the necessary outlay of available labor power and other resources. Such a procedure may not allow a neat and precise calculation but the necessary judgements and comparisons (of alternatives foregone) are for that reason no less 'economic' in character. In fact, the Chinese planning effort seems to be guided by the avoidance of 'waste' and 'extravagance' (socially evaluated). The essential data, aims and priorities of Chinese planning are derived from empirical investigations, scientific research, diagnosis of causes and effects as well as from specific notions of essential requirements of human existence. In this sense, China makes use of a substantive concept of economic rationality related to concrete individual and social needs. Nor are the comparisons or calculations of inputs and outputs purely technical in character; on the contrary, desirable outputs and necessary inputs, benefits and costs, aims and means are evaluated but not in

101. The entire debate on 'zero growth' in recent years in the West shows curious contradictory elements. On the one hand growth is 'defined' and measured in GNP the limitations of which as a measuring rod are more or less generally seen and exposed. At the same time one favors a reduction of 'growth'. Actually an effective policy aiming at the protection and improvement of the environment would lead to an expansion of the production of specific goods and services but, it is true, to a different composition of the national product (gross or net). In other words the traditional argument that environmental protection policies and allocation patterns reduce the rate of growth forgets that it is not the growth rate (as traditionally expressed) but only a new kind of measuring rod (including a system of socio-environmental indicators) which would give expression to the quality of living conditions and which is the relevant measure. Measured in these terms effective environmental policies would and should increase the level of national well-being; in any event it would be absurd to aim at a reduction of the quality of the socio-physical environment or the conditions of human well-being. *Cf.* also Udo S. Simonis, 'Neue Zielvariable für die regionale Wirtschaftspolitik', *Stadtbauwelt,* 1972, Heft 34, p. 139 and Edmond Maire, 'Ecologie et révolution', *Le nouvel observateur,* no. 397, 19-25 June, 1972, p. III.

monetary or market terms. In short, the Chinese case seems to illustrate the fundamental contrast between a system of calculating in monetary terms and a substantive economic calculus in terms of socio-economic use values.

4. THE IMPLEMENTATION OF ENVIRONMENTAL POLICIES

All planning calls for the implementation of the policies and projects decided upon. Implementation is used here in the broadest sense; it refers to a whole spectrum of measures which include those necessary for the popularization of policies through education and persuasion, the enforcement of rules and regulations and the mobilization of mass support and mass participation. To some extent we have dealt with such measures in preceding sections of the present essay. However, the implementation of environmental policies is of such central importance and seems to play such a key role in China that it deserves separate treatment. As a matter of fact, China's implementation of environmental policies offers a particularly striking illustration of how these important tasks of environmental planning (as indeed of all planning) could be met.

While all sorts of remedial action by means of cleaning up operations have played a role in China's environmental policies and received widespread publicity, it is clearly prevention rather than remedial action upon which China concentrates its efforts to protect and improve her social and natural environment. The planned transformation of the Chinese Earth by means of water and land conservancy policies, industrial and community hygiene, preventive medicine, the decentralization of industries, the re-use of waste materials, the gradual development and adaptation of techniques of production in accordance with environmental and ecological criteria – all these policies are preventive rather than remedial.

a) *'Participatory' planning*

Many of China's environmental policies are regional or local in character; they must take account of local conditions not only with regard to the design of specific projects but also with respect to their implementation and the mobilization of resources including manpower. Such mobilization will be more or less successful depending upon the extent to which the benefits of the project are understood by and actually accrue to the local population. In so far as the benefits of environmental improvements are understood part of the necessary investments for the project and even its design can become a matter of local responsibility under the guidance of trained personnel and cadres. Under these circumstances even the definition of the specific goals to be pursued within the framework of the general plan can, to some extent at least, be transferred to the local popula-

tion and the role of the technical expert need not be that of a manipulative agent but that of a participating and creative guide.[102] The advantages of such 'participatory planning' are evident: Enlistment of local intelligence, local interest and local capital and active cooperation with the result that at least part of the necessary investments can be financed out of local resources, e.g. underutilized and idle manpower. The required technologies need not be capital intensive and the additional food supply (or 'wage goods') can be made available by an appropriate institutional infrastructure.[103]

Chinese methods of enlisting cooperation of the local population may be illustrated by the following examples:

> Drinking water in the villages comes from wells, rivers or springs which can easily be contaminated with disease-producing germs. The first step was to win the active support of the people, for without this nothing could be done. Lectures illustrated by posters and lantern slides were given and a microscope was set up near a contaminated water source so that the peasants could themselves see the germs swimming about in the water. An old Chinese saying holds that one seeing is worth ten thousand hearings. Once they were convinced that they had been swallowing millions of micro-organisms, they co-operated whole-heartedly.[104]

In a village in Hopei province 6 small mobile medical teams based in different villages and serving about 15,000 peasants discovered that outbreaks of intestinal infection were common.

> An investigating group from the mobile medical team found that the water was heavily contaminated. The mouth of the well opened at ground level and was surrounded by mud and excreta which was washed into the well whenever it rained. Moreover, as many peasants regretfully affirmed, not a few piglets and chickens had fallen into the well, never to be seen again. The team suggested building a low wall around the mouth of the well, covering it with removable wooden boards and paving the surrounding soil with stone slabs. The peasants agreed and working together with the doctors and nurses, soon had the job done. After this, outbreaks of intestinal infection gradually ceased and a few weeks later the peasants could see that there were no more wriggling germs in the water. Drums and gongs to celebrate victory over the tiny enemy! And the word got around that these young doctors sometimes knew what they were talking about and that it might be worthwhile to listen to their advice.[105]

Chinese literature dealing with the re-use of the 'three wastes' refers to numerous instances of team-work and the enlistment of workers' participation, who are reported to have invented new methods of utilizing

102. Constance Perin, *With man in mind*, Cambridge, MIT Press, 1970, p. 69.

103. Ignacy Sachs, 'Environmental quality management and development planning: Some suggestions for action', in *Development and Environment*, Paris – The Hague, Mouton, 1972, pp. 126-127, 128.

104. Joshua S. Horn, *op.cit.*, p. 131.

105. *Ibid.*, p. 131. For further illustration of how village resources and participation can be effectively mobilized to stop health hazards after diagnosis of the sources of the contamination of water, see *ibid.*, p. 131 *ff.*

waste products. In fact, official pronouncements reflect a high degree of confidence in the practical knowledge of the more experienced workers as a source of practical improvements.[106] Contemporary China, particularly since the Cultural Revolution, seems to place increasing reliance on the inventive skill of the worker-artisan. In fact, the Cultural Revolution may be interpreted as a device to keep the party responsive to suggestions from the masses as well as an effort to permit policy decisions to flow from them (rather than from an established managerial and party bureaucracy) to the party and back to the masses.[107] We are not suggesting that planning in China is fully participatory. It is likely that traditional bureaucratic attitudes are surviving. The Chinese leadership is aware of the continuous danger that officials tend to fall back into traditional behavior patterns and 'selfishness, irresponsibility and careerism are still to be found' . . . 'Some administrators and party functionaries pay lip service to the virtue of participation in manual labor but when it comes to the point consistently evade it.'[108]

Nevertheless, with the appropriate 'popularization' (education, persuasion and 'propaganda') it is possible to achieve a high degree of participatory planning so that public choices and environmental policies bear a high degree of correspondance to the actual wishes and interests of the population.

The emphasis on popular participation and the enlistment of the inventive skill of workers and peasants does not mean that the Chinese leadership relies on 'politics' and neglects modern science and techniques. Actually, what is aimed at is a policy of promoting both science and politics:

> In the past we had talents in fighting and land reform. These talents are not enough now and we must learn new things such as a real understanding of business matters, science, and technology. . . . With the focus on technology, we are apt to neglect politics. Therefore we must carefully combine technology with politics. Red and Expert, politics and business – the relationship between them is the unification of contradictions. We must criticize the apolitical attitude. We must oppose empty-headed 'politicoes' on the one hand and disoriented 'practicoes' on the other.'[109]

For the Chinese leadership the problem of implementing policies which make up the plan has always presented itself as a question of how to win over the uncommitted part of the population to social change and modernization.

Basically, the implementation of policies consists in the popularization

106. *Cf.* 'A chemical plant fights pollution', *China reconstructs,* June 1972, pp. 11-12.

107. John Fairbanks, 'China is far', *New York review,* Sept. 3, 1970, p. 21.

108. Joshua Horn, *op.cit.,* p. 65.

109. Mao Tse-tung, 'Sixty points of working methods', in Jerome Ch'en, *op.cit.,* pp. 63-64.

of the most 'progressive' solution. In China this method is known as grasping the progressive and the backward solution of a problem. Provided due allowance is made for differences in local conditions the aim is to encourage the backward (and the middle) to catch up with the progressive solution. Special care needs to be taken to sift and evaluate the experiences of more advanced units of production in order to avoid any uncritical transfer of methods and techniques. In practice this procedure may take different forms. By organizing inspection tours for cadres and agricultural or urban laborers to agricultural experiment stations and to progressive factories in the cities, a diffusion of knowledge can be achieved. Exhibitions and the systematic interchange of personnel,[110] as well as radio and films and even the traditional media such as the theater, the opera, the storyteller and poetry recitals[111] are being used to diffuse and popularize new experiences and knowledge with a view to stimulating the application of progressive methods of production.[112] According to Buchanan, this interchange of applied intelligence and the testing of new techniques in the light of local conditions and potentialities is the outstanding feature of China today in accordance with the watch-word 'dare to think, dare to act'.[113] This promotion and diffusion of knowledge without reliance on highly capital intensive modern means of communication like TV or satellite programs seem to be a clear indication that China is fully aware of the importance of education and the spread of knowledge for the social reconstruction and modernization of the country.

b) *Rules and regulations*

The literature and official documents dealing with the protection of the natural and social environment makes few specific references to statutory rules and regulations or other specific measures of environmental control. Press reports speak in general terms of ordinances according to which no new industrial enterprises are allowed to be established which have not solved satisfactorily the environmental problem; they also refer to the establishment of a permanent environmental authority in Peking.[114] Minimum standards are mentioned only in connection with public health, sanitation and housing where they seem to serve as norms for planning and implementation. This lack of reference to specific rules and regula-

110. *Ibid.*, p. 62.

111. Alan P. L. Liu, *The use of traditional media for modernization in Communist China*, Cambridge, MIT Press, 1965.

112. Mao Tse-tung, in Jerome Ch'en, *op.cit.*, p. 62.

113. Keith Buchanan, *op.cit.*, p. 38.

114. Similar rules were reported recently (1972) from the Soviet Union: 'Aucune construction immobilière et installation industrielle nouvelles ne seront mises en service si elles ne comportent pas d'ouvrage d'épuration permettant de recycler les eaux résiduaires', *Le Monde*, August 29 (8), 1972.

tions may be due to the fact that they are part of the plan and are simply administrative rules. It would doubtless be interesting to have more detailed information about this point.[115] However, the Chinese Delegation at the Stockholm Conference (1972) made specific legislative proposals to deal with pollution on an international scale: Thus, China endorsed a special version of 'the polluter must pay' principle by calling for the compensation for international pollution:

> All countries have the right to protect their environment from pollution from outside. Any victim country whose environment is seriously polluted and poisoned by harmful substances discharged or dumped at will by another country is entitled to claim for compensation from that culprit country.[116]

As was to be expected this proposal met with the almost unanimous rejection of the delegates from industrialized countries. The Chinese Delegation also endorsed the proposal for the establishment of an international environment fund to protect and improve the environment. The financial means for such a fund 'should be furnished by the major industrially developed countries, especially countries which seriously pollute the international environment'.[117]

5. CONCLUSIONS

China's environmental policies are an integral part of the planned sociopolitical reconstruction which has been going on ever since the successful conclusion of the anti-Japanese war and the civil war which led to the establishment of the Chinese Peoples' Republic in 1948. More specifically, China's environmental policies are being formulated and implemented within the framework of her general development policies and planning. In the field of agriculture these policies reflect a response to China's excessive specialization and intensive utilization of her alluvial soils and river valleys and the resulting vulnerability to natural catastrophes. China's environmental policies have taken the form of land and water development schemes, large-scale afforestation projects and include regional development and the decentralization of industries. These policies are also concerned with the improvement of public health through preventive medicine and the amelioration of working conditions both in rural and industrial areas. More recently, Chinese planners have paid increasing attention to the prevention of water and air pollution.

115. On the fact that the Chinese legal system operates with general laws and without a constraining jurisprudence, see René Dekkers, 'Le droit chinois', *Encyclopedia universalis*, Paris, 1970, Vol. III, pp. 382-385.

116. *Peking review, June* 27, 1972.

117. *Ibid.*

While China's environmental policies are a response to specific conditions and historical experiences they cannot be understood without reference to an egalitarian orientation aiming at the satisfaction of essential human needs – policies which reflect Marxian and pre-Marxian Chinese aspirations.[118] We have suggested that the fundamental rationale for China's early concern with and the current formulation of environmental policies can be found in certain ideas suggested by Engels and Marx about the central role of social use values as criteria and guiding principles of planning in a socialist society. Neither Engels nor Marx accepted the market and effective demand (i.e. the individual's ability to pay) as the criterion of evaluating the relative social importance of goods and services. Furthermore, the Chinese leadership places considerable emphasis on prior factual assessment and research as a point of departure for the evaluation and formulation of social use values and priorities. As far as the implementation of environmental policies is concerned we have shown that particular stress is placed on some form of 'participatory' planning and the popularization of environmental goals and practical measures, particularly the comprehensive use of materials, and we have finally pointed out that legal rules and regulations seem to play a relatively minor role in China.

We are aware of the fact that there remain many gaps in our account of Chinese environmental policies particularly as far as their overall effects and the relative effectiveness of specific policy measures are concerned. However, it seems safe to assert that China has made considerable progress thanks to her policies of protecting and improving the human environment. While China has certainly not avoided all the social costs of development the country does not seem to present the picture of a deteriorating social and physical environment characteristic of many developing and developed countries.[119]

118. As an example the pre-Marxist egalitarian goals of Sun Yat Sen's principles of economic and social reconstruction may be quoted here: 'The first principle of reconstruction is that of popular livelihood or the promotion of the general welfare. In order to meet the most urgent needs of the people for food, clothing, shelter and communication with one another, the Government shall cooperate with the people in the improvement of agriculture so that all may have sufficient food, in the development of the textile industry so that all may have sufficient clothing, in the building of houses on a large scale so that all may have comfortable homes, and in the building and improvement of roads and waterways so that all may conveniently travel and transport their goods.' Lyon Sharman, *Sun Yat Sen – His life and its meaning*, Stanford, 1968, p. 296.

119. While there are many reports by travellers to China about the 'garden like' character of the Chinese landscape such reports can hardly be accepted as sufficient evidence. The fact that the Chinese landscape makes the impression of a garden is rather a reflection of China's traditional excessive specialization and intensive use of the alluvial plains and valleys to which we have referred earlier. Instead reference should be made rather to the fact that 'the fruit trees are climbing up the hills', that

Before raising the question of the relevance of Chinese policies for other countries and the long-run outlook it may be useful to speculate about the significance of traditional Chinese notions of man and nature for the maintenance of a viable human environment. By raising this question we do not want to suggest that Chinese policy makers are consciously guided by traditional notions. On the contrary. But traditional notions as to man's role in the world are not disappearing over night. They may survive even if they are consciously rejected and the question which concerns us here is to establish whether these notions support or hinder the adoption and implementation of environmental policies. This question is not without relevance for the West, especially if we consider the fact that for hundreds of years Western man has been guided by the notion of man's power over and conquest of nature.

China can look back upon a two thousand year old tradition according to which human behavior including economic action must adapt themselves to nature with a view to assuring that the 'cosmic order of things' remained in harmony with man. By adapting himself to the rhythm of the seasons, by discovering the 'auspicious' and 'inauspicious' days for human action it was believed that man could propitiate the 'forces of nature' and avoid the obstacles and penalties which the latter might put in his way in the form of droughts, floods, poor harvests, etc. We are not suggesting that this traditional Chinese view of man and nature is in any way equivalent to what modern science regards as the laws of nature nor that traditional Chinese behavior observed ecological criteria. The old Chinese rites and sacrifices have nothing in common with modern science and technology – in fact, they may as best be regarded as a pseudo-technology.[120] Nor are we suggesting that the Taoist component of Chinese civilization determines contemporary environmental policies. However, the traditional Chinese view of Man and Nature *does* seem to contain elements of a concept of a dynamic pattern of things in which Man is dependent upon nature and is able to achieve his objectives only in alliance with and not against it. This view of man and his dependence on nature supports the belief that human action (including production) has to be

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the slopes are being cultivated, and that forestry and horticulture are beginning to prevent erosion and that the frequency and severity of floods has decreased (see Wertheim, *op.cit.*, and Engelborghs-Bertels, *op.cit.)* and, last but not least, to the cleanliness of Chinese cities in striking contrast to pre-revolutionary China. In addition, there are the policies of industrial decentralization and the prevention of large urban agglomerations as well as the systematic efforts of re-using waste materials. That there are at the same time industrial districts in which water and air pollution have not been avoided should not be ignored as should be the fact that the Chinese authorities are aware of it.

120. Ignacy Sachs, 'La notion du surplus et son application aux économies primitives', *L'Homme*, July/September 1966, pp. 5-18.

fitted into and guided by an ethical system enforced by a political framework. While modern China has doubtless absorbed the Western and Marxist concept of man's conquest of nature, these ideas have not, it would appear, implied a reversal of the traditional view.[121]

From this perspective it may not be too optimistic to state that the high degree of administrative decentralization and Chinese development policies in general offer an alternative basis of decision-making based upon a socio-economic calculation which tends to avoid or at least to minimize social costs and the impairment of the human environment which has marked the industrial and agricultural development in the West. In short, the Chinese example offers a challenge to socialists (and non-socialists) to reformulate the criteria and objectives of development policies in order 'to take advantage of the convergence between socialist and ecological criteria so as to prevent the destruction of civilization'[122] promoted as it is by the monetary calculus of the market economy and its formal concept of rationality. The Chinese leadership has shown not only a relatively early awareness of problems of environmental disruption but a willingness and a capacity of dealing with them. This differs greatly from the position of some other developing countries which have even been willing to accept polluting industrial plants which certain advanced countries are trying to dispose of under the pressure of public opinion and legislation.

We have neither argued nor implied that the Chinese process of development was primarily determined by ecological and other qualitative criteria; but we do maintain that such criteria have played a role in determining the direction and the rate of development to a considerable extent. In this sense, we feel that the Chinese 'model' offers some hope that alternative principles of decision-making – alternative to those applied by competitive economies – do exist and that a 'convergence between socialist and environmental criteria'[123] is not only possible but offers a real opportunity for an improvement of the quality of life. Again, we are not arguing that these alternative principles of environmental planning can be simply borrowed from China and that their application would not necessitate far-reaching political and institutional changes as well as changes in the distribution of wealth, income and power as well as a stronger commitment of the working class, the trade-union movement and other groups

121. For a contrary position, see Rhoads Murphy, 'Man and nature in China', *Modern Asian studies* 1 (4), 1967, pp. 313-333, *cf.* especially p. 319. On the whole subject see, however, Leo A. Orleans and P. Richard Suttmeier, 'The Mao ethics and environmental quality', *Science,* vol. 170, p., 1173. – and above all Joseph Needham, 'The past in China's present', *The centennial review of arts and science* (Michigan), 4 (2+3), 1960, pp. 281-308, and Engelborghs-Bertels, *op.cit.*

122. Colin Stoneman, 'The unviability of capitalism', *Socialism and the environment,* Nottingham, Spokesman Books, 1972, p. 97.

123. *Ibid.,* p. 97.

to the goal of improving the quality of life. The pressures of market domination (oligopoly) and the development of technologies (for military purposes including space exploration) would have to be curbed and resources re-allocated in accordance with a socio-political evaluation of the essential requirements of human life. In other words, we do not think that environmental disruption will be stopped by correcting a few minor 'market failures' and 'misallocations' of resources, by levying taxes or effluent charges or by punishing those who evade the new rules of the game administered by a bureaucracy which may actually work hand in hand with the industries to be regulated. Environmental planning calls for new socio-economic institutions and new forms of calculation in terms of criteria and data which are not derived from a monetary calculus or computed in the light of individual willingness to pay.

However, with regard to China's future the question may be raised as to whether industrial development, population growth, modern technologies and external military threats may not force China to change her present policies and expose her people to a degradation of their social and physical environment similar to that of the 'rich' countries of the West. As we have pointed out China stands only at the beginning of the process of industrialization. Her technology and techniques will change and advance and so will the volume of her industrial and agricultural output. The modernization of agriculture in order to feed a growing population and to provide the raw materials for industries will call for a greater application of chemical fertilizers, pesticides and other modern inputs which may increase the danger of pollution.[124] Industrial expansion may carry similar risks of air and water pollution. There are those who are inclined to argue, apparently in implicit analogy to experiences made in affluent societies that 700 million poor Chinese operating with a traditional technology may be one thing 'but 700 million rich Chinese would wreck China's environment in no time'.[125] Finally, international threats and the importance of defending herself and her mineral resources against foreign power may be such as to force China into courses of action which may be disrupting her environment. While these and similar considerations may raise questions and uncertainties regarding China's environmental policies in the future they should not be permitted to distort our perspective and create the impression that there are after all no differences between China and the 'affluent'

124. 'The rapid rise in the use of chemical fertilizers would mean that these chemicals will sooner or later lessen China's dependence on night soil for fertilization, and human wastes will be increasingly discharged into the waterways.' Charles Snyder, 'Tomorrows' challenge', *Far Eastern economic review*, Oct. 31, 1970, p. 43.

125. 'It's the rich who wreck the environment . . . occupying much more space, consume more of each natural resource, disturb ecology more, litter the landscape and create more pollution', J. Mayer and T. G. Harris, *Psychology to-day* 3 (48), January 1970.

market societies of the West. To be sure if China is attacked she will defend herself regardless of the environmental consequences of the economic and industrial policies imposed upon her. However, in case of war the main threat to China's environment will come less from her own policies than from modern methods of environmental warfare the prototype of which has been the war in Indochina. As far as the juxtaposition of 700 million poor with 700 million rich Chinese is concerned it is based upon the tacit and false assumption that 700 'rich' Chinese would adopt the consumption pattern of 500 million 'rich' Americans or Europeans. This assumption overlooks the fact that the consumption patterns of America and Europe are based upon the unequal distribution of income in market economies and is, moreover, actively enhanced by the sales promotional efforts of those who have a commercial interest in these patterns of distribution and consumption. Communist China's egalitarian aspirations and her traditional ethic of frugality and perhaps even her traditional notions of the relationship between man and nature may offer, in our estimation, some protection against the distortions of human consumption habits and standards which have developed in contemporary 'affluent' societies under the pressure of market domination and the commercial manipulation of human wants. At least, in the foreseeable future there are no reasons to believe that China is likely to change her priorities and her concern for the satisfaction of essential fundamental human needs or that she should develop the type of ecologically disruptive consumption patterns characteristic of Western societies. Moreover, China is actively pursuing a policy of family planning aiming at a population growth rate of not more than 1% (by 1980).[126] Latest Chinese data indicate that population growth has been slowed down. In fact, these estimates place the Chinese population at 697 million in 1970. In the cities the majority of the families are satisfied with two children in contrast to families in the rural areas which are indeed substantially larger but even there family planning is said to have made marked progress.[127]

During the last decades China has been able to feed its growing population (with relatively negligible imports from abroad) thanks to its water conservancy policies and the expansion of production and yields. It is true, this does not prove that China can support twice or three times its present population with its present technology but the opportunities for an improvement of agricultural production are far from being fully utilized.

In addition, China will have to develop safer chemical fertilizers and pesticides and non-chemical, i.e. biological methods of insect and pest con-

126. *Cf.* Statement of Chou En-lai quoted in Stoneman, *op.cit.*, p. 96. See also the report from a Japanese expert (Mr. T. Katagiri) on birth control and its success in China, *U.S. news and world reports*, March 5, 1973, pp. 77-78.

127. Stoneman, *op.cit.*, p. 95.

trol[128] as well as systematically develop and use safe methods of applying natural easily degradable human and industrial waste products for fertilization. The present emphasis on the re-use of industrial waste products (recycling) is another illustration of the fact that China is able to cope with its environmental problems even though it must be admitted that with the labor supply becoming more scarce it would be more difficult and more 'costly' to apply the present labor intensive methods of recycling waste materials.

Nevertheless, in all these respects, it seems to us that environmental disruption in China is less critical and easier to control than in other countries. The Chinese Government has time on its side, and can adopt the necessary controls. While China may not escape all the environmental risks of economic development she finds herself, thanks to her socio-economic institutions, her political system, her cultural heritage and traditions, her egalitarean aspirations and value premises, her methods of socio-economic calculation, her economic and environmental policies and interestingly enough even due to the size of her population in a more favorable position to pursue also in the future developmental policies that are ecologically less hazardous than some of the highly industrialized countries. In fact, 'present theory and practice ... offer hope that future circumstances will not automatically force adoption of [environmentally] unviable techniques. Paradoxically, the huge size of the population may bring recognition of the dangers of exhausting natural resources (including water) before any commitment to unviable consumption patterns develop.'[129] Indeed the fundamental difference between market economies and socialist methods of allocation and evaluation make it likely that China's chances to avoid what has happened and is still happening to man's environment in Europe, America and parts of South America are much greater quite apart from the fact that the environmental degradation is much further advanced in these countries and therefore more susceptible to catastrophic breakdowns.[130]

128. Large-scale experiments on biological methods of insect control (breeding of parasitic wasps) and use of neon-lights against insect pests were reported from South China, Kwantung and Honan. See Jon Sigurdson, 'China: Recycling that pays', *Läkartidningen*, 69 (23), 1972, p. 2841.

129. Stoneman, *op.cit.*, p. 96.

130. *Ibid.*, p. 96.

Environmental disruption: Challenge to social science*

1. INTRODUCTION

Since the task of presenting the opening statement to this international symposium has been assigned to me, I should like to preface my paper by one or two introductory observations. I consider it as particularly appropriate that this first international symposium on the disruption and possible destruction of man's environment takes place in a country that had to endure the horrors of Hiroshima and Nagasaki. Moreover, Japan today has one of the most rapid rates of industrialization and of economic development with all its disruptive consequences on the environment. This is another reason which makes the choice of Tokyo as the geographical site for this international discussion of a world-wide problem highly appropriate.

The impairment of man's environment has a long history; some of the phenomena even antedate the Industrial Revolution; they can be observed in varying forms and intensities in pre-industrial societies and less developed economies. However, while deforestation, soil erosion and even air and water pollution are anything but new phenomena, their role and significance as threats to human well-being and in fact to human survival tend to become cumulative with the progress of modern industrial techniques and their indiscriminate application under conditions of increasing rates of population growth and settlement density. In fact, the rapid advance of science and technology in such fields as energy production from atomic and thermo-nuclear sources, the unresolved problem of the disposal of radio-active waste material, the indiscriminate use of pesticides

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and 'hard' detergents, new means of transportation at super-sonic speeds with their detrimental effects of noise, the ever increasing use of automobiles, the steady growth of agglomerations with their congested and unsanitary living conditions, new techniques of communication and of storing data and centralizing knowledge of all sorts together with their potential use for purposes of controlling and manipulating human behavior and human choices – all this introduces new hazards into man's natural and socio-political environment which are bound to undermine his physical and mental health[1] and ultimately to threaten human civilization and survival. I do not regard it as my task to analyze these actual and potential consequences, which, indeed, has been done by more competent scholars working both in the natural and social sciences. However, we need to remind ourselves that the impairment of our environment has reached not only a new quantitative dimension but a new quality as a result of the combined and cumulative effects of the complex interaction of a multitude of factors. While pre-industrial societies have been threatened by man-made deforestation, erosion and natural catastrophes of various sorts, and while air and water pollution could perhaps still be regarded as limited dangers a few decades ago, the causes and effects of the disruption of man's environment have multiplied to such an extent that it is necessary to view them as immediate threats and typical phenomena which transform the world upon which human life and survival depends.

The disruption of man's natural and social environment has been discussed and to some extent systematically investigated for more than two decades. However, the growing realization of the magnitude of the dangers involved has given the problem of environmental disruption a new urgency which makes it one of the most challenging issues which mankind has ever faced and calls for practical action which does not permit further postponement. The social sciences must develop more adequate perspectives and concepts for the analysis of the causal chain which leads to environmental disruption and thus prepare the ground for more effective methods of control.

The analysis and control of the impairment of the environment in modern society is not the special province of any particular scientific discipline or group of disciplines. No single discipline and indeed neither the social nor the natural sciences of and by themselves are able to come to grips with the problem of environmental disruption. For, this disruption is

1. 'The problem of the psychological pressure of crowding [. . .] the development of stress syndromes in some mammals leads to death, increases frustrations and neurotic behaviour [. . .] it is bound to engender violence if it goes on too long [. . .] crowding means you are going to have an increasing amount of regimentation, which can very readily go over to authoritarianism if you are not careful.' From Sir Julian Huxley, 'On population', *The center diary*, Santa Barbara, July 4, 1946.

the outcome of a complex process of interaction of social and physical factors which cannot be adequately analyzed in terms of the concepts, theories and perspectives of any of the conventional disciplines. The disruption of man's environment by his own activities and decisions is a particularly complex process which transcends the scope and the points of view of any of today's highly compartmentalized fields of study. For this and other reasons which, I hope, will become more persuasive in the course of the subsequent analysis, I feel that many of the terms and concepts developed by particular disciplines (as, *e.g.*, externalities, diseconomies, nuisances, ecological imbalance, biospheric disruption, etc.), useful as they may have been and perhaps still are for particular theoretical purposes, are no longer adequate. In fact, the increasing disruption of man's natural and social environment raises the most far-reaching problems not only with respect to the proper methodological and theoretical procedures but also, and particularly with regard to the proper modes of control and policy-making. The solution of these theoretical and practical problems calls for the closest possible collaboration of social and natural scientists, including technologists. With this end in view I would indeed endorse Professor Tsuru's suggestion to use the term 'environmental disruption' as a broad and general concept designed to cover all those phenomena which either singly or together affect the character and quality of the natural and the social environment of man. The use of the term environmental disruption should serve as a recognition of the fact that we are concerned with matters that touch the core of human existence and which in their complexity transcend the scope and competence of any particular discipline.

2. CIRCULAR CAUSATION

This brings me back to the fundamental issue of the causal process which gives rise to the disruption of the physical and social environment. Only if we view the process of causation correctly can we hope to make headway with the urgent task of controlling this disruption or at least limiting its most destructive effects. Nothing would be more misleading than to oversimplify this process of causation and view it in a superficial and uncritical way.

Of course, it is true that the increase of population alone is bound to give rise to an impairment of man's environment. It is also correct that some disruption may be caused by natural catastrophes without man's intervention. And nobody can deny that evidence of environmental disruption antedated modern industrial societies. Air pollution was reported in London as early as the 13th century and deforestation of steep slopes and valleys with its increased incidence of destructive snow and stone

avalanches – not to mention erosion – has been present in Switzerland long before the Industrial Revolution and before this country developed a predominantly industrial structure during the 19th and 20th centuries. Similarly, destructive effects of deforestation have been characteristic features of other pre-industrial economies including many of today's less developed Asian countries, as for instance the Philippines, Indonesia and India.[2]

However, these earlier examples should not divert our attention from the important fact that in modern societies disruptive effects are set in motion by the often indiscriminate use of industrial techniques under specific conditions of institutionalized legal relations and patterns of action and investment. Hence to concentrate only on the physical chain of causation or to view the problem in isolation from the institutional framework in which it takes place can convey only an incomplete and therefore a false picture. In short, the causal chain is at the same time a physical and a social process.[3] Speaking as an economist, I have long held the view and continue to believe that the institutionalized system of decision-making in a market economy has a built-in tendency of disregarding those negative effects (*e.g.*, air and water pollution) which are 'external' to the decision-making unit. Even if an individual firm intended to and would be in a financial position, as many oligopolists obviously are, to avoid the negative effects of their applied technology, it could do so only by raising its costs; that is by deliberately reducing its profit margin and its profit earning capacity. Thus, a system of decision-making, operating in accordance with the principle of investment for profit, cannot be expected to proceed in any other way but to try to reduce its costs whenever possible by shifting them to the shoulders of others or to society at large. Two points may be raised in opposition to this view. In the first place it may be argued that these affected persons or society will defend themselves by legal action if they consider the damages of sufficient importance. If they do not defend themselves, this must be proof of the fact that the damages are not important enough to warrant such action. This argument overlooks that *a)* the damage may be gradual in building up until it becomes cumulative in character and comes to light only after considerable delays, and *b)* it may be difficult to prove damages and impossible to impute them to the action or lack of action of any particular economic unit.

2. See K. Wm. Kapp, 'Social costs in economic development', in: G. P. Sicat *et al.* (eds.), *Economics and development: An introduction*, Quezon City, 1965 (Reprint no. 49, Institut für Sozialwissenschaften, Universität Basel, Switzerland), and C. Uhlig, *Das Problem der 'social costs' in der Entwicklungspolitik*, Stuttgart, 1966.

3. Professor Tsuru has made the point that 'superimposed upon the physical chain of causation are the socio-economic and legal relations which could make a great deal of difference to the impact of physical factors upon human welfare'. *Cf.* 'Environmental pollution control in Japan', Paper presented to the International Symposium on Environmental Disruption in the Modern World, *op.cit.*, p. 1.

In the second place, it may be argued – in opposition to my view that the institutional pattern of decision-making in a market economy has a built-in tendency of disregarding all negative effects – that the decisions of municipalities and public authorities in general are also responsible for the disruption of the environment. This is doubtless correct. One may even be inclined to go a step further and argue that socialist planning agencies will act in a similar way. Perhaps this is so, although it is not self-evident why.

But let us review these cases a little more closely. In the first place there is no doubt that municipalities also contribute to the disruption of the environment. However, apart from the problem of the relative importance of public sources of environmental disruption (in comparison to private sources),[4] does this refute the thesis advanced earlier? If municipalities and public or planning authorities set the stage for an impairment of the environment, for instance when they attract industries in order to increase their tax income regardless of possible negative effects they sacrifice the quality of the environment for revenues by choice, that is their action is identical to that of a private firm operating under the 'constraints' of the principles of rentability. Both try to maintain an artificial, purely formal short-run financial solvency by ignoring the social costs of development. Some of the current attempts to render public decision-making more 'rational' in terms of market costs and returns may carry the danger that the disregard of some or all of the negative effects of decisions may become even more general and typical. Instead of reducing the incidence of social costs connected with environmental disruption, such attempts are likely to increase them.

Rather than pursuing this perhaps controversial line of reasoning, let me suggest a more general framework of analysis in order to deal with the explanation of the process of causation which underlies the disruption of man's environment. Human action, including public decision-making, takes place within, and has repercussions on our natural-physical environment which has its own ecological structure and is subject to specific laws.[5] If these structures and regularities are left out of account, either due to ignorance or deliberately, the outcome of any decision may differ from one's intended objectives or, even if the original goal is attained, there may be additional effects of a negative character. Viewed in this way, the disruption of the environment can be interpreted as the outcome of human action which, while apparently rational within a given institutionalized

4. 'According to some estimates in some fields, and with respect to some kinds of discharge, industrial wastes exceed by a multiple the discharge by all municipalities, quite apart from the fact that industrial plants discharge vastly different amounts of waste.' A. V. Kneese, 'Research goals and progress towards them', in: H. Jarret (ed.), *Environmental quality in a growing economy*, Baltimore, Md., 1966, p. 79.

5. The same applies *pari passu* to the disruption of the social environment.

framework of socio-economic and legal relations, nevertheless gives rise to a particularly destructive (social) irrationality because its repercussions on the physical, biological, psychological and social environment are ignored or neglected.

The result is an inefficient use of economic means and resources in the sense that socially more important values and objectives are sacrificed and remain unsatisfied in favor of less important ones. More specifically, formerly 'free' goods like clean air and water have become scarce. Moreover, by shifting the costs of environmental disruption to third persons or to society, we add to the distortion of an already imperfect market and price structure and of the distribution process. Some economic units are able to acquire income by disrupting our environment. It is not only that they get something for nothing, which is problematical enough from the point of view of any hoped for and frequently alleged correlation between income and output, but they get something by causing damages to others and society.

We may go one step further: by viewing human action as taking place within, and with repercussions on a physical and social environment with specific structures and regularities, it becomes clear that the various spheres of man's environment which are affected by his action are interdependent. Moreover, the interaction of the socio-economic with the physical and biological spheres (or systems of relationships) is much more complex and much less explored than the operation of any of the various systems which the conventional academic disciplines have isolated for separate study in the light of their particular objectives. If we look in this way upon the causal chain which gives rise to disruption it must be evident that its causal analysis cannot be carried on successfully in terms of one or the other of the compartmentalized social, physical and biological disciplines. Neither social nor natural scientists nor engineers and public health experts, trained in their limited disciplines and familiar only with their narrow concepts and theories today are able to focus attention on the whole relevant pattern of interaction which must be the 'unit of investigation' – if we are to make headway with the causal analysis of the impairment of our environment. It is true, we still lack such a theory and/or science which is capable of elucidating the mode and outcome of the complex interaction of several systems. Hence, our knowledge of the causes and extent of environmental disruption is incomplete and we continue to feed this imperfect knowledge into data-processing computers. In other words, we must act on the basis of imperfect knowledge as we have in the past and may have to, even though to a lesser extent, in the future.

However, there is one important aspect we do know about the causal chain which gives rise to the disruption of man's natural and social environment: in many (if not in most) instances it is a process of circular causation which has a tendency of becoming cumulative unless some

deliberate action is taken to arrest or redirect it. The effects for instance of air and water pollution are typically the result of the interaction of several factors. Thus, the effects of any single discharge of pollutants varies with its frequency and concentration as well as the capacity of the environment to absorb the pollutants without harmful effects.

'Up to a certain level of concentration, disposal of wastes, disfigurement of the landscape, and congestions are, at worst, local irritations. Air, water and earth room can absorb a lot without great damage. Beyond that point, real trouble ensues; differences of degree of frequency and concentration create differences in kind.'[6] In short, there is a threshold beyond which further discharges of waste cause not constant but cumulative changes and disproportionate damages. The disruption of man's natural and social environment is cumulative in still another way. Not only will different kinds of pollutants from different sources combine in chemical reactions but a whole series of intervening environmental variables such as weather, wind, topography and even design of construction of dwellings in large cities may combine to bring about varying degrees of deterioration of the quality of the environment. Such cumulative tendencies apply not only to air but also to water pollution. What is frequently overlooked is the fact that the quality of our environment as indeed that of society is always an aggregate: that is to say, the actual effect in terms of damage to human health and vitality, and actually experienced discomfort caused by any particular type of environmental disruption is always a function of the combined effects of all sources of disruption which may include, in addition to air and water pollution, other factors such as excessive noise, urban concentration, long hours spent in travel to and from work in metropolitan areas under chaotic traffic conditions and inadequate, congested transport facilities with high accident and death rates, inadequate time for leisure and recreation and the progressive absorption of free space and open landscapes.[7] Future hazards to man are such more or less dimly visualized developments as sonic booms, radio-active contamination, damage to the genetic structure and mutations, to name only a few.[8]

6. Jarret (ed.), *op.cit.*, pp. ix-x.

7. A more complete picture would have to include such perhaps less tangible but no less important factors as the effects of increasingly sedentary working conditions in an expanding service-sector of the economy, changes in the rhythm of work and rest, increasing specialization and monotony of work in some, and requirements of hectic performances in other professions, which in their combined effects are manifest in specific occupational morbidity and mortality rates and new characteristic civilization diseases. (*Cf.* M. Hochrein, J. Schleicher, *Herz-Kreislauferkrankungen*, 1959).

8. *Cf.* H. J. Barnett, 'Pressure of growth upon environment', in: Jarret (ed.), *op.cit.*, p. 16.

3. INCREASING ENVIRONMENTAL DISRUPTION AND INCREASING SOCIAL COSTS

Before dealing with some of the more specific issues raised by the control and maintenance of the quality of man's environment, I would like to advance the thesis that we are faced with a tendency of an increasing impairment of the environment and hence of increasing social costs resulting thereform. The thesis is advanced tentatively and substantiated here in a deductive, systematic manner but I am sure that it can be and will be substantiated also in terms of empirico-quantitative data as soon as we put our mind to developing the proper statistics and quantitative indicators. With population rising at prevailing rates, with output (as measured in terms of GNP) rising at higher rates than rates of population growth, with time (as measured in travel time) and space shrinking, not only congestion but input and hence residual waste products and the need for their disposal tend to increase disproportionately. Under these circumstances, the resulting disruption of the environment is likely to increase disproportionately also unless inputs could be converted fully into outputs and consumption of final outputs took the form of a final 'destruction' of such outputs or, alternatively, if the capacity of the environment to assimilate residual waste products could be shown to be unlimited or could be increased without running into increasing real costs. None of these conditions is fulfilled or can be expected to hold as has been shown recently.[9]

The capacity of the environment to assimilate residual waste products is limited and can be expanded only at increasing costs; inputs cannot be converted fully into outputs and the so-called consumption of final products, far from being a process in which such outputs are fully used up or 'destroyed', leaves undesirable waste products to be discharged and disposed of in one way or another. After a certain threshold has been reached, such discharge tends to lead to a growing impairment of the environment with resulting negative consequences on human health and life which can be counteracted and controlled only at increasing costs. In the light of these considerations it must be clear that increasing population, rapid progress of science and an indiscriminate application of new technology, increasing outputs and hence inputs, while increasing 'productivity' (in a narrow sense), nevertheless are giving rise to increasing social costs understood either in physical terms (*i.e.*, in terms of the negative social effects represented by the impairment of the environment, human health and life) or in terms of the real outlays measured in terms of labor required to prevent or remedy damages caused by the disposal of residual waste products. Until quite recently, modern industrial economies have not held their producers accountable for the widespread damages caused

9. R. U. Ayres and A. V. Kneese, 'Production, consumption, and externalities', *American economic review* 59 (3), June 1969, pp. 282-284.

by increasing outputs (and inputs) and their practice of disposing of residual waste products more or less indiscriminately with the resulting impairment of the quality of the environment.

Today we are witnessing a growing awareness of the character of the damages caused and of the losses sustained. As long as this awareness was absent or could be played down by general references to the advantages of growth and development and also to the obvious difficulties surrounding all exact measurement and evaluation of losses, it was possible to take a 'calculated risk'[10] with regard to these losses or to disregard them by shifting them to the economically and politically weaker sections of society. Such a willingness to take 'calculated risks' with man's environment and hence with human health and life was and is, of course, in open violation to all those systems of ethics which do not condone the sacrifice of human health and life either to increased output or to some abstract notion of the common good.[11] Today with the growing awareness of the actual and potential damages, the deterioration of man's environment is a public and hence a political issue. Thus, it becomes evident that economic practice and economic theory have systematically underestimated the costs of production, that the unpaid or social costs unaccounted for in traditional entrepreneurial outlays have been staggering and that the real costs (measured in terms of labor required to remedy or prevent the deterioration of the environment) are assuming increasing proportions of total costs and outputs.[12]

But whether the principle of increasing environmental disruption and increasing social costs is accepted or not one conclusion can hardly be denied: under the impact of human action and decision-making and under the influence of a rapidly advancing technology and science, our environment is being transformed to an ever increasing extent. To be sure, man has always changed and adapted his environment in accordance to his

10. The term 'calculated risk' is, of course, a popular cliché which appeals to our age of calculation and measurement; actually nobody 'calculated' anything and there was at first no empirical experience in terms of which probabilities could be measured. *Cf.* L. A. Chambers, 'Risk versus cost in environmental health', in: H. Wolozin (ed.), *The economics of air pollution*, New York, 1966, pp. 51-60. On the illusions underlying the cliché of a 'calculated risk' and probability calculations in contemporary social and military sciences, including capital and investment theory and business administration, see A. Rappoport, *Strategy and conscience*, New York, 1964, p. 22 *sq.*

11. Chambers, *op.cit.*, p. 52.

12. I cannot deal here with the implications of the foregoing analysis for future rates of growth except to emphasize that our traditional measures of output and growth in terms of GNP are likely to become progressively inadequate and unreliable as indicators of growth and development if increasing amounts and proportions of outlays are spent on nothing else but works designed to protect and keep intact the substance of our environment.

own requirements. In this sense the present disruption represents an acceleration of a trend which has been present in the past. However, what must not be overlooked is the fact that we are confronted with a change of quantity into quality. Today's transformation of the environment is no longer an expression of an increasing mastery over the world we live in but is instead a sign of a loss of such mastery. We have reached the point where a steadily growing quantity of disruption turns into a serious impairment of the quality of the environment. It is this impairment with its manifest threats to human health and human life which has created an entirely novel situation. Its novelty is precisely the fact that the more the environment becomes the product of our action the less can we escape with impunity the responsibility of controlling and maintaining it. This brings us first to the problems of measurement and evaluation.

4. PROBLEMS OF MEASUREMENT AND EVALUATION

In view of the extent of the deterioration of man's environment nothing seems to be more important than to develop reliable indicators designed to assess, measure and evaluate, to the fullest possible extent, the degree and consequences of this deterioration in its various manifestations. This issue is directly related to the problem of environmental control. In the first place, the assessment of the negative consequences of environmental disruption is an important desideratum of and, indeed, the first step toward an evaluation of the benefits obtainable from the control, protection and improvement of the quality of the environment. The two tasks: assessment of negative consequences and estimates of benefits, are closely interrelated. In the second place, it has long been argued that measures of control are economically justified only if their total benefits exceed or equal their costs. For this reason too, problems of assessment and measurement are obviously important.

And yet, problems of measuring costs and benefits belong to the thorniest and most controversial issues. Nor is this surprising. Both the costs of environmental disruption and the benefits of environmental control and improvement are predominantly non-market in character. Many of the costs and benefits cannot be quantified and still less be adequately measured in terms of prices. Some may be measurable in this manner or means may be found to arrive at some indirect form of quantification in monetary terms. For example, when air and water pollution affect property values, any improvement of the quality of air and water may be reflected in higher land or real estate values. But even here problems arise. Suppose we were able to devise a technique to establish and impute the causal contribution which a particular source of water or air pollution has made to the loss of value of a particular site, this would still not be a

reliable and unambiguous measure of social costs nor of benefits of control. Just as the decreased land and property values caused by air and water pollution affect third persons who may have had nothing to do with the productive process responsible for the pollution, the increased property value resulting from air and water pollution control are in many instances 'unearned' increments. To identify such unearned increments with the social benefits of environmental control is highly questionable, even on theoretical grounds, which most social scientists, and especially economists, would have to reject as problematical even though, or more precisely because, such identification may be found acceptable by the real estate lobby.[13]

Any suggestion to decide the justification of control measures in terms of a willingness to pay for them, or by assuming a capacity to compensate those who have to bear the costs of control out of increments of property values or other monetary values accruing to others fails to take sufficient account of three factors: *a)* actual markets are far from perfect – in fact they are 'oligopolistic' in character –, *b)* the consequences of environmental disruption are highly heterogeneous and cannot be compared quantitatively with one another, and *c)* the benefits obtainable from environmental control are equally heterogeneous and can neither be compared quantitatively with one another nor with the outlays for control. To quantify them nevertheless by means of some arbitrary monetary standard is at best problematical and at worst contradictory to logic if not in violation of our ethics. For what is the monetary value of human health and human life? What is the value of the quality of urban life or the beauty of a landscape that is being sacrificed in the process of urban expansion? The fact of the matter is that both, disruption and improvement of our environment, involve us in decisions which have the most heterogeneous long-term effects and which, moreover, are decisions made by one generation with consequences to be borne by the next. To place a monetary value on and apply a discount rate (which?) to future utilities or disutilities in order to express their present capitalized value may give us a precise monetary calculation, but it does not get us out of the dilemma of a choice and the fact that we take a risk with human health and survival. For this reason, I am inclined to consider the attempt of measuring social costs and social benefits simply in terms of monetary or market values as doomed to failure. Social costs and social benefits have to be considered as extra -market phenomena; they are borne by and accrue to society as a whole; they are heterogeneous and cannot be com-

13. It is possible to justify such identification of social benefits with unearned increments on the basis of some arbitrary and highly unrealistic assumptions as to market structure; on the whole subject see M. Mason Gaffney, 'Welfare economics and the environment', in: Jarret (ed.), *op.cit.*, p. 91 *sq.* and 99.

pared quantitatively among themselves and with each other, not even in principle.

More specifically, the social benefits sought by environmental control are social or public goods and must be dealt with as such. That is to say, they are above all goods or services which diffuse themselves throughout society; no one can nor should be excluded from their enjoyment; they are 'non-rival' that is, their use or enjoyment by one does not necessarily reduce their supply. For this reason we will have to look for other methods of assessment than those available or suggested in terms of market values. We will have to face political decisions based on evaluations arrived at outside the market under conditions of possible disagreements and lack of unanimous consent. Such decisions are similar to those which were made in the past and continue to be made with regard to labor legislation (including workmen's compensation for accidents and occupational diseases), to social security legislation and legislation regulating standards of food and drugs, provisions of educational facilities, etc. No cost-benefit analysis helps us in these instances and no market values and indeed no compensatory principle and no Pareto optimum can help us here in deciding whether and which controls are to be adopted. As in all decisions of this kind, we will have to act even if some industries may be worse off or fail to give their consent initially as was the case with regard to the aforementioned cases of legislation. In fact, the more we admit that *all* benefits (secondary, indirect, intangible, etc.) of control measures ultimately have to be included in benefit-cost calculations the more problematical becomes any evaluation in terms of one single monetary standard. In short, I fail to see that cost-benefit analyses as they stand today have a solution of the problem of evaluating either the social costs of the disruption, or the social benefits of the improvement of our environment by control measures.[14]

And yet, my position should not be interpreted as a counsel in favor of

14. Musgrave and others have made the point that the situation is more 'manageable' when we deal with multipurpose water development projects, for in this case we are confronted not with a final social benefit but with an intermediate (social or public) good which contributes to final goods with market values, R. A. Musgrave, 'Cost benefit analysis and the theory of public finance', *Journal of economic literature* 3 (3), September 1969, p. 800. While this is true up to a certain point I doubt whether the case is in fact much easier and more manageable. Because even in this case it is not evident that the current market values (*e.g.*, of crops or electricity) are such as to provide (especially in less developed countries) a sufficiently reliable and meaningful indicator of the relative importance of the goods and services which can be produced with the aid of such intermediate social goods or projects – quite apart from such thorny problems as the choice of the capital inputs (*e.g.*, seed varieties) and hence yield data to be used not to speak of the selection of the interest rate to be applied as the relevant discount rate in order to arrive at current values of benefits.

arbitrary action; nor should economists who hold similar views be accused of preaching a gospel of license. In order to act rationally, we must know and assess the consequences of our action or non-action. To this effect we will have to draw the necessary inferences from what I have called the complex and cumulatice character of the causal chain and to make an inventory of the actual and potential damages and losses caused by investment decisions and government action or non-action. To this effect, we need a cooperative multi-disciplinary research effort on a national and perhaps an international basis.[15] In fact, in modern industrial societies it has always been important and is steadily becoming more urgent to anticipate the actual and potential effects of damages *before* investment decisions are taken. What are needed are inventories of the fullest possible range of the consequences which new technologies and inputs are likely to have on man and his environment. There can be no rational action and decision-making any more without systematic prior scientific analysis and prognosis. Many (though perhaps not all) of the unanticipated negative consequences and social costs which confront us today could have been anticipated by prior research and adequate outlays for scientific analysis. Today when we can build upon the accumulated experiences and lessons of the past, the pay-off of such prior research and prognosis is likely to be considerable.

Analysis and prognosis, by assessing the consequences of decision-making, will provide us with an inventory of the nature of the damages and social costs of private and public investments; it will at the same time yield the necessary data and facts in the light of which it will be possible to evaluate and revise our aims and objectives and thereby to improve our policy-making. However, far from denying that measurement is important and that science is measurement (and all that), I want to emphasize that what is even more important than precision in measurement is the selection of the goals, *i.e.*, the distinction of what is essential and what is less essential; this indeed will call for more than data and facts concerning the possible consequences of alternative courses of action. It calls above all for some general standards in terms of which it may be possible to agree on and select the social goals we seek. Once agreed and stipulated, it would then be necessary to compare the real costs of attaining such stipulated ends by different courses of action or methods of control.

15. It may well be that this research effort calls for an institutionalization in the form of national and international research institutes whose primary task it would be to develop methods of study and collect relevant data related to the deterioration of man's environment by various types of investment decisions under specific conditions.

5. ENVIRONMENTAL CONTROL

The data and relationships established by analysis and their possible future consequences are directly relevant for the elaboration of the policies and methods of control which we are looking for. Implicit in this suggestion is the thesis that such data and relationships point to norms of action and facilitate the formulation of explicit value premises. By telling us what we have to expect; by showing us the dangers and threats which the disruption of the environment implies for human health and survival, analysis and prognosis define the choices before us and are thus part of the process of arriving at intelligent and reasoned decisions. In short, they are indispensable parts of the logic of formulating aims, policy objectives and methods of control.

The standards in terms of which it may be possible to stipulate specific social goals remain, of course, subject to *bona fide* differences of opinion. For this reason it is essential to work out objective standards in the form of appropriate limits of maximum tolerable or acceptable levels of concentrations of contaminants, *e.g.*, in such fields as air and water pollution or minimum requirements for the maintenance of human health and survival. The object of such safety limits is to determine the extent to which any type of disruption becomes a threat to the environment and to man. We cannot concern ourselves here with the specific techniques of elaborating such limits.[16] This is the task of natural scientists, technologists, public health experts and social psychologists. What concerns us is the role and significance of safety limits in connection with the problem of controlling the disruption of the environment. Such limits fulfill several functions in addition to providing criteria for measuring (in physical terms) the state of the disruption of the environment at a given time and place, thus serving also as indicators of dangers. They define what may be called the fundamental existential or minimum requirements of individual life (or social needs). In fact, they may be regarded as the individual and social welfare minima directly relevant for the formulation of social goals or objectives. That is to say, while such safety limits do not represent automatically social goals – indeed they have not been social goals in all those countries which have tolerated the present disruption of the environment – and while the selection of policy objectives will continue to call for choices, such choices will have to be taken as a function of the social or existential minimum needs on the one hand and the community's pro-

16. In the light of our analysis of the cumulative nature of the causal chain it goes without saying that such limits or safety standards cannot be identical for all localities and all countries. Thus, the multiplicity of the sources of air and water pollution, of the intervening environmental variables, of the conditions of climate, topography and the nature of the cumulative process would call for a variety of standards.

ductive potentialities on the other.[17] Furthermore, such social minima would be relevant for the selection of what is important in the light of objectives derived from individual human requirements and would bring us closer to a substantive concept of economic rationality measured in terms of actual satisfaction of human needs in contrast to a purely formal concept of rationality which underlies our contemporary abstract models.

It must be admitted, however, that social minima do not define an ideal or perfect state or, for that matter, an 'optimal' use of resources. In fact, they provide only a modest and imperfect answer to the problem – but they would offer at least operational criteria or indicators for policy-making in terms of increments of improvements. Such operational indicators would be a considerable advance over optima formulated in terms of market outlays and returns which take inadequate account of social costs and benefits, and which despite their obviously questionable character have again and again been advocated as criteria of action.[18] Once safety limits, as for instance maximum permissible levels of concentration of pollutants, have been stipulated by the political process of decision-making, they can then be translated into a broad production function (or physical investment pattern), in the form of an input-output model designed to identify the inputs and techniques as well as the outputs called for by our existential minimum needs.[19]

The emphasis must be placed on a direct *ex-ante* approach to control in contrast to current attempts at remedial action by such indirect measures as tax-exemptions, subsidies and the levying of charges according to the flow of pollutants. *Ex-post* remedial measures designed to check the impairment may have the advantage of leaving the choice of input and techniques to the individual economic unit. This method, which has been relied upon in the past, is becoming hazardous and in many instances irrational and potentially suicidal. Penalties, tax exemptions, subsidies or charges in accordance with the volume of contaminants discharged have very different incentive (or disincentive) effects on different firms depending upon their market power and their income and income tax position.[20] A penalty of $ 100 for each violation is ineffective and invites

17. C. Bettelheim, *Studies in the theory of planning*, Bombay, 1959, p. 14. It goes without saying that social minima or existential minimum needs must not be considered as static but are subject to change depending upon the state of our knowledge, our technology and the level of productivity.

18. For a recent denunciation of this 'vice of vulgar economics', *cf.* J. Robinson, *Essays in the theory of economic growth*, London, 1962, p. 27.

19. I realize that I am using the concept of an input-output relationship in a broader fashion than it was originally developed but I think that this extension of the concept can be justified, see W. Leontief, 'The problem of quality and quantity in economics', in: *Essays in economic theories and theorizing*, London, 1966.

20. On this point see Gaffney, *op.cit.*, p. 91.

pollution if several hundred thousand dollars worth of costs (if not millions) can be avoided by the discharge of untreated waste materials. Similarly, small subsidies may offer little incentives for the installation of the required equipment. In view of the fact that expenditures for such equipment can anyway be treated as costs and hence are tax deductible, the resulting incentive effect has apparently not worked in the past.

Massive subsidies and hence public expenditures may have to be called for in order to be effective and the outcome would be additional taxes levied on Peter to pay Paul.[21] In short, tax reductions and incentives alone will not be effective, quite apart from the fact that they tend to distort further an already imperfectly working price system.

The magnitude of the threat and the values at stake seem to me to call for a line of attack which must be directed towards the design and technique of production. What needs to be changed and controlled are the 'input mix', the technical process and the location and concentration of the process of production. This is perhaps best illustrated by a concrete example: if we want to avoid the destruction of plants by insects and pests, we can use insecticides and pesticides. We have done so in the past only to discover that the insects and disease carriers develop immunity and that the increasing amounts of chemicals or their residues pollute our environment and tend to become serious health hazards to man. Instead of developing more and 'better' pesticides which, moreover, tend to attack not only pests but insects in general, plant geneticists and plant breeders are experimenting today with breeding plants with greater resistance to attacks by insects and pests. This type of control, by changing the nature of capital inputs, may be more economical and more effective in the long run than the use of chemicals, while at the same time avoiding the dangers of the pollution of the environment.[22] Similarly, the control of air pollution by automobiles seems to me to be more economical and more certain by the design of new and more effective engines and/or by substitutes for gasoline than by indirect controls or better law enforcement.

Another illustration of the possibilities of controlling pollution by a new input mix and design is the installation of a central heating unit for a new residential district in the northwest of Frankfurt (Germany), following earlier experiments in Lausanne (Switzerland). This heating unit uses as inputs the garbage collected in the residential district, which is burned at high temperatures (900° C). This not only prevents odorous compounds of the garbage from entering the atmosphere but tends to avoid the impairment of the atmosphere of the residential area thanks to the installa-

21. Time and space do not permit a consideration of the question as to the proper allocation of costs of remedying past damage and preventing future disruption.

22. *Cf.* S. S. Chase, 'Anti-famine strategy, genetic engineering for foods', *Bulletin of the atomic scientists* 25 (8), October 1969, p. 4.

tion of one single smoke stack of special height (110 m), equipped with an electric filter. Moreover, the site for the smoke stack was selected after careful study of climatic conditions with respect to prevailing wind direction and velocity. The case of the Northwest City of Frankfurt is mentioned here as an illustration of a simultaneous disposal of waste material and its utilization as input for a central heat generating unit designed and located in accordance with the relevant technical and meteorological considerations.[23] While even this approach does not solve all problems of air pollution,[24] it does show that the choice of a rational input mix necessarily calls for a deliberate choice of location.

In fact, this brings me to the final observations I wish to make in this context. Since the disruption of the environment is clearly a function of the location and relative congestion of an area it is imperative to consider these factors in all future decisions concerning industrial and residential sites. In other words, a rational determination of land use requires that we extend the unit of investigation and the area of environmental control in accordance with the actual physical interdependencies in an area determined by its waterways, its topography, its climatic and meteorological conditions as well as its density of settlement. This broader perspective in location theory will become more and more urgent with the growing exposure to the dangers of pollution from radioactive waste materials and possible accidents from radioactive sources such as atomic reactors. Instead of purely local zoning regulations, a rational location policy requires planning based upon a complete inventory of physical conditions and existing population densities on a regional, national and perhaps even international basis. In short, choices of site and location problems in general, whether residential, commercial or industrial can no longer be made solely with reference to traditional market factors and costs such as outlays for transportation, materials and labor. Here too, costs and benefits will have to be evaluated in the light of inventories of hazards established by multidisciplinary research efforts. Whether the practical implications of such studies will be a dispersal or a concentration of industries and residential areas and which methods of control will be called for is today an open question.

23. H. Kampffmeyer *et al.*, *Die Nordweststadt in Frankfurt-am-Main*, Frankfurt-am-Main, 1968, and personal communications.

24. It does not because it is not feasible to reduce completely or destroy all effluents of a noxious character *(e.g.*, sulphur dioxyde, SO_2). Furthermore 'the leeside of one city may be the windward side of another city', *cf.* J. R. Taylor *et al.*, 'Control of air pollution by site selection and zoning', in: World Health Organization (ed.), *Air pollution*, Geneva, 1961, p. 294 (Monograph series, 46).

6. CONCLUSIONS

We are thus led to the conclusion that while science and technology and their application under given institutional arrangements have led to a serious deterioration of man's environment, the mastery and control of the resulting hazards to human health and life can be achieved if at all only by making science and technology accountable to society. At the same time, social policy and decision-making must themselves be shaped by scientific research. So far we have applied science and technology without paying attention to their human and social consequences. If we want to reverse this process and bring it under social and political control, we will have to pay greater attention to the imperatives of human life and survival in making use of science and technology.

Unless we succeed in this endeavor even at the price of substantial changes in our institutional arrangements, the disruption of man's environment is likely to assume increasing dimensions. In fact, this disruption is becoming the dominant problem of the outgoing 20th century – equal if not surpassing in importance the recurrent threats to human health and survival in the Middle Ages by diseases of epidemic proportions, the exposure of the individual to arbitrary and despotic rule and exploitation, and the human and material losses caused by mass unemployment which preoccupied economists during the last decades.

From the perspective of modern biology and anthropology man has been described as an endangered being whose survival and development into a functioning member of his culture constitutes an achievement against many odds. In the light of the cumulative effects of an uncontrolled use of modern technologies on the quality of man's natural and social environment, man in addition endangers himself because his action and his uncontrolled productive activities threaten his health and actually his survival as a species. Ultimately the disruption of man's environment by his own action and the human and social costs created thereby call for more than remedial action here and there; they call for *ex-ante* measures of control. The destructive transformation of the world we live in will neither be stopped nor reversed as long as responsibility for the maintenance of the quality of the environment in the interest of present and future generations does not find an unequivocal expression in our system of morals and ultimately in ethical and political imperatives which guide individual and social action. It seems to me that such a system of social and ethical responsibilities for the maintenance of man's environment also confronts the social sciences and is one of the challenges which we have to face.

The modern problems of the disruption of man's environment and of the social costs and consequences of such impairment, and the search for ways and means of controlling and improving the quality of man's en-

vironment, constitute not only a challenge to our intellectual and practical ingenuity but could open opportunities for joining those early social critics and dissenters, who were concerned with these issues. And, if I may add one concluding remark: perhaps it is this urgent task of preventing a further disruption of man's natural and social environment and of improving the quality of the conditions of human life which could bridge the gap between the disaffected parts of the younger generation and those among the older ones whose critical judgments have not been eroded by a positivistic acceptance of the *status quo*.

Environmental disruption and social costs: Challenge to economics*

Phenomena of environmental disruption[1] and social costs have suddenly been thrust into the center of political discussions; they raise not only practical issues of environmental control which are likely to occupy industrial societies far beyond the decade of the seventies but also fundamental theoretical problems with which economists will have to concern themselves. The present essay is designed to discuss this challenge to economic theorizing and, in a broader sense, to social inquiry in general. As a topic chosen for this memorial volume it bears a direct relationship to certain theoretical and practical issues which were in another but related context of interest to Jacques Stohler: The problem of 'externalities'.

The critique of economic theory advanced in the following pages may be received with certain misgivings: and yet it appears to me that lack of popularity of a critical thesis is not an appropriate criterion of judgment. The issues raised cannot be decided by appeal to prevailing opinions, popularity or even authority. Habits of thought and theoretical frameworks have a tendency to spread and perpetuate themselves far beyond the point at which they tend to become ill-adapted and in fact irrelevant for the treatment of new problems. Moreover, theoretical systems, not only in the social sciences, can always defend themselves by new assumptions and refinements which redefine the scope of the analysis and tend to narrow the admissible evidence with a view to reinforcing the conclusions and to making empirical evidence to the contrary appear to lie outside the analysis. This was the case when the orthodox cosmology of Ptolomey

* From: 'Gedenkschrift für Jacques Stohler', *Kyklos* 23 (4), 1970, pp. 833-848.

1. Environmental Disruption is a term which was first used interchangeably with the Japanese term *Kogai* at the International Symposium on Environmental Disruption in the Modern World, held under the auspices of The International Social Science Council (Paris) in Tokyo, March 8 to 14, 1970. As such it is a term which is still in search of a precise definition. Provisionally it may be said to refer to the impairment beyond certain definable threshold levels of the aggregate of all external conditions and influences affecting the life and development of human beings and human behaviour and hence of society.

introduced always new epicycles to 'harmonize' theory with 'facts' and observation. I believe something of this sort has happened to economic theory during the last decades. The theory has been made increasingly more abstract and formal at the price of a loss of relevance for the treatment of problems like environmental disruption and social costs which, however, are assuming increasing significance as output, productivity and population density grow under the impact of new technologies based upon the accelerated advance of science and research.

Environmental disruption and social costs have long been neglected or kept at the periphery of economic theory; they belong to the more disturbing elements of economic reality which economic theory since the classics had set out to analyze with the aid of the construct of a largely self-regulating equilibrium mechanism capable of harmonizing micro-economic decisions into a consistent and rational pattern. This theoretical system became a powerful argument in defense of economic liberalism. However, step by step it has been forced into the defensive while the core of its theoretical framework, namely neo-classical utility and price theory has maintained itself, if not in its original form, so at least in its various manifestations of modern welfare economics.

Environmental disruption and social costs of the character and scale now confronting modern industrial societies have created such critical conditions that it has become urgent to raise new questions about the adequacy and relevance of the old framework of analysis. Indeed the acute and potential dangers involved in the disruption of our natural and social environment for human health and well-being, discussed by dissenters for years and even decades, have suddenly attracted world-wide and political attention. This political interest may act as a catalyst for a new and more appropriate treatment of these phenomena by economic theory and social inquiry. In this as in other cases 'stubborn' facts, particularly if backed by political interest may prove stronger than theoretical constructs.

However, let us begin our discussion with an explicit warning against the current political rethoric about the need of protecting the environment and against the mistaken belief that the phenomena of environmental disruption exhaust the problem of social costs. When politicians appeal to a rebellious younger generation which has legitimate grievances about the quality of their society and the politics of their governments, by invitations to 'wage war' on the disruption of nature, such appeals may be not much more than an attempt to restore a consensus evidently severely shaken by such issues as the undeclared war in Indochina, the unresolved consequences of slavery and racial discrimination, the pernicious effects of a secular inflation and the continued poverty in the midst of plenty. Indeed, the problem of environmental disruption may well be used as an issue designed to restore a failing political unity which threatens both the

'establishment' and society. The declaration of war on the disruption of the environment just as the earlier 'war on poverty' may turn out to be not much more than a diversion of attention and a fixation on a problem which seems to be less controversial and easily subject to manipulation without interfering all too radically with customary ways of thinking and established methods of conducting business, modified only by a few *ad hoc* controls. The current advocacy of *ex post* remedies by offering incentives and disincentives via subsidies and taxes may turn out to be just as ineffective as the Sherman Anti-Trust Act. This legislation too was passed to pacify a wide-spread populist dissatisfaction with policies and practices of big business oligopolies but was actually incapable of stopping the trend towards administered prices and the 'planning' of production and sales by large industrial concerns. It would not be surprising if the contemplated legislation against environmental disruption by underestimating its significance achieves not much more than the passing on to consumers or to society as a whole the costs of 'cleanliness' without really coming to terms with the serious problems raised by the current disruption of our environment.[2]

For, there should be no mistake that the impairment of our environment and the damages and costs resulting therefrom constitute one of the most fundamental, dangerous and long-run issues which mankind has ever faced. While it cannot be our purpose to present at length the empirical evidence for this assertion, we do intend to elucidate some of the complex interdependencies which, under given institutional arrangements, lead to various forms of environmental disruption and social costs for which conventional economic theory can offer no solution.

These interdependencies and the causal chain which give rise to environmental disruption differ in kind and complexity from those with which economists have traditionally been concerned. In order to illustrate this thesis it is not sufficient to point to the obvious interrelationship of population growth and the concentration of population in urban agglomerations emerging under the impact of the increased productivity made possible by the development of science and technology, particularly during the last 50 years. Of course, science, new techniques, increased production, population growth, are all causally related and play in their interaction, and under the impact of our institutionalized framework of investment and production for profit, a decisive role in environmental disruption.

However, the process of causation is more complex. Thus, air and water pollution are not only the result of, and not proportionate to the volume

2. For a good discussion of these possibilities by two political scientists, cf. John H. Schaar and Sheldon S. Wolin, 'Where we are now', *The New York review of books*, May 7, 1970, pp. 6-7.

of production and the emissions of residual waste products. They are also governed by the interaction of a whole series of variables which may react upon one another. Thus, waste products of various kinds may not only react upon each other, but also upon other elements in the environment and in this way give rise to additional toxological effects on plant, animal and human life with delayed cumulative consequences on human health. In addition, the actual rate of air and water pollution at any given time is governed by such intervening environmental variables as wind velocities and direction, topography, temperature inversions, stream flows and water temperatures.

Similarly, the actual radio-active contamination of closed or semi-closed water systems like rivers or lakes by atomic reactors is dependant, according to nuclear physisists, not simply on the volume of gaseous emissions or water effluents but on the rate of dilution and the physical build-up of concentrations from one or more reactors and the rate of reconcentration of radionuclides by biological systems (e.g. fish).[3]

Or let us consider some of the problems which arise in connection with the disposal of garbage in congested urban areas. Of course, the volume of production, concentration of population and the amount of garbage collected are related and this relation can be expressed in quantitative terms. Thus, the City of Tokyo collected ca. 5000 tons of garbage per day in 1960, whereas today (1970) the volume of garbage collected and disposed of amounts to 10,000 tons daily. Even if the volume of garbage collected in 1980 should have doubled again – an assumption rather than a calculated rate of growth of garbage – the character of the problem will be different because by 1980 Tokyo will have run out of space to dump the garbage and will have to make increasing use of incinerators thereby adding to air pollution. In other words, it would be unjustified to operate with constant output-garbage coefficients and linear correlations of national or regional output and the impairment of the environment.

The cumulative character and complexity of the sequence of events could be further illustrated by a variety of economic activities, including those of agriculture, where erosion, soil depletion and the use of chemicals constitute the most typical and spectacular examples of cumulative chains of causation. Thus, the ingestion by cows of plants affected by chemical pesticides gives rise to a contamination of milk products and human tissues. According to American biologists, most mother's milk in the United States contains so much DDT that it would be declared illegal in interstate commerce if it were sold as cows milk.[4]

3. Philip F. Gustafson, 'Nuclear power and thermal pollution', Zion, Illinois, in: *Bulletin of the atomic scientists,* March 1970, p. 23; cf. also René Dubos, 'The human landscape', *ibid.,* p. 36.

4. Paul R. Ehrlich and Anne H. Ehrlich, *Population, resources and environment,*

One final illustration may serve to conclude this discussion of the cumulative character and complexity of the causal sequence which gives rise to environmental disruption and social costs. Let us assume that as a result of the increasing air pollution the content of carbondioxide in the atmosphere increases by 100 per cent by the year 2000, thereby raising the heat-retaining properties of the atmosphere; let us further assume that as a result the average temperatures rise. Under these assumptions it is conceivable that the resulting climatic changes may lead to a partial melting of the arctic ice floes with the subsequent advent of a new Ice Age and/or a rise of the water level of the oceans by, let us say, 60 to 100 feet. This in turn could have the effect of submerging a substantial part of existing continental land areas.[5] In short, problems of environmental disruption confront the social scientist with an unusually complex set of interdependencies and delayed cumulative effects; any attempt to treat these quantitative and qualitative relationships by assuming constant rates of environmental disruption can only give rise to a simplistic and hence inadequate and false view of the problem, particularly as far as the formulation of criteria for action is concerned.

Before taking up the central issue under consideration it is relevant to emphasize that the term 'environmental disruption', by stressing the ecological aspect may divert our attention from those social costs which find their expression in such phenomena as work injuries and accidents, rythms of work inimical to human health, crowded and inadequate housing conditions, damaging levels of noise, enforced and uncompensated adaptations to structural changes, workmen compensation systems rendered inadequate by inflation and, last but not least, monopolistic determination of real estate values and rents in congested urban areas, all of which can and do arise in contemporary industrial societies.[6]

For this reason it should be understood that when we speak of environ-

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San Francisco 1970. For an analogous case of the effects of emissions of mercury into waterways on fish which were then absorbed into human tissue, see Kin-ichi Yoshioka, *Natural and social scientific study of Itai Itai disease,* Tokyo 1970, and Ui, Sonoda, and Iijima, 'Excerpts from environmental pollution control and public opinion', Paper presented to the International Symposium on Environmental Disruption in the Modern World, International Social Science Council, Tokyo, March 8-14, 1970.

5. Cf. Robert L. Heilbronner, 'Ecological Armageddon', *The New York review of books,* April 23, 1970, p. 3, see also H. J. Barnett, 'Pressure of growth upon environment', in: H. Jarret (ed.), *Environmental quality in a growing economy,* Baltimore 1966, p. 16.

6. These social costs are everywhere borne by the economically and politically weaker elements of society. Seasonal and socalled 'guest' workers, as well as minority groups bear the brunt of these social costs. But they are not alone. In France nearly 65,000 farmers are forced annually to abandon their activity and their residence and more than half of the admittedly redundant retailers had to give up their occupations

mental disruption we mean in effect the disruption of man's natural *and* social environment.

In the light of the foregoing discussion of the causal chain and complex interdependencies which give rise to a disruption of man's natural and social environment, it becomes evident that the conventional framework and tools of economic theory are ill-adapted and in fact irrelevant for the analysis of the phenomena under discussion. Economic theory and its analytical tools have been shaped by the basic perspective according to which the task of economic analysis is confined to the explication of the logic of choice and the purely instrumental allocation of 'given' scarce resources to 'given' competing ends by individual economic units (producers and consumers). Partial equilibrium analysis has developed a logic of choice within the context of market transactions by firms and households and has defined optimal solutions of allocation in terms of a principle of marginal valuations under static conditions. In addition economic theory has made it an axiom of 'positive' analysis to exclude from its purview any discussion of human needs, requirements and aspirations. In fact, ends are regarded as given, both in the static sense of the term and in the sense that they are to be accepted by economic theory as final data on the ground that any other procedure would necessarily sacrifice the scientific, i.e. the 'positive' character of the analysis. It is these preconceptions together with the concentration of the analysis on market transactions to which the theory was originally confined, which have shaped both the scope and the tools of the analysis. And neither the scope nor the tools of the analysis are adapted to the kind of interdependencies and complex causal sequences which give rise to environmental disruption and their social costs. These interdependencies have nothing to do with market transactions or exchanges of any kind; nor are they the result of choices unless one is prepared to argue that they are caused by the deliberate action of private firms which in full knowledge of the consequences decide to shift part of their costs to third persons or to society. Nobody affected by the negative consequences can be said to have voluntarily and in full knowledge agreed to bear these consequences.

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during the last 15 years under the impact of the impersonal market forces set in motion by deliberate policies of growth and structural change. (Jean-Pierre Soisson, 'Les retombées de la croissance', *Le Monde*, May 20, 1970). These middle class victims of economic growth and structural change may reach physical and psychological thresholds of tolerance, making them an easy prey of street corner demagogues and the current trend toward racism, chauvinism and authoritarianism – something which the theory and models of economic growth are incapable of taking into consideration just as the advocates of deflationary wage policies and balanced budgets were unable to anticipate the 'external' effects of unemployment rates of 20 to 30 per cent during the thirties and prior to the advent of fascism and 'national socialism'.

In dealing with problems of environmental disruption and social costs we are confronted with direct technological non-market effects which in their cumulative character and consequences make the customary equilibrium approach of conventional economics irrelevant and antiquated. In view of the increasingly harmful character of certain capital inputs and technologies in modern industrial societies, increasing output and increasing population densities in urban agglomerations, economic growth as measured by GNP gives rise to increasing environmental disruption and social costs, unless the institutional framework and criteria of action are radically changed.[7] From this point of view it is indeed correct to say that 'economic growth renders many things obsolete and one of the things is economic theory'.[8]

Environmental disruption cannot be explained adequately as a case of market failure, unless the term is understood in the sense of the failure of the market system and of conventional economics to come to terms with interdependencies and complex causal chains which have long ceased to occupy a peripheral place in modern industrial societies and are bound to assume increasing significance as residual industrial waste products and debris are permitted to be discarded freely into the environment.

The foregoing considerations should dispose also of the belief that since the days of Alfred Marshall, the concept of externalities has offered an adequate tool for the treatment of problems raised by environmental disruption. We cannot concern ourselves here with a systematic exposition of the 'empty box' character and the logical shortcoming of the concept of externalities as a cover-all concept. When Marshall introduced the concept of externalities he was concerned mainly with problems connected with his concept of the representative firm and the notion of constant costs as a result of certain cost reductions resulting not from decisions of the firm but originating outside the firm or which were bestowed upon it by expanding markets, access to a trained working force, higher standards of health, education and culture, provided for by other firms or more particularly by public investments.[9] In short, the concept of external economies was designed by Marshall to harmonize increasing economies in a dynamic world with the static assumptions underlying the principle of decreasing

7. We have argued elsewhere that the damages and social costs tend to increase absolutely and relatively as output (and hence inputs) and therefore residual waste products and debris are dumped freely into the environment. Cf. K. William Kapp, 'Environmental disruption: General issues and methodological problems', Paper submitted to the International Symposium on Environmental Disruption – A Challenge to Social Scientists, Tokyo, March 8-14, 1970, *supra* p. 57 ff.

8. Alan Coddington, 'The economics of ecology', *New society*, April 9, 1970, p. 596.

9. Used in this sense, the concept of *external economies* is in fact an important one; it has its relevance in connection with all problems related to infrastructure

returns. As such it introduced dynamic elements into partial static equilibrium analysis.[10]

Attempts to use Marshall's concept of externalities to cover the 'diseconomies' reflected in environmental disruption and social costs have been hampered by the reluctance of many theorists to break out of the narrow range and perspective of traditional price equilibrium analysis. As a result they failed to concern themselves with empirical evidence and did not consider the nature of the causal chain of events which gives rise to environmental disruption and social costs. In short, economic theory continued to treat allocation, production, exchange and distribution as if they occurred in an essentially closed and autonomous 'economic' sphere with only minor effects on man's natural and social environment. The main body of economic theory including welfare economics has continued to concentrate its analysis on the voluntary and mutual reciprocal exchange relationships between micro-economic units (i.e. between firms and consumers).

As long as economic theory continues on this methodological path there is no hope for an adequate analysis of environmental disruption and social costs. In the first place the so-called autonomous economic sphere is a fiction contradicted daily by the fact that choice and behaviour are not autonomous but are shaped by dominating units with a commercial interest in the content of such choices. Secondly, for the immediate problem under discussion, the effects of production and distribution on the environment and society are anything but negligible. To assume that they are or to believe that we can save the analytical framework and the theoretical conclusions derived from it by introducing such terms as external diseconomies with no empirical content creates the false impression that the theory has adequately incorporated the interdependencies at work. In short, simplifying assumptions and empty terms create the impression of adequacy but do not solve the problem. They will give us empty conclusions such as that rational allocation and optimal efficiency will be the outcome provided that important external diseconomies (and economies) are absent.[11] Neither the assumptions nor the concepts nor the conclusions

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investments designed to create the pre-conditions of production and development by increasing the capacity to create wealth. Cf. Gunnar Myrdal, *Rich land and poor*, New York 1966, pp. 89-90, and H. W. Singer, *International development: Growth and change*, New York 1966.

10. For this attempt to introduce a dynamic concept into static analysis Marshall was criticized by Stigler, who held that Marshall's external economies involved not only an abandonment of static analysis but could serve only the purposes of historical analysis. G. J. Stigler, *Production and distribution theories*, New York 1941, pp. 68-76.

11. W. J. Baumol, *Welfare economics and the theory of the state*, London 1965, 2nd ed., p. 206.

can lay claim to any of the virtues of which neo-classical and 'positive' economics have traditionally boasted. They are neither neutral nor objective; they are misleading and apologetic if not consciously so at any rate in effect. Such assumptions and concepts do not reveal but conceal what is actually happening. Moreover, they distract our attention from what is really important and what needs to be investigated. Thus they are preventing us from formulating the problem in an adequate fashion and hence from developing adequate criteria of action and appropriate methods of control.

In other words, the phenomena of environmental disruption and social costs demonstrate once again that the scope of economic analysis is seriously challenged. The really important problems of economic analysis understood as a political science of public affairs are not so much those which concern intra-firm and intra-industry relations – these can be safely left to business administration and the science of business management – but those macro-economic cumulative and extra-market and extra-industry cause and effect relations which neo-classical economics in contrast to the classics, Marx and Veblen, has neglected or ignored. Let me add that there will be considerable need for quantification and exact treatment of the problems of environmental disruption and social costs. However, the interdependencies which give rise to these phenomena and which economic theory with its closed models is incapable of analyzing are marked by a complexity and are governed by a plurality of factors for which we still have to develop the appropriate analytical including mathematical tools. Formal equilibrium analysis will not suffice. Indeed, in order to grasp the causal chain in operation it is necessary to include within the scope of economic analysis a whole series of factors and relationships in a somewhat similar manner in which the modern student of cancer – an equally complex phenomenon marked by the interaction of a plurality of factors and different systems – had to become familiar with very specific and novel patterns of interaction before he was able even to formulate the nature of the problem.[12]

We have argued elsewhere that environmental disruption and social costs must be looked upon as the outcome of an interaction of several complex systems (economic, physical, meteorological, biological, etc.) in which a plurality of factors interplay through 'feedback' processes[13] – an interaction which is much more complex and much less explored and

12. 'Le développement d'un cancer est gouverné par de multiples facteurs: la constitution génétique du virus, la constitution génétique de la cellule, l'équilibre hormonal, le régime alimentaire, l'âge, l'intervention éventuelle de cancérogènes physiques ou chimiques, l'efficacité des réactions immunitaires.' A. Lwoff, 'Les tumeurs de l'homme', *Le Monde*, May 27, 1970.

13. Dubos, *op.cit.*, p. 37.

understood than the functioning of any of the various systems which the conventional social disciplines have ever studied.[14]

In addition to this fundamental challenge there are a whole series of further questions which environmental disruption and social costs raise with respect to economic theorizing. Thus, environmental disruption and social costs put in question not only the scope of economic analysis but above all the efficiency of the market as a mechanism of steering and coordinating the decisions of the various micro-economic units or subsystems in the light of the indicators or signals provided by the price system. For, if neither enterpreneurial outlays nor enterpreneurial returns or, for that matter, prices in general are capable of registering the extra-market physical flows which disrupt our environment and affect our health, our lives and our material assets in a negative way, then the price indicators are not only imperfect and incomplete; they are misleading. If we use them nevertheless without finding ways and means by which to induce or force the subsystem to take the fullest possible account of the destructive extra-market effects, it must be clear that efficiency and optimality of the sub-system (viewed in the light of its own ends and objectives) will not give rise to any social efficiency and optimum of the macro-system as a whole. On the contrary, the rational pursuit by the subsystem of the objective of maximizing net advantage (profit, utility) will take place by sacrificing with impunity those values and objectives which, from the point of view of the macro-system may be highly important and in fact constitute the foundations of individual well-being and survival. In short, optimal solutions by micro-economic units will *not* give rise to social optima; on the contrary, they may and will coincide with a disruption of the natural and social environment. It is not sufficient to point out that this outcome is greatly facilitated by the fact that the resources and values at stake have no market values (some of them were in fact until recently 'free' goods) or that what we need is better information and greater transparency. Even with complete transparency there is no guarantee that micro-units would not continue to maximize their net benefits without much regard to the damages caused thereby to society and hence to other individuals.[15] It is this inherent irrationality of the allocation

14. For a preliminary discussion of these complexities cf. *supra* pp. 62-63.

15. Marx and Veblen saw this more clearly, I feel, than Pigou. Whereas Pigou saw the divergence between private and social net marginal product (but considered the negative effects as of secondary importance and therefore hoped to come to terms with such divergencies by incentives or disincentives, Marx saw the inherent and fundamental character of the problem in his treatment of 'general economies' which concludes with the well-known statement: 'No matter how economical capitalist production may be in other respects, it is utterly prodigal with human life... Capitalism looses on one side for society what is gains on another for the individual capitalist.' *Capital,* vol. III, 1909, p. 104. For Veblen's position see *Theory of*

process which must concern us if economic theory and national accounting are to become relevant as a tool of analysis and adequate as a basis for the formulation of effective and substantive criteria of environmental control.

Before concluding this essay let us turn briefly to the implications of environmental disruption and social costs for our system of national accounting as a measure of economic growth and development. This system also derives its content and logic from the traditional scope of economic analysis and its perception of the circular market flow of goods and money, measured in terms of market values, adjusted in more or less appropriate ways in the case of the use of durable consumer goods and the public sector. Now since market transactions between firms and households and the resulting flows are only part of the total flows and, moreover, do not measure those physical flows and effects which take place outside the market (e.g. the disposal of residual waste and debris by firms and households into the environment from where they emanate in the form of physical nuisances and damages and reduce our well-being) GNP and its derivates are inadequate as measures of economic growth. What is more they are becoming increasingly inadequate as the omitted environmental disruption and social costs rise absolutely and relatively. In other words, we may register persistently high growth rates but do not take account of almost catastrophic rates of environmental disruption (as evidenced by rising rates of water and air pollution, mounting rates of chronic bronchitis and other diseases, increasing levels of noise and odor nuisances, higher frequencies of accidents and work injuries, etc.). As in the case of the failure of the price mechanism referred to above a policy of growth guided by inadequate and incomplete indicators of output and income will turn out upon closer analysis to have given rise to a pursuit of pseudogrowth 'in which increases of consumption or investment are made possible not by the growth of net production but at the expense of running down our natural assets in the form of both resources and amenities'.[16] This 'running down of natural assets' by the disposal into the environment of residual waste products and the resulting environmental disruption with its 'flows' of disservices and damages to man and society differ from the traditional market flows. They are not exchanged in any meaningful sense of the word. They have no market value; they are forced

business enterprises, New York 1904, and *The engineers and the price system,* New York 1921, especially chapters V and VI.

16. Coddington, *op.cit.,* p. 597. Coddington illustrates the inadequacies of the present system of national accounts by supplementing the well-known voluntary and reciprocal flows between firms and households diagrammatically by a set of additional flows of residual waste products from firms and households to the environment on the one hand and the corresponding flows of damages and disservices to firms and household on the other.

upon the environment and through the intermediary of a deteriorating environment upon man. The heterogeneous character of the disrupting flows of damages and the complex interdependencies to which we have referred above preclude any measurement and evaluation in terms of a common denominator (unless a common denominator be formulated in substantive terms, e.g. in terms of objective safety limits or critical zones of maximum permissible or tolerable levels of concentration for instance in the case of water and air pollution). It is this heterogeneous character of the disruptive extra-market flows in addition to the complex and novel character of the interdependencies which give rise to environmental disruption, which constitute the greatest challenge to economic theory.

To meet this challenge it will not be sufficient to assign monetary values or shadow-prices to human beings, their health or their lives. It requires even more than quantification and mathematics. It requires a willingness to take account of and evaluate the physical flows and effects in real terms – something economic theory has always been reluctant to do and is indeed ill-equipped to do without any interdisciplinary effort. Above all, we need a critical attitude towards one's own habits of thought and a willingness to formulate basic concepts in the light of a realistic appraisal of the nature and significance of environmental disruption and social costs and their fundamental character as a threat to man and society. More specifically, it requires a willingness to evaluate and a courage to criticize institutions, arrangements and policies in terms of whether or not they contribute to the satisfaction of actual substantive needs and requirements of human life. In other words, the theoretical and practical issues[17] raised by environmental disruption and social costs are such as to compel economic theory to abandon its concentration on purely formal definitions of utility, efficiency and optimality unrelated to actual levels of satisfaction of human needs and requirements. Only in this way, we feel, will it be possible to come to terms with the dangerous acute and potential hazards to which the production and use of the products of modern civilization expose our natural and social environments and threaten man and society.

17. We have not dealt with the practical issues raised by environmental disruption, cf. however the author's earlier paper which stresses the need for a translation of minimum safety standards in terms of maximum tolerable levels of concentration into a corresponding input mix and input-output pattern, together with the recycling of residual waste materials in contrast with the more general but less effective measures of subsidies and taxation à la Pigou. *Supra* pp. 71-73.

Social costs, neo-classical economics, environmental planning: A reply*

Professor Beckerman describes my book on *The social costs of private enterprise* (1950) as a pioneering work which was not duly appreciated at the time it was published 'because this was before the concern with the environment became fashionable'; however, he takes issue with 'the whole tone' of my recent paper 'Environmental disruption and social costs: A challenge to economics'.[1]

He feels that my challenge carries the critique too far because in his words, I want to start 'from scratch' and favor a new beginning, a 'rethinking' of economic theory; moreover I am critized for the lack of examples; my use of the concept of social costs is said to be 'antiquated and misleading'; with respect to the complexity of the causal chain and effects of pollution Beckerman holds that economists have long been used to the treatment of conditions with numerous and interrelated variables; in addition, he states that economics does recognize complex feedback effects and operates with changes of coefficients according to postulated time lags. Moreover, economists have developed new analytical tools; above all the logic of choice and optimization has reached such a level of generality (and by implication of general validity) that it can be applied to the new problems arising in connection with the environmental crisis and can form the basis for evaluations in monetary terms and decisions required for its abatement or control. Thus, according to Beckerman, economists have been able to handle the admittedly difficult problems of aggregating numerous disparate items in terms of the common denominator of money

* This article is a reply to the paper by W. Beckerman, 'Environmental policy and the challenge to economic theory' and represents a summary of the position taken by K. W. Kapp during the Symposium on Political Economy of Environment: Problems of Method, which was organized at the Maison des Sciences de l'Homme in Paris, from July 5 to 8, 1971, by the École Pratique des Hautes Études, under the auspices of the International Social Science Council. The papers presented at this Symposium are published in: *Political economy of environment. Problems of method*, Paris – The Hague, Mouton, 1972.

1. K. W. Kapp, 'Environmental disruption and social costs: A challenge to economics', *Kyklos* 23 (4), 1970, pp. 833-848. See *supra* pp. 77-88.

and we would do well to apply the principles of welfare economics to the treatment of the new environmental problems which are upon us.

I would regret it if it was the tone of my paper rather than the content and scope of my criticism which provoked Beckerman's objections. Nothing is further from my mind than to disrupt a rational dialogue by the *tone* of my observations. For I know only too well that there is no other way of advancing our knowledge than dispassionate analysis and rational criticism. For this reason I shall refrain from taking notice of Beckerman's remarks *ad hominem*.

Due to limitations of time and space I shall not be able to deal explicitly with all the points raised by Beckerman, but I hope that my reply will cover at least implicitly most of his specific objections. The major emphasis of my reply will be on what I consider to be the central issue raised: namely the question of the adequacy of evaluating environmental goals and values in terms of the individual's willingness to pay or accept compensation.

Beckerman believes that my book was not duly appreciated because it was written before the discussion of the disruption of the environment by economic activities became popular.[2] I believe rather that what was not appreciated was the association of social costs and business enterprise and the confrontation of economic theory with my empirical data and observations – *i.e.*, the great variety of losses borne by third persons and society as a whole. The main thrust of my conclusions was a critique of the practices of business enterprise and of the scope of our inherited economic theory with its concepts of market rationality and optimality. My central thesis was and has remained that the maximization of net income by micro-economic units is likely to reduce the income (or utility) of other economic units and of society at large and that the conventional measurements of the performance of the economy are unsatisfactory and indeed misleading. To my mind, traditional theoretical inquiry was neither guided nor supported by empirical observations and available data. I tried to show that micro-economic analysis ignored important relationships between the economy (wrongly viewed as a closed system) and the physical and social environment and that these intrinsic relationships gave rise to negative consequences of the economic process. It was and is my contention that the nature and scope of economic theory is too narrow. This restriction has affected economic theory at its foundation: *i.e.*, at the stage of concept formation (*e.g.*, costs and returns), in the choice of criteria of valuation and aggregation (in terms of money and exchange values) and hence in the delimitation of the scope of the inquiry. Not only the dyna-

2. Incidentally, *The social costs of private enterprise*, Cambridge, Mass., 1950, was widely reviewed and discussed also in the United States, and was translated into five foreign languages; a second enlarged and revised edition appeared under the title *Social costs of business enterprise*, Bombay, Asia Publishing House, 1963.

mic interconnection of the economy with the physical and social environment and the impact which the disruption of the environment has upon the producer (worker) and consumer but also the complex relations of human wants and needs to their actual satisfaction have remained outside the scope and preoccupation of economic theory. Human wants and preferences (all subjective concepts), are treated as 'given' and the analytical apparatus is designed to develop an instrumental logic of choice and allocation under these given conditions within a closed system.

This traditional restriction of economic analysis is not only contrary to the empirical facts of the interdependence of the economy with the environment but also protects the analysis and its conclusions against its critics who present evidence of the negative impact of economic activities on human health and human development. In fact, the whole procedure 'alienates' economic analysis from what I consider to be one of its most important objectives, namely the appraisal of the substantive rationality (Max Weber) of the use of society's scarce resources. Critics of the traditional approach from Marx and Veblen to Myrdal and more recently H. Albert and W. A. Weisskopf have pointed out that the restriction of the analysis is the result of specific analytical preconceptions as well as hidden value premises. In short, the critics have argued that the restriction of economic analysis reflects a subtle dogmatism on the part of its practitioners.[3]

In the light of this critical analysis it would appear that the formal logic of choice and optimization in terms of market costs and market returns is somewhat less generally accepted and more vulnerable than Beckerman seems to assume. In fact, the formal logic of choice reveals its limitations in the light of a concept of substantive rationality which considers the actual degree of satisfaction of human needs and human requirements. As to Beckerman's suggestion that I want to start 'from scratch', it seems to me that Beckerman fails to see that my critique is not quite as novel as he implies and that in fact both my book and my article must be seen within the context of a body of critical analysis which has been advanced over the last decades. I shall deal with this point by outlining a whole

3. I shall not pursue these lines of thought here which could be extended to show that what has happened is nothing less than that economic analysis and welfare economics in particular have permitted their value premises to determine not only their hypotheses but their notions of the nature and essential characteristics of the economic process. Their perspective of what constitutes rational choice under given conditions in a closed system has formed their ontology. *Cf.* H. Albert, 'Die Problematik der ökonomischen Perspektive', *Zeitschrift für die gesamte Staatswissenschaft* 117, 1961, p. 438 *sq.* On the problem of 'alienation' and economics in the sense of a dehumanization of economic analysis, see the important analysis by W. A. Weisskopf, *Alienation and economics*, New York, 1971 and my observations in 'Zum Problem der Enthumanisierung der "reinen Theorie" und der gesellschaftlichen Realität', *Kyklos* 20 (1), 1967, pp. 307-330.

pattern of reaction of an entrenched community of scholars against its critics. One reaction is to ignore them by a conspiracy of silence by all those who have 'invested' in the established body of doctrine and thus may be said to have a 'vested interest' in it, to use a favorite term of Veblen. This period can last quite a long time.

However, when the accumulation of new empirical observations and data contradicting the conventional body of knowledge can no longer be passed over in silence, the relevance of the new evidence is likely to be questioned. After all, it comes from outside the realm of the traditional discourse; thus it may be said to be 'non-economic' or 'meta-economic' in character. The critics are considered as outsiders – sociologists or political scientists perhaps – who are not sufficiently familiar with what are admissible and relevant criteria with which to confront the conclusions derived from the closed model. At a later stage old concepts and assumptions will be refined in order to cope with the disturbing evidence within the traditional framework. This phase may be illustrated by the reaction of traditional astronomy prior to and during the Copernican revolution; the Ptolemaic astronomy accounted for discrepancies between its predictions and empirical observations by manipulating an ever increasing number of epicycles within its explanatory system. In short, it is the method of scholasticism – another of the devices of dogmatism.

Closely related to this phase are efforts to force the new evidence and data into old concepts despite the fact that the latter were originally designed to take account of different phenomena than those referred to by the critics. In other words, older concepts and new phenomena are reinterpreted in such a manner as to convince the community of scholars that no new approach is required and that in fact new data and facts can be and indeed have always been taken care of. The current discussion of the environmental issue has reached this stage and Beckerman is certainly not alone in his endeavor to show that the conventional wisdom is quite capable of dealing with the phenomena of environmental disruption in its own fashion. Environmental problems are being forced today into the conceptual box of externalities first developed by Alfred Marshall. In my estimation this concept was not designed for and is not adequate to deal with the full range and pervasive character of the environmental and social repercussions set in motion by economic activities of producers or the goods produced and sold by them to consumers. I agree with those who have criticized the use of the concept of externalities as empty and incompatible with the logical structure of the static equilibrium theory.

At the same time the linguistics of the critics will be rejected and found wanting in precision and determinateness. Their terms and concepts will be found to be 'too wide', 'confusing', 'misleading' and after a while even 'antiquated'. Since Beckerman has raised objections of this sort against the use of the term social costs and feels that I 'may have missed some-

thing', I shall deal with the problem of concept formation in order to elucidate a few fundamental points. Of course, conceptual precision is desirable and terms and concepts should not be misleading. Objections raised against terms and concepts should be met. However, let us not overlook that new ideas and concepts do not emerge immediately with the intellectual precision which may be desirable. In fact at an early stage of analysis some degree of openness of concepts may be actually useful. Ideas and concepts need to be elaborated and become more precise only as the analysis of substantive problems proceeds.[4]

However, it is a logical error to make concepts more precise and determinate than warranted by the empirical data to which they refer. Myrdal has reminded us that statistical convenience and measurement must *not* be permitted to set limits to concept formations and thus to exclude relevant elements. This has happened in the case of many economic concepts such as capital and investment. Furthermore, an element of inescapable indeterminacy may remain either due to the lack of homogeneity of the facts or of people's valuations or due to a lack of accurate knowledge about causal interrelationships. This applies to social costs as well as to such concepts as unemployment, underdevelopment, monopoly, etc. In short 'to define the concept more precisely than is justifiable is logically faulty'.[5] Finally, concepts in the social sciences are not the product of measurement as in physics where concepts are, as a rule, the by-product of observations and actual measurements. Social concepts are, a rule, constructs, or abstractions or deliberate accentuations. As such they should define the empirical instances to which they refer. Our concepts are chosen and constructed for specific purposes; their relevance and usefulness are to be judged in terms of their effectiveness as instruments designed to grasp social facts even if some of these facts lie outside the scope of the traditional boundaries erected arbitrarily by the discipline. They reflect our perspective and thus help us to perceive novel and hitherto neglected aspects of reality. In this sense they may and indeed will reflect our value premises; the important thing is that these value premises be stated openly and are not hidden as in many endeavors to define concepts in an alleged 'value free' manner, which conceals the hidden value premises of the investigator. The concept of social costs does not leave the reader in any doubt in this respect.[6]

4. C. Wright Mills, *The sociological imagination*, New York, 1959, p. 125.

5. G. Myrdal, 'Value loaded concepts', in: H. Hegelland (ed.), *Money, growth and methodology*, Lund, 1961, p. 285.

6. Beckerman's summary judgement that the term social costs is misleading and antiquated may be evidence of the fact that he holds different views about concept formation or he may have misread the article he quoted, which is directed against Pigou's use of the term 'social costs'; this article points out correctly that my use of the term is identical to what the authors call 'uncompensated social costs', a term

In conclusion let me say that it is quite understandable that many economists defend the traditional perspective, assumptions, concepts and the narrow scope of micro-economic analysis. But this cannot last indefinitely, particularly if we remain committed to the notion that scientific inquiry has to do with a confrontation of theories and empirical observations. When empirical data and new facts become incompatible with, or can no longer be accounted for by established theories, the time has come for the formulation of new concepts, new modes of thought and procedures. This is the time of 'scientific revolutions'. In the history of science and in the history of the social sciences there have been radical reformulations of concepts as well as new modes of thought and new procedures.[7] However, they did not start from the beginning. Who would want to assert that Copernicus, Newton, Einstein or for that matter Marx, Walras, Veblen or Keynes started from a *tabula rasa*. But they faced the crisis of their disciplines by doing more than merely refining old concepts or forcing new data into old molds. I believe that economics faces such a crisis today largely as a result of the environmental disruption but also because of its inability to come to terms with the development problem in less developed countries and because of the failure of Keynesian and monetary policies to maintain economic stability and prevent inflation.

Beckerman complains that I cite no examples. In the following I shall show that his own propositions which reflect the procedures and normative conclusions of welfare economics provide examples and illustrations of what I am criticizing. For Beckerman, together with others, assumes that no fundamental revision of economics is required in order to come to terms with the environmental crisis. While he admits that there are still numerous unsolved theoretical and practical problems raised by pollution and its abatement, he is convinced that welfare economics is equipped for dealing with the problem of pollution policy. In fact he feels that there is nothing to take its place as if this – if it were true – proved the adequacy of what we are offered. According to Beckerman, the disposal of pollutants imposes external costs in the form of water treatment downstream and 'the economist will come to the conclusion, on the basis of elementary economics, that there is too much polluting

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not quite unsimilar to my own suggestion to speak of 'unpaid costs'. The predilection to render the term social costs innocuous by using it to designate the total costs reminds one of an earlier episode in the history of economic analysis when some neo-classical economists tended to identify market prices as 'social value' in the sense of value to society. Schumpeter set an end to this apologetic reinterpretation of terms and concepts. *Cf.* J. A. Schumpeter, 'On the concept of social value', *Quarterly journal of economics*, 23, 1909, p. 213-232.

7. T. S. Kuhn, *The structure of scientific revolutions*, Chicago, Ill. – London, 1962. *Cf.* also, by the same author 'Logic of discovery or psychology of research' and 'Reflections on my critics', in: I. Lakatos and A. Musgrave (eds.), *Criticism and the growth of knowledge*, Cambridge, Mass., 1970, pp. 1-23 and pp. 231-278.

effluent flowing into the stream . . .[8] The economist will then consider what is the best means of reducing the pollution to a level that, in terms of welfare theory, would represent the optimum'. Beckerman and others are convinced that the standard tools and procedures of economics and the logic and criteria of choice including the aggregation of numerous (environmental) disparate items in terms of money and willingness to pay can be used as criteria 'for evaluating things according to their equivalence at the margin – *i.e.*, how much money one would accept in order to be indifferent between having the previous number of units of some 'good' and one less unit'. In short it is believed that economists are on solid grounds and have the basic approach to a solution, if not the final answer, to the determination and evaluation of environmental values (including goals and preferences) and the formulation of the appropriate instruments of control and environmental planning.

Beckerman's open acceptance of the compensation principle (willingness to pay or accept money) as a criteria of evaluation has at least the merit of leaving no doubt about the common denominator to be used for the evaluation of environmental costs and benefits in contrast to statements which speak of 'balancing' advantages of each activity and the physical and aesthetic discomfort created thereby or suggest, in general terms, that the improvement (of the quality of the environment) must be worth the costs of abatement without specifying how the 'worth' of the improvement is to be valuated.[9]

It is my contention that this treatment of the pollution problem within the conceptual framework of the formal theory of choice is logically defective and operationally ineffective. While it may be possible to express the costs of abatement and anti-pollution measures in monetary terms, I fail to see how the 'worth' of the improvement can be evaluated adequately in monetary terms by the willingness of an individual or a group of individuals to pay for environmental amenities or to accept compensation for tolerating environmental disamenities such as polluted air or water. There are, as far as I can see, three distinct reasons which speak against the use of the compensation principle (apart from the practical difficulties of establishing the willingness to pay).

First, what a person or firm is willing to pay for clean air or recreation facilities or to accept as compensation for tolerating injuries to his health caused by pollution depends upon their income or their *ability* to pay. If incomes are unequally distributed (as they are), and if this inequality of

8. Beckerman oversimplifies the problem when he suggests that economists can arrive at the conclusion that there is 'too much' pollution. Elementary economics teaches nothing about pollution nor about the negative effects of pollution or the benefits of abatement.

9. *Cf. Annual report of the Council of Economic Advisers* (to the President of the United States), Washington, DC, 1971, pp. 114-122.

distribution results among other things from unequal exchanges between unequal economic units in dominating and dominated positions (as it does), the resulting ability and willingness to pay are as arbitrary as the price and wage structure of which they are the outcome.[10] The problematical character of such attempts to evaluate environmental goals becomes evident when it is suggested to determine the losses caused by the pollution of a lake in terms of the additional transportation costs of people seeking recreation facilities to reach the nearest lake not yet polluted, or to measure the value of environmental improvement (such as recreational beaches, parks, a marina for pleasure boats or a public park in a poor section of a large city) in terms of the willingness and hence ability to pay as reflected in money spent for admission or for the purchase of fishing and recreation equipment,[11] or in terms of the hypothetical hourly income of those seeking recreation. In all these cases, the use of willingness to pay as the criterion of quantifying and evaluating the quality of the environment has the insidious effect of reinterpreting original human needs and requirements into a desire for money and of evaluating the relative importance of such needs in terms of criteria which reflect the existing inequalities and distortions in the price, wage and income structure. 'The basically questionable point of departure consists in the fact that original physical needs for rest, clean air, non-polluted water and health as well as the inviolability of the individual are being reinterpreted in an untenable way as desires or preferences for money income . . . These fundamental human requirements must not be articulated, nor are they to be satisfied through the market mechanism. Their reinterpretation and (evaluation) in terms of a desire for money within the context of the price system falsifies the original need and at the same time the core of the problem of decision-making. Health, opportunities for recreation in parks, clean water or aesthetically satisfying environmental conditions are objectives which today are not pursued primarily with regard to their actual contributions to GNP. In many instances, it will be possible to realize these goals only by actually foregoing a short and medium term

10. Beckerman himself admits that it makes no sense to evaluate the life of a person by asking him 'how much money he would accept, if he died, in order to be as well off as if he were still alive' *(sic)*. To my mind methods of individual self-evaluation of life and health (*e.g.*, discounting future earnings, legal compensation claimed or received in liability cases, willingness to pay for insurances, etc.) make not much more sense. See C. Senior, *A model for quantifying risk: A cost effectiveness study of industrial safety*, Nuffield, 1971, pp. 8-9 (mimeo).

11. On the ground that 'a logical basis for determining the probable recreation benefits to be derived from the proposed improvement to the amount of money voluntarily invested by boat owners to obtain them', *cf.* US Secretary of the Army, 89th Congress, Second Session IIB, Cross Village Harbour, Mich. - Washington, DC, 1966, p. 31, quoted from D. Weiss, *Infrastrukturplanung*, Berlin, Deutsches Institut für Entwicklungspolitik, 1971, p. 68.

increase of GNP in its present statistical computation.'[12] The logical and practical result of using willingness to pay as a criterion would be that public parks or clean air in the ghetto sections of a large city would yield a lower benefit-cost-ratio than the marina for top management personnel. A mode of reasoning which leads to or indirectly supports such an outcome reveals its hidden, basically unequalitarian value judgments inherent in the compensation principle as a criterion of evaluating the 'worth' of environmental goals.[13]

Second, apart from income inequalities which undermine the validity of the compensation principle there is the individual's inability to ascertain the full range of short and long run benefits of environmental improvements or, for that matter, of the full impact of environmental disruption upon his health and his well-being. It is today generally recognized that environmental pollution and the disruption of the environment are the results of a complex interaction of the economic system with physical and biological systems which have their own specific regularities. Moreover, pollutants from different sources act upon one another and what counts are not only the effects of particular effluents and toxic materials but the total toxological situation. The causation and the effects of pollution are far from being transparent to the individual. Those who have studied these complex causal relationships know that environmental disruption can easily become cumulative with pervasive and disproportionate effects per unit of additional pollutants.[14] To ask the individual what he is willing

12. *Ibid.*, pp. 68-70.

13. Actually, welfare economists would probably shy away from the logic of their procedures by falling back upon their own personal value judgments, in which case society may again be poorly served in so far as these personal valuations may diverge from those which society may place upon environmental values through the political process. For in this case we would be faced with personal idiosyncrasies and potentially arbitrary judgments which would enter through the back door into the evaluation process. For economists and technocrats would then prepare environmental projects and policies which reflect market valuations 'corrected' by their own views and values. Such projects and policies prepared by experts would still have to be ratified by political decision-makers. Some of the latter would like nothing better than this procedure which would enable them to present their decisions as being based upon the advice of 'experts'. In fact this is exactly the model of policy-making by experts which J. Habermas has criticised, see his *Technik und Wissenschaft als Ideologie*, Frankfurt, 1968, p. 125 (*cf.* also H. P. Widmaier and O. Roloff, 'Zur Kritik der quantitativen Wirtschaftspolitik', in: E. Dürr, *Neue Ansätze der Wirtschaftspolitik*, Berlin, 1971).

14. It is hardly convincing to argue, as Beckerman does, that economics is capable of dealing with these complex causal interrelationships and interdependencies because it has long dealt with economic systems with numerous and interrelated variables. Nor is the more recent recognition of feedback effects and time lags, or for that matter of multipliers and accelerators in traditional macro-economics of any help. Economists who do not study the causal chain which gives rise to pollution and its impact on human health are ill-equipped to deal with the elaboration of environmental plans and projects and to judge their effectiveness and relative worth.

to pay for the improvement of the quality of the environment or what amount of compensation he is willing to accept to tolerate current or even higher levels of pollution constitutes therefore an inadequate and ineffective and indeed a highly problematical basis for evaluating judgments concerning the 'amount' of value of alternative environmental goals. The practical consequences of making the content and extent of the control of environmental quality dependent upon individual willingness to pay could at best lead to piecemeal measures and an ineffective formal sub-optimization if it does not become the pretext for endless delays or a policy of doing too little too late.

The third reason which speaks against the compensation principle is to be found in the fact that it does not lead to the systematic search (by R and D expenditures) for alternative non- or less-polluting technologies.[15] To suggest that environmental improvements are economically worthwhile only if the 'worth' of the improvement (as measured by the compensation principle) exceeds or equals the cost of the improvement says nothing about the techniques to be employed or to be developed. It sidetracks this important issue and leaves it to the pollutor to develop anti-pollution techniques only in accordance with his private cost-benefit calculations. This has not been adequate in the past and may turn out to have disastrous consequences with disproportionately increasing environmental disruption in the future.

In conclusion, let me make explicit the basic elements of the approach I have used in dealing with the admittedly difficult problem of evaluation. Negatively speaking I feel the environmental issue forces us to abandon the traditional assertion that values and value judgments are beyond scientific inquiry and have to be accepted as given. In economic discourse this has meant that we have accepted individual valuations, prices and income as given. Instead I suggest that it is possible and necessary to follow an empirical or pragmatic approach to the study of value. Such an approach is based upon a critical analysis of the consequences of accepting criteria such as market values and an examination of the question of whether monetary values are appropriate for the evaluation of the characteristics of the environment. In the case under consideration the evaluative judgment must correspond to these characteristics as they affect human health and human life without arbitrarily excluding anybody (whether due to the fact that he is unaware of the consequences of pollution or is unable to pay or even prefers a polluted environment to the maintenance of minimum environmental standards). I have endeavored to show that monetary criteria (willingness to pay, compensation principle, etc.) are in this sense not appropriate because they do not evaluate the characteristics which

15. This is not to say that the pollution problem will be solved simply by the introduction of different technologies.

define the quality of the environment and its potentially negative impact on human health, human well-being and human survival. This has nothing to do with Hegelian essences (as Beckerman seems to fear) but with the nature and quality of the environment, *i.e.*, its characteristics. Therefore the 'amount' of its value needs to be quantified and evaluated in terms of criteria that express or measure its effects on human health. These can only be environmental standards for all concerned without exclusion. Such standards are not beyond reach; in fact they are available or could be developed. They will have to be objective or objectified criteria reflecting our current knowledge and are subject, at the same time, to change in the light of new knowledge and new experiences.

To repeat, the basic issue under discussion is not whether evaluations, *i.e.*, judgments as to the presence and 'amount' of environmental values can be made in terms of willingness to pay but whether these criteria are cognitively responsible.[16] I have tried to show that monetary criteria are not cognitively responsible. The use of monetary criteria would have the effect of making environmental planning ineffective and would give rise at best to a piecemeal approach which will not overcome the sub-optimization which has been characteristic of the market system in the past. Today and with respect to the current debate of environmental policies such criteria seem to be an expression of an attempt to force the not so new facts of environmental disruption once more into existing theoretical frameworks and conceptual boxes which have served our discipline as instruments to play down the significance of the phenomena of unpaid social costs by making them appear more harmless than they are.

This is not the place to set forth an alternative approach to the evaluation of environmental goals and environmental planning. Nevertheless, since Beckerman insists that the critic must show that there is a better instrument than that which he criticizes – a view which I do no share – I shall formulate a few generalizations in the hope that these sketchy observations may suffice to indicate at least the general direction in which a more effective approach to evaluating environmental values and environmental planning may lead us. Above all it would be necessary to recognize the systems character of the environmental problem and to admit that environmental relations differ radically and in kind from market relationships. Furthermore, the elaboration and acceptance of environmental goals call for a collective or social choice with a direct participation and

16. Pepper speaks of evaluative criteria in discourse as becoming 'responsible' by their attachment to the evaluative criteria which operate outside of discourse. Where this attachment does not hold or cannot be made out the evaluative criterion is cognitively irresponsible, *i.e.*, it is not true to the empirical fact of the matter. Quantitative standards must be correlated in an appropriate way with the defining characteristics of the (qualitative) definitions. C. Pepper, *The sources of value*, Berkeley, Calif., 1958, pp. 277-279.

expression of preferences by all members of society, even those outside the market and without reference to effective demand. Lastly, we need systematic and comparative cost studies for alternative goals and projects together with the appropriate implementation, rules and procedures. This is merely another way of saying that economic theory will have to draw the consequences from the fact that formal rationality concepts leave out of account a whole series of fundamental human needs, of which environmental requirements have been recognized rather late. In order to satisfy these human needs and to arrive at a substantive rationality in the utilization of society's scarce resources, these requirements will have to be defined as objectively as our present knowledge permits and evaluated by means of a deliberate collective, *i.e.,* political decision in comparison to other public goals to be pursued. This means that we shall have to face the task of introducing to an increasing degree politically formulated norms into the socio-economic process. In short we face the task of operating with objective substantive and socially acceptable criteria which have been politically sanctioned. This formulation of goals will be appropriate and necessary in all those instances in which the market fails to generate an effective demand and does not maintain environmental standards but actually contributes to their degradation.

The implementation of environmental policies*

1. PRELIMINARY OBSERVATIONS

The implementation of environmental policies in developing countries raises important issues of resource allocation, of social controls and of institutional requirements which will be discussed in this order.

These issues must be explored in the light of the causal chain which gives rise to environmental disruption in general and the special conditions which aggravate its impact in today's less developed countries. Environmental disruption also raises important issues related to the objectives of economic development.

The causal chain which leads to the disruption of man's natural (and social) environment is not only a physical but also a social dynamic process. Hence to concentrate only on ecological problems and the physical chain of causation or to view the problem in isolation from the institutional framework in which it takes place is bound to convey only an incomplete and therefore a false picture. Population increase, density of settlement, urbanization, modern technologies and techniques of production, climate, topography, soil conditions, stream flows, etc. may all be regarded as factors which have an impact upon the social and physical environment and hence upon human well-being. However, superimposed upon these factors and their interaction is a system of institutional arrangements and a customary way of allocating resources, that is to say the determination of the input and output pattern and hence the pattern of distribution and consumption.

In this context it is important to emphasize that many elements of the environment like air, water or the aesthetic beauty of a landscape or even certain underground resources which have traditionally been regarded as 'free gifts to nature' are not only exhaustible or destructible but cannot

* Reprinted from: *Development and environment.* Report and working papers of a panel of experts convened by the Secretary General of the UN Conference on the human environment (Founex, Switzerland, June 4-12, 1971). Paris – The Hague, Mouton, 1972.

be easily reproduced. For these reasons, their deterioration or exhaustion will not be adequately accounted for in economic calculations carried out in market prices or monetary terms. Hence the process of decision-making takes account only of part of the costs of production; it disregards almost all negative consequences which economic activities relating to production and distribution may have on man's natural and social environment. Today it is more or less generally agreed that market or price systems have a built-in, institutionalized tendency of disregarding those social costs and negative effects which occur outside the exchange relationships between different producers and between producers and consumers of final commodities. Even if an individual firm wanted to and would be in the financial position to avoid some negative environmental effects of its actions it could apparently do so only by raising its costs; in other words, any economic unit which works within the market nexus and is tied to national (or international) competition will do everything to keep its costs at a minimum even if its action has a negative impact on the environment and hence on all members of society. In this respect there is little difference between highly developed countries and the economically less developed nations.

The process of environmental disruption is complex and cumulative. Thus, the effect of any single discharge of pollutants does not vary proportionately with its amount or frequency but depends on such factors as topography, climate, temperature, wind velocity, direct stream flow and the general capacity of the given local or regional environment to absorb or assimilate the pollutants. For this reason also there will be threshhold levels beyond which further discharges of toxic materials do not have equi-proportional but disproportionate and possibly catastrophic effects on human health and well-being. In addition there is the further danger that different pollutants combine in chemical reactions and concentrations.

The quality of the particular environment or, for that matter, of society, must always be understood as a function of the combined effect of *all* sources of disruption which, in modern industrial societies, go far beyond air and water pollution and include excessive noise, urban congestion, long hours spent in travel to and from work in metropolitan areas under chaotic traffic conditions marked by long delays and high accident rates, the progressive absorption of free space and open landscapes, increasing specialization and monotony of work in some, and hectic performance requirements in other professions. In less developed countries reduced vitality due to chronic poverty, deficient nutrition and poor health increase even more the actually felt effects of environmental disruption. To repeat, the experienced disutilities and damages caused by any particular type of environmental disruption are a function of the combined effects of all sources of disruption. Hence, both environmental disruption and the quality of the environment must be understood as a totality.

Several factors need to be considered in determining the seriousness of the problem of environmental disruption in less developed countries. While these countries are at an early stage of economic development and while their real growth rates may still be relatively low, they enter the process of economic and social change under conditions which are in several respects less favourable than those which prevailed in today's advanced economies two hundred years ago. Thus, their geographical location in tropical and subtropical regions of the world; the particular vulnerability and depletion of their soils; their high population growth rates, their inadequate infrastructure particularly with respect to sanitary conditions in rapidly growing urban agglomerations and large villages; the precarious health conditions of a chronically under-employed and undernourished population, the relatively weaker political and social position of large parts of the population without adequate 'counter-vailing' political power; the fact that the extended family system acts as a buffer and facilitates the support of the unemployed and the sick; the greater complexity and potential dangers of modern technologies as compared to those which were introduced two hundred years ago – all these factors expose many developing countries to more serious environmental dangers than those existing during the Industrial Revolution.

In addition there is the likelihood that polluting industries in the industrialized countries meeting with increasing opposition and more stringent anti-pollution measures at home may move their production facilities to less developed areas. Such migration of polluting industries which is actually under consideration constitutes an 'exportation of pollution' to less developed countries and may give rise to a division of labour highly problematical for the latter in the long run – no matter how tempting the establishment of new industries may seem to be from a short-run perspective.

The problem of environmental disruption needs to be seen in relation to the goal of economic development and its measurement. Traditionally this goal has been viewed in terms of rising 'levels of development' expressed and measured by national income data such as GNP, Net National Income or *per capita* income. These data as presently calculated do not take into account the impact of development upon the quality of the environment. As long as the less developed countries continue to measure their development in terms of such national income data they do not take account of the full effects of their development policies on their social and physical environment.

2. ALLOCATION OF RESOURCES

As indicated above the disruption of man's physical and social environment is the result of a complex process of interaction of many factors. In this process the institutionalized pattern of allocation plays a central role. More specifically, environmental disruption reflects a misallocation of resources resulting from an economic calculation which induces economic units to take inadequate or no account of harmful environmental effects of their investment (including location) and production decisions. Measures of social control and the implementation of environmental policies will have to aim at a different allocation of resources in accordance with a more comprehensive economic calculus, taking into account the short and long term social costs and potential social benefits of alternative patterns of resource allocation.

Stated in different terms, costs do not express the actual total costs of production and as a result the revenues of the economic units are no adequate indicator of the actual or total benefits. Such allocation and production decisions necessarily affect distribution; they give rise to revenues to some units at the expense of third persons (or society) who will have to bear the negative consequences of the disruption of the environment and/or the additional costs of its restoration. More than this, investment and production plans (including project designs, location, input patterns, etc.) of different economic units are not compatible and may in fact interfere with one another. The monetary returns from investments are no accurate measure of the contribution made to development: in fact they tend to inflate the data traditionally used to measure the 'level of development'. In short, actual growth and development are lower than expressed in national income accounts. In this sense environmental disruption resulting from the misallocation of resources gives rise to a divergence of private costs and revenues from actual total costs and revenues (viewed from the point of view of society at the macro-economic level).

Alternatively, environmental disruption may also be interpreted as a process in the course of which some economic units exert a dominant influence not only upon investment, production and distribution, but upon the whole direction of the development process. They determine the rate and direction of growth which may not be compatible with the preferences of third persons and indeed of society as a whole. In extreme cases, environmental disruption may slow down and indeed interfere with particular processes of development (as for instance when large-scale multipurpose projects had to be abandoned due to faulty agricultural practices, or had to be redesigned with considerable additional public outlays). Furthermore, deforestation, erosion and a higher frequency of floods destroy property and other much needed implements of production; they reduce output and productivity and thus interfere with the development process.

The financial expenditures and real resources required to remedy such damages place a heavy burden on public budgets and tie up scarce resources which are thus no longer available for other purposes.

Even in less extreme cases, the negative effects of environmental disruption on development cannot be ignored. The emergence and shifting of social costs of various kinds resulting from environmental disruption to the economically weaker parts of the population in less developed countries is neither insignificant nor without influence upon the development process. Such shifts are bound to perpetuate low levels of vitality and the unequal distribution of income. Hence it would appear that the thesis according to which less developed countries cannot afford the controls required to combat or prevent the undesirable effects of environmental disruption and must *nolens volens* repeat the old 'capitalistic trick' of ignoring or neglecting the environmental losses associated with production and growth, must be rejected as theoretically untenable and potentially self-defeating. The argument that the shifting of social costs would set the stage for a more dynamic and less costly process of economic growth is based on a problematical reasoning by an analogy to the development process in the earlier stages of the Industrial Revolution (if indeed it had any validity then). It fails to consider the points raised above (the false identification of development with growth measured in terms of GNP); it ignores the different conditions which make today's less developed countries more prone to environmental disruption and overlooks completely the dangers likely to result from the migration of pollution-producing industries to less developed countries. There is no *prima facie* proof that the neglect of social costs and environmental disruption in the calculation of economic units renders the process of development and modernization less costly and hence less difficult than it is anyhow.

Instead it would be more correct to say that some of today's developing economies are less able than the developed countries to cope with the negative effects of environmental disruption. Thus, it has been argued not without justification, that the market calculus and a policy of laissez-faire may well write the last chapter of the depletion of their soil and forest resources and drain important mineral and petroleum reserves before the end of the present century. While minimizing the costs of current production and concealing the long-term capital losses of scarce resources, this policy may raise output and yield foreign exchange in the short run but exhaust prematurely the resource base.

In other words, the less developed countries today face the same task which confronts the developed nations including the centrally planned economies: namely to develop a more comprehensive economic calculus than that which has guided the allocation of resources and the development process in the past. It would be a mistake to believe that development planning and resource allocation can be approached effectively and

economically by the same methods of minimization and maximization of fixed target or goal functions which have been the subject of theoretical discussions in recent years. Planning must be understood in a fundamentally different manner than has been the case hitherto. Allocation is not the relatively simple adaptation of given means to given ends. Neither the means nor the ends are 'given'. They must be explored and must take into consideration the effects of production and development on the environment. To measure development in terms of a single monetary indicator, as for example in terms of GNP, is a selection of one goal and hence an exclusion of other, for instance environmental, goals. Such a fixation of one's attention on one goal is always problematical. In the case of development planning, resource allocation and investment with its potentially negative environmental effects, it is nothing short of an 'act of folly' as John Dewey once described any fixation of one's attention on one objective viewed as given and in isolation from a whole range or constellation of objectives.

For this reason it would be essential that the less developed countries consider the process of development from the very outset as a multi-purpose undertaking including some definable concern for the quality of the physical and social environment as it affects individual and social well-being. Such concern could find its quantitative expression in environmental standards as one of the objectives of economic development. The elaboration and implementation of such standards or goals must be part of the planning process. Instead of defining economic development exclusively in terms of national income, it will be necessary to include the quality of the environment in the appraisal and measurement of economic development. This will not be possible in terms of a single monetary denominator. In short, what is required is nothing less than the perception and definition of fundamental requirements of human life and survival as integral parts of the constellation of goals (objectives) of economic development and hence of economic planning and allocation. Economic policies and controls must serve these purposes as well.

More specifically, development planning must overcome its present uncertainty in its perception of the quality of the physical and socio-economic environment as a necessary requirement of considerable and, in some critical areas, of overruling urgency. That is to say it must consider the quality of the environment or of particular aspects thereof like air or water as an end in itself, i.e. as a basic social need. To this effect it will be necessary to aim at an objectification of environmental requirements and to make them part of the goals of the development plan.

Once this is agreed upon, it will become clear that economic planning and resource allocation are not identical with the decision-making process of an individual firm. For the goal of the latter is indeed clear and beyond discussion. Hence its decision-making process is highly structured. It

consists in the mobilization and choice of the physical or real means and hence the selection of the technique evaluated in terms of market costs in relation to expected returns without consideration of the impact of this choice on the quality of the environment. In contrast, economic development planning and allocation is (or ought to be) a process in which neither the goals nor the means (including the technologies) are predetermined. Their socio-economic and their environmental impact needs to be explored and appraised in the light of an inventory of the total situation. The planning act includes therefore first a kind of stock-taking as a point of departure, and secondly the choice of the goals to be pursued as well as the choice of the means including the technologies to be applied. Unlike the theorist who assumes an artificial juxtaposition of given means and given ends, planning and allocation are rational only if the planner faces openly and unequivocally the task of arriving at judgments and priorities in the light of objective criteria of human needs and requirements, including the quality of the environment.

With respect to specific threats to the physical and social environment development planning will have to start with an inventory of present and potential dangers for human health and well-being and to social productivity. The preparation and continuous correction of such an inventory in physical terms of the state of the environment, its functioning and its probable changes over time together with its negative effects on individuals and society will have to become a continuous preoccupation of the planner. In fact, such an inventory is the precondition for the definition and rational selection of environmental and developmental goals. It is part of the process of decision-making in the course of which the relative importance of different goals are established and will have to be made transparent to the general public and to the ultimate political decision-makers. In this process it is important neither to evade nor to conceal the fact that conflicting vested interests will be affected. Finally, the necessarily interdisciplinary research, diagnosis and prognosis must also aim at the determination of the appropriate techniques and technologies either available or in need of development in order to achieve the selected goals of environmental requirements. Needless to add that neither these goals nor the means and techniques are fixed once and for all. They will be subject to change and adaptation to new conditions, new experiences, new data, new analyses and new knowledge. Viewed in this fashion, economic planning includes the selection of goals and techniques together with the appropriate controls and methods of supervision. This, however, can be done only if the planner understands the dynamic relationships between the economy, its institutional arrangements and the environment each regarded as interdependent systems.

It is no valid argument that our knowledge is always incomplete and that we are able to act and plan rationally only after all the relevant data

have been assembled. This would be a council of perfection or despair and with regard to the prevention of the disruption of the environment it could lead only to a delaying of action. Besides, many of the key pollutants and major sources of pollution have been known for decades or could have been known with proper research. The less developed countries can avoid many of the environmental failures of the industrialized economies if they applied the available knowledge in their development planning and allocation decisions.

Before proceeding with this analysis of allocation and planning decisions related to environmental goals, it may be worthwhile to emphasize that the notion of planning here suggested is not an invitation to disregard costs. Nor does it support what is sometimes regarded as a technocratic approach. On the contrary, far from disregarding the costs of maintaining environmental standards and far from advocating the adoption of the first technique and input pattern that presents itself, we advocate the systematic exploration of alternative programmes and alternative input patterns by which the desired goals can be achieved. This exploration must include a consideration of actual including social costs, by means of studies designed to ascertain the least costly method of attaining the stipulated goal. Such studies must indeed be regarded as an integral part of any development planning directed towards the maintenance of minimum environmental requirements both in developed and in less developed countries. Such studies are necessary for deliberate and reasoned choices.

Coming back to the elaboration and definition of environmental minimum standards, it will be necessary first to establish environmental indicators. These are data or measurements providing the essential information on the nature and quality of the environment and their effects on the conditions of human life. Such indicators are designed to provide an account in physical terms of the state of the environment. Their purpose is to determine the particular environmental threats and to define the major pollution problems both actual and potential. While some of these problems may well be similar to those of highly developed countries, others may differ and be highly specific in less developed economies. Polluted sources of water and even scarcity of drinking water, problems of settlement density and slums and the widespread absence of sanitary facilities, monsoon conditioned floods, malaria infestation, etc., are some of the specific manifestations of environmental disruption in less developed countries. To repeat, what is required is an identification of the key pollutants and of the major sources of pollution by establishing indicators of the present state and the possible trends of environmental degradation in the future. These indicators would make it possible to determine by means of monitoring or observation systems, for instance the amount of specific contaminants in samples of water, air, soil or organisms with a view to providing the required information on the pre-

sent state of the physical environment: if carried out systematically and periodically, monitoring would also provide the data in the light of which it is possible to trace the changes of a particular environmental system (e.g. of a river basin system, or of a system of relationships between climate, topography, settlement density and atmospheric pollution). Understood in this broad sense, environmental indicators are an important aid in determining environmental standards or norms. They are also an essential tool for the continuous evaluation of the effectiveness of alternative methods of social control.[1]

Environmental standards are both definitions and at the same time evaluations of critical zones of environmental disruption as for instance maximum acceptable levels of concentration of toxic materials in the atmosphere or water relating to specific regions. Such safety standards differ from environmental indicators in as much as they represent already an element of evaluation in the light of past experiences and currently available knowledge of essential environmental requirements from the point of view human health and survival. They are thus substantive 'welfare' criteria. Definitions of essential minimum requirements (with respect to sanitation, nutrition, public health and elementary education) are not seriously questioned, at least in principle, although their implementation may still be open to discussion. The environmental crisis calls for an extension of the principle of social minima to a problem area in which individual preferences and supply and demand cannot be relied upon.

The subject of environmental safety standards raises complex technical and methodological questions (as to their reliability) which need not be taken up in detail within the present context. Special difficulties arise, for example, from the cumulative character of the causal process which gives rise to environmental disruption and particularly from the fact that different pollutants and toxic substances act and interact upon one another. Even if each of these substances is emitted in 'tolerable' quantities they may, in their interaction, become dangerous to, and incompatible with human health and survival. Moreover, different age and income groups in different localities may be affected to very different degrees. Such environmental safety standards must, of course, be kept open to modification; they need to be revised in the light of new experiences and new knowledge. Less developed countries may have to apply at first only the most essential safety standards below which any further deterioration of the environment cannot be tolerated under any circumstances. With increasing prosperity, these standards could then be extended and revised upward with a view to improving the safety factor.

1. *Cf.* C. L. Wilson and W. H. Matthews (eds.), *Man's impact on the global environment: Assessment and recommendations for action*, Cambridge, Mass., 1970, pp. 167-222.

Since the establishment of environmental safety standards constitutes a fundamental break with the utilitarian principles which underlie past and current economic theorizing, it may be worthwhile to deal briefly with their justification. The utilitarian tradition rests on the conviction that the determination of what is morally good, and by extension what is useful or desirable (in the narrower economic sense), must be left to the individual himself who alone can and must decide what is 'good', useful and to be preferred. Despite its excentric formulation as a calculus of happiness in which the ultilitarian principle became part of political economy and economic theory it was and remained a radical assertion in favour of individual rights and human freedom. Systematized into a pure theory of optimization by abstracting from disparities of income and wealth, and by disregarding the manipulation of consumers' preferences through sales promotion under conditions of oligopoly and by not taking account of the absence of information regarding the environmental consequences of human action, the utilitarian principle has itself become a dogma which serves vested interests rather than the individual whom it was once designed to protect. Under these circumstances and because of the nature and magnitude of the environmental threat the objectification of criteria of human well-being in the form of environmental standards seems to be called for as an approach to a more effective control of the quality of the environment.

While environmental standards are a step beyond the elaboration of environmental indicators they specify only what needs to be done but do not indicate the costs. In other words, their implementation is still a problem that calls for a solution. However, once environmental standards are accepted as a goal of planning and allocation, they provide the basis for working out alternative production and investment patterns together with the respective inputs and techniques to be employed.

We are not arguing that all less developed countries will be able to establish environmental indicators and work out environmental safety standards in the immediate future. The institutionalization of both environmental indicators and standards is a long-run desideratum; it calls for a scientific infrastructure for which the financial and manpower resources need to be developed. For these reasons and since the protection of the environment cannot be postponed even in less developed countries, it will be necessary to establish pragmatic criteria of resource allocation which, though less systematic than those envisaged above, may nevertheless serve as a first step to induce (or compel) individual decision-makers and planners to minimize the negative effects of their allocation and investment decisions on the environment.

As a step in this direction it would be important, for example, to ascertain beforehand the physical interdependencies and cumulative processes, which specific projects or the economic plan as a whole are likely to put in

motion. Among the factors and questions which may have to be considered in all major allocation decisions are the following: the quantity and quality of available and required natural resources, the possible effects and probable date of their exhaustion; the availability or deliberate development of alternative technologies (including their relative costs); the suitability of alternative sites ascertained in terms of their environmental effects for example on the density of population, the level of air and water pollution, and available opportunities for waste disposal. It may also be necessary to ascertain whether and how and at which costs effluents and residual products can be disposed of. Are they bio-degradable? Can they be recovered and re-cycled? In agriculture (and forestry) which is going to remain a major sector in many less developed countries, it will be necessary to ascertain the effects of alternative investment and allocation patterns on the water household in particular drainage areas, on the rate of erosion, on soil fertility and the potential effects of required pesticides and chemical fertilizers.

In conclusion it may be said that the social costs of environmental disruption and the social benefits sought by environmental controls make it necessary to focus attention on larger aggregates or regions viewed as systems of physical and economic relationships. In the last analysis what is called for is the setting up of criteria of evaluation which are appropriate for the social costs and benefits at stake. That these are complex and heterogeneous and often intangible makes the application of the traditional economic calculus in monetary terms difficult if not impossible. What is needed instead is a comprehensive system of social accounts in the light of explicitly stipulated environmental objectives (e.g. minimum environmental standards) as part of the development plan. Environmental planning and development planning must thus go hand in hand and this will have to be reflected in techniques chosen, investment patterns adopted and projects designed.

Such a comprehensive system of social accounts will have to operate with a much longer time horizon than the individual economic unit. By thus reducing the divergence between private costs and total costs (or private net revenues and social net benefits) the rate of economic development may be reduced in some countries. However, in the long run, it may actually be increased even if gross and net national product data, as presently calculated, do not reflect such an increase. This would be particularly true in all those cases where the additional costs of improved project designs drawn up in accordance with environmental safety standards would actually be compensated by correspondingly higher additional social benefits.

3. SOCIAL CONTROLS

The preceding discussion should have left no doubt that environmental disruption raises fundamental issues with respect to resource allocation and development planning. Pollution effects are not minor side-issues and cannot be easily corrected by isolated *ad hoc* measures of legislative control, chosen and preferred because they are more or less compatible with the market system. In fact, what has always been put in question by the phenomena of environmental disruption and social costs is the rationality of allocation and production patterns guided by market prices. What is called for are new criteria of allocation and new methods of decision-making. This applies both to developed and less developed countries.

Such new criteria will not be found as long as one assumes tacitly or explicitly that the market system offers the fundamental criteria for a solution of the problems raised by the environmental crisis. To repeat, environmental disruption will neither be prevented nor effectively abated by piece-meal regulations compatible with the prevailing structure and organization of the economy.

These observations do not imply that the approach outlined in the previous section will be put in operation from one day to the next. For many economies and for some time to come the prevailing structure and organization of the economy will provide the organizational and institutional framework for the formulation of environmental policies and controls. For this reason it is important to examine the relative effectiveness of different methods of control.

Social controls currently under discussion include a wide spectrum of alternative and complementary measures. At one pole of this spectrum there are suggestions which leave the protection of the environment to private business supported perhaps by the collection and dissemination of information on the state of environmental disruption or the establishment of inter-industry, advisory or consultant services. A similar, although slightly more specific suggestion relies on private business to develop pollution abatement equipment on a commercial basis. The other pole of the spectrum would be the collectivization of investment and production under public, i.e., central or state auspices. Between these poles there are proposals for indirect controls of the quality of the environment by taxes, penalties or subsidies; and direct controls of factor inputs and output patterns and/or the systematic development of new technologies and techniques less detrimental to the environment.

This spectrum of social controls and anti-pollution measures will be examined in the present section. Problems of legislation and legal reforms will be considered under institutional requirements as will be the doctrine of 'zero growth'.

Suggestions to control pollution by providing pollutors with more de-

tailed information about the causes and negative effects resulting from environmental disruption and proposals to establish inter-industry or nation-wide advisory services to business and consumers on how to reduce pollution are not likely to yield results as long as the costs of environmental control exceed the expected revenues. However, there may be differences from country to country depending on the willingness of industry to subordinate private interests to social imperatives.

Another approach to environmental control which relies on individual incentives for the avoidance of environmental disruption and social costs is the development of new anti-pollution equipment by private industry as a profitable business proposition. Some investigators in developed countries speak of a new industry engaged in research and production of pollution abatement equipment. While such an industry may be interested in promoting the necessary abatement equipment and may in fact act as a kind of lobby favouring anti-pollution legislation, the chances of improving the quality of our environment in this way can be easily overestimated. For the introduction of pollution abatement equipment is expensive and yields no additional private revenue (except perhaps in those cases where the new equipment lowers costs and the recovered pollutants have a marketable value and/or can be recycled). In addition, pollution abatement equipment relates primarily to some specific cases of air and water pollution and perhaps noise control. Problems of congestion in urban areas would not be affected, quite apart from the fact that the considerations advanced in connection with certain effects of indirect controls would apply to this form of control of the quality of the environment by *ex post* abatement.

Indirect controls have attracted the relatively greatest attention. They may take the form of subsidies (including accelerated write-off rates for the installation of waste treatment equipment) or of taxes or penalties for violations of regulations (e.g. charges on effluents) on those economic units which continue to pollute by emitting residual untreated waste materials into the environment. Such controls are measures which operate through existing price and cost relationships. That is to say they are appealing to private incentives or are enlisting disincentives as a means of changing the choice of inputs and the use of residual waste materials. They are advocated because they are making use of market principles in order to restore or maintain environmental quality. The explicit aim of these indirect controls is frequently the 'internalization' of the unpaid social costs of production; they are often defended on the ground that pollutors should pay for the costs of preventing pollution and/or of remedying the current disruption of the environment. Taxes and penalties are also advanced as possible methods of providing the necessary funds for the elimination of environmental disruption. In the great majority of cases indirect controls constitute *ex post* remedial measures although they

may in fact also exert an *ex ante* preventive influence. They are said to achieve their aim by a minimum of interference with decentralized decision-making. While indirect controls may be distinguished from direct controls which constitute a quantitative 'intervention' with the market process the two methods may also be used in a complementary manner as will be pointed out later.

Subsidies paid to pollutors who introduce waste treatment or filter equipment are often advocated as an incentive to reduce pollution while the decision to do so is left to the individual firm. However, the effects of incentives can easily be overestimated. Pollutors have always had an incentive to introduce abatement equipment in so far as the installation of such equipment would have been tax-deductable. If they have not introduced it in the past this must have been due to the fact that the deduction was not sufficient as an incentive and that it was more profitable to operate without anti-pollution equipment. Hence subsidies would have to be much higher than the incentive provided by existing tax laws. Massive subsidies and hence public expenditures would be called for in order to make these indirect controls effective. However, since subsidies call for additional taxes, they give rise to questions of equity and redistribution of income. In fact, they constitute a redistribution of income: Taxpayers (who may be affected by pollution) are called upon to pay the pollutors to stop polluting. This procedure is sometimes advocated as a way of compensating the pollutor for a loss of a legitimate interest; what this argument overlooks is the fact that the incidence of pollution represents an inequitable shifting of costs to third persons or to society which can hardly be considered as legitimate whether considered from the point of view of common law or the perspective of current price theory. Anti-pollution policies start from a prevailing state of price distortion and inequity of distribution, and subsidies may distort this inequitable distribution still further. In addition, subsidies have very different effects on different pollutors depending on their market position; nor can we determine how high the subsidy must be in order to be effective and actually reach environmental standards.

Penalties and *taxes* (e.g. excise taxes on materials which are pollutants or effluent charges) may be more effective than subsidies. Their actual effectiveness depends again on the tax and the market position of the pollutor. While it is correct that a tax on the volume of discharge of pollutants (e.g. 10 cents per pound of untreated waste materials dumped into rivers) leaves the choice of control to the individual firm and may act as an incentive to reduce the volume of such discharges and to install abatement equipment, it must not be overlooked that such charges have very different and unpredictable effects on different firms. Firms operating in a more competitive market situation may be unable to shift the tax to consumers, whereas oligopolistic firms occupying a more dominating

position in markets may find it relatively easy to shift (or, alternatively, to absorb) the charge (particularly if such charges could be treated as a cost and hence be tax-deductible) and continue to pollute. Here too, we do not know how high the tax or penalty must be in order to be effective as a measure of control. In addition, general penalties for each discharge of pollutants are *ex post* measures after the pollution has taken place and thus may come too late; furthermore, they may be entirely ineffective if they do not exceed substantially the private costs saved by the discharge of untreated waste materials. To summarize: Indirect controls raise issues of equity and contribute to a 'distortion' of the price structure. In addition, the exact rate of the tax and the amount of the subsidy cannot be determined and their effect is not certain. Moreover, as methods of control, subsidies tend to perpetuate an uneconomical bias in as much as they would promote the construction of abatement equipment for existing polluting techniques whereas more economical and effective methods of control such as the development of new technologies and alternative input factors would be neglected. For these reasons, indirect methods of controls operating through the price system and relying on incentives to change the behavior of the pollutor cannot be regarded as reliable and sufficient measures of counteracting the disruption of the environment. This applies also to countries in the initial stages of development, particularly if they permit foreign polluting industries to migrate to their shores in an effort of evading the more effective controls of their home countries.

In short, indirect methods of control fall short of what seems to be required in order to protect or improve the quality of the environment. Their effectiveness is problematical, their utilizaiton can be justified at best only as a stop-gap measure pending the development and enactment of more effective methods of control, although they may become part of a comprehensive anti-pollution program. An effective system of environmental controls will call for more fundamental measures than penalties, taxes and subsidies.

Direct controls aim at safeguarding the quality of the environment by stopping the pollution before it occurs, or by sharply reducing it. The most far-reaching of such direct controls are outright prohibitions and statutory regulations or curtailments of production of toxic materials. Cases in point would be the prohibition of the production of leaded gasoline or the use of automobiles in the centre of cities, and the closing down of factories in selected areas with high and unacceptable rates of pollution. Other direct controls are the statutory regulation of the use of particular inputs and the prohibition of the emission of specified pollutants (e.g. sulphur dioxide, mercury, cadmium, etc.) or deliberate measures to channel the location of industries in order to limit the maximum density of industrial production in accordance with a general location,

land use and zoning policy in an effort to decentralize production and settlement in the light of a national inventory of environmental hazards and existing population densities rather than in terms of private costs (e.g. transportation costs) and returns.

In view of the rapid deterioration of the environment, direct controls will also have to play an increasing role as instruments of environmental planning in some of the less developed countries, for they provide relatively more effective means (than indirect controls) of preventing or reducing the disruption of the environment.

However, even direct controls are neither the last word nor the key answer to the danger of environmental disruption. Their use must be coordinated with systematic research and the development of *alternative technologies and new techniques.* Nothing seems to be more urgent than the planned development of technologies and techniques designed to reduce or to eliminate environmental disruption. They are of particular relevance to less developed countries because these countries still have – within the constraints placed upon them by their poverty – the option of adopting techniques and of choosing capital inputs which are less disruptive of their environment than the techniques currently used in industrialized nations. The following discussion may serve to illustrate this point.

Developing economies have drawn substantial benefits from DDT for the control of malaria and from other pesticides for the management of plant diseases and pests. The demand for such pesticides is likely to increase as the development of high yielding varieties will be extended to other varieties than corn, wheat and rice. While the increasing use of DDT and other chemicals of a non-degradable type has reduced the incidence of malaria and its consequences (expressed in terms of lower morbidity and death rates from 'fevers' and increased vitality and labour productivity), DDT (and other chemicals) are affecting both flora and fauna and are today recognized as health hazards to man. Instead of viewing this problem simply in its static dimension as an inevitable option between the continued use, for example, of DDT and its discontinuance (with increasing death rates from malaria, and reduced productivity), there may be the alternative of developing new methods of controlling pests. This may be achieved for instance by biological agents or by breeding plants with greater resistance to attacks by pests and insects, or by new methods of insect control through the sterilization of the male insect through radiation. This search for new technologies in order to replace harmful (capital) inputs, while offering perhaps no absolute safety, may well turn out to be the most economical and effective method of environmental control in the long run.

The control of the environment by developing new technologies is not confined to alternative techniques in agriculture and pest control. It is

applicable, at least in principle, to all production processes which pollute our environment. In fact, in some countries the substitution of technologies is not only under discussion but under way. Experiences in Sweden and Japan seem to indicate that the use and emission of mercury by certain industries into lakes has been reduced or eliminated thanks to the systematic effort by government research (in cooperation with industry) to develop new techniques. Thus, in Sweden, firms formerly exporting liquid wood pulp have abandoned the use of mercury as a result of adopting a new technology, which also enables them to reduce their water requirements, and to move their production facilities closer to their raw materials, thereby also reducing their transport outlays.

Another possibility to reduce pollution is the *recycling of residual waste materials* which may also lead to a reduction of costs. We may note in passing that the development of new techniques under government or joint public-private auspices may be fruitfully combined with a policy of subsidies in order to hasten the conversion from polluting to non- or less polluting techniques. Other illustrations, in addition to the systematic recycling of residual waste materials, are the replacement of presently non-degradable detergents, and the development of new synthetic materials (plastics) with are subject to bio-degradation, photo-degradation or oxydization. Another case in point would be the replacement of the gasoline motor by other and less polluting engines or sources of energy.

Technology substitution is often identified as a 'technocratic' solution which in reality may only achieve a shift of pollution from one stage of production to another or from air to water pollution (or vice-versa). While it is correct that all production (and consumption) processes leave waste products it is not correct to assert that all productive processes and techniques must necessarily have polluting effects, or for that matter, the same polluting effects. Our present technologies and the industrial techniques currently in use are the result of past research and of an unqualified attitude toward 'growth' which did not take into account the negative effects of these techniques and of their residual materials on the environment. Hitherto research and development budgets did not include expenditures for the development of non-polluting techniques and there is no *a priori* reason why the development and use of new techniques must necessarily be uneconomical, particularly if their effectiveness, i.e. their total benefits and total costs, are compared with the effects of current techniques of production which have given rise to the present pollution of the environment. Modern science and contemporary technological research have hardly begun to concentrate their attention on these matters.

However, it has first to be stated clearly that the worthwhileness of such research cannot be decided upon on the basis of private costs and benefits. Second, the development of new technologies has to be guided by a new orientation and has to consider priorities in harmony with the

urgency of the pollution problem. Third, the necessary research work has to be interdisciplinary and has to take full account of the ecological, social and economic interdependencies (i.e. their systems character) which go beyond the scope of the specialist trained in his particular field. In any event it cannot be expected that this kind of research can or will be conducted in the less developed countries. In short, the development of such 'cleaner' technologies, techniques and capital inputs belongs to the most important tasks of foreign technical assistance and foreign aid in general. Indeed, the need for this type of foreign support is today as urgent as was the assistance which led to the development of high yielding varieties of agricultural crops.

In conclusion, the substitution of new techniques and non-polluting capital inputs for currently used polluting techniques and input patterns may be faciliated by the employment of both direct and indirect methods of social control.

The *collectivization of investment and production* under public auspices represents the other pole of the wide spectrum of measures of social control under review. It is sometimes believed that investment and production under public auspices offer a guarantee for the avoidance and elimination of environmental disruption. This thesis cannot be accepted without qualification. Even though public sector industries may not be set up to produce at a profit, they are operating under budgetary restraints and are forced to minimize their costs, which they may do at the price of a negative impact on the environment. In addition, municipalities and regional public authorities are known to use temporary tax reductions and other means to attract new industries in order to enlarge their tax or public revenue basis. They may thus 'trade off' the quality of the environment for public revenues.

There seems to be a *prima facie* presumption that in socialist countries environmental disruption and social costs could be taken into account in allocation and investment decisions. Thus it could be argued that the socialization of the means of production and central planning leads to a more comprehensive assessment of the consequences of alternative production patterns and alternative techniques. Production facilities causing environmental damage can be stopped with relatively greater ease. Direct and indirect controls can be introduced and enforced. And yet this presumption holds true only with certain qualifications. Even in socialist countries legislation may remain a dead letter, particularly if production goals are pursued at any price or if competition with non-socialist countries becomes a primary preoccupation either for internal reasons or for considerations of defense and security. More fundamental than these observations is another more general consideration: some socialist countries and centrally planned economies may find it necessary to increase the role of 'profits' within the internal management of economic units in order to

enlist additional material incentives for an improvement of the efficiency of management and in order to achieve a better coordination between production and distribution within the economic plan. Even if the principle of centralized planning and investment is maintained, these economic reforms in socialist economies may induce economic units to sacrifice environmental quality in an effort to reduce costs to attain their output targets and to maintain their (short run) financial solvency. In fact, the *prima facie* presumption that socialist countries will not use polluting techniques holds true only if and as long as cost minimization is not made the overruling criterion of public production. In other words, even socialist developing economies will have to work out effective methods of environmental control and non-polluting techniques and capital inputs.

4. INSTITUTIONAL REQUIREMENTS

In view of the fact that less developed countries are particularly vulnerable to environmental disruption and considering the speed with which environmental conditions can deteriorate under the impact of uncontrolled economic development particularly in areas of high population density, it will be important to set up new or strengthen existing institutions for the protection of the environment. In this effort methods of control and implementation in industrialized countries could be considered for possible transfer and adaptation.

However, more will be needed than the setting up of new administrative environmental agencies. Even the enactment of new legislation and legal controls, important as they are, will not suffice to come to terms with the dangers of environmental disruption set in motion by uncontrolled development. In fact, what needs to be institutionalized is also a general concern for and a new attitude towards the environment as a basis for environmental planning. Understood in this broad sense the term 'institutional requirements' refers not only to administrative, legal and political arrangements but includes also the attitudes and valuations which influence and motivate human behaviour and action.

In line with this broad interpretation of the term institutional requirements, the less developed countries must develop a greater public awareness of the urgency of their environmental problems. They must recognize the fact that uncontrolled development is bound to have harmful effects on the quality of their environment and that these effects cannot be safely ignored in development planning. These negative effects must not be considered as inevitable side-effects of secondary importance as compared to an allegedly over-ruling primary objective of material progress measured in terms of GNP. This calls for the inclusion in the planning agency of a staff of environmental experts who would have to

collect the relevant data and to advise the planner with regard to the formulation of environmental goals.

The first step would be the establishment of agencies concerned with the collection and appraisal of data showing the present state and probable trends of pollution. As already pointed out, the environmental conditions in less developed countries may be highly specific. Scarcity of drinking water or polluted sources of water, lack of sanitary facilities, settlement density and slums, monsoon floods, malaria infestation, salinization of the soil and water-logging require special attention. In all these instances the collection and appraisal of data for specific regions and for the country as a whole are a prerequisite for the formulation of environmental goals as well as for remedial action and environmental planning.

The collection and appraisal of such data will call for the setting up of a scientific infrastructure with the appropriate personnel. This will be necessary in order to identify the key pollutants and major sources of disruption of the physical (and social) environment and to explore systematically the causal relationships between productive activities and the disruption of the environment. To this effect it will be essential to maintain, at least in the more exposed rural and metropolitan areas of human settlement, environmental observation or monitoring stations with the functions already outlined above.

While it is true that this scientific infrastructure calls for new administrative agencies, both at the state and local level and requires funds as well as trained personnel, these requirements need not be beyond the reach of some of the less developed countries. Many of the sampling techniques and instruments have been developed or are in the process of development in several industrialized countries. It may even be necessary to attach this scientific infrastructure (laboratories, monitoring stations, etc.) to the planning agencies.

The analysis of the problem of resource allocation has stressed the necessity of a prior appraisal of the impact of investment decisions, both at the project level and for the plan as a whole, upon the quality of the environment. Such an assessment of environmental consequences must be made an integral part of all feasibility studies carried out as a preliminary step in selecting development projects, in order to anticipate and to keep environmental damages under control.

The planning agency needs for each project not only a technical feasibility study in engineering terms but also a comparative cost study including an assessment of the specific pollution hazards, ecological contingencies and possible social consequences. Such an assessment calls for a systematic interdisciplinary research effort which will have to explore the possibilities of alternative locations and technologies together with estimates of alternative costs.

While the need for a systematic assessment of environmental conse-

quences is accepted at least in principle, its institutional implementation is still under discussion. Specific suggestions advanced go beyond the recognition of the principle. There is need for the establishment of environment-, technology- and location assessment boards to assume the tasks outlined above. Such boards would have to conduct their work openly and with adequate representation of the population affected; their conclusions must be given full publicity. Their members must possess the required professional competence and must be under obligation to secure advice from independent experts.

Although the work of such boards would be time-consuming and would add to the costs of project planning, it would provide the development agency with the data that are absolutely essential for rational decision-making. While it may be less costly and hence more profitable in the short run to develop and operate projects without prior assessment of the environmental and social consequences, it will be more economical in the long run to act upon the data provided by the assessment board.

Another institutional requirement for the maintenance of the quality of the environment is education on a broad level. Educational systems, even in industrialized countries, have never been set up with a view to developing an understanding of environmental problems and of man's active role in creating his own environment. This cultural lag can be overcome only by introducing the study of environmental problems and the causes of environmental disruption into the curricula of elementary schools, colleges and universities (including those of adult educational programmes). Particularly the training of scientists, engineers, economists, lawyers and other technical experts will have to include the study of the interrelated issues of production, technology and environmental disruption; such training must be interdisciplinary in character.

In addition, intelligent action and rational policies with regard to the environment need the support of an informed public opinion. This in turn calls for a systematic dissemination of information regarding environmental disruption by mass media (radio, television, films, newspapers, etc.). Here again there is considerable scope for foreign assistance and technical educational aid under international auspices.

Since the market mechanism provides no safeguard against environmental disruption and since it does not generate an effective demand for the elimination of pollution and will not supply such essential common goods as 'clean' air and water, the problems raised by the disruption of man's physical and social environment call for legal reforms. Legislation and legal reforms relating to the environment are a relatively new field which is bound to assume increasing importance also in less developed countries.

The social controls discussed above call for specific legal and administrative reforms such as the establishment of new specialized agencies, the

promulgation of new tax laws, direct controls by legal prescriptions and injunctions as well as penalties within the scope of administrative, civil and criminal law. These legal reforms need not to be discussed here. It is necessary, however, to refer briefly to certain legal innovations which the protection of the environment may require. Thus, a relatively new field of legislation with doubtless far-reaching consequences would be the enactment of specific laws establishing norms for the maintenance of clean air and clean water. Such acts would have to prohibit or restrict the use and/or emission in specific areas of untreated toxic materials with manifestly high degrees of pollution. They may even have to prescribe explicitly the use of specific capital inputs in accordance with a systematic promotion of less harmful techniques. The main difficulty will be adequate supervision and enforcement.

Another legal reform concerns the further development of new liability legislation regulating compensation for environmental damages. In the past liability laws have not proved to be effective in providing for such compensation, due to the fact that it has been difficult and costly to prove or identify the sources of pollution, or to establish causal relationships and legal responsibility. As a result, endless litigation and delays have stood in the way of making liability laws effective, quite apart from the fact that traditional liability laws provide at best remedies after the damage has already occurred. The failure of the market to prevent environmental damage and social costs may be said to have gone hand in hand with the failure of the law to provide for an effective system of compensation. This failure of the law was perhaps due to the fact that liability laws were never designed to deal with cases of environmental damage. As in the case of work accidents and occupational diseases, they placed the burden of proof of responsibility, causal relationship and damage on the injured person.

Under these circumstances it may be necessary to develop more effective compensation laws by placing the burden of proof that inputs, products or the disposal of waste materials are 'safe' on the producer or the seller. As in the case of workmen's compensation acts, the new legislation would have to be based upon the principle of presumptive responsibility of those who produce or sell products and in the process cause environmental damages or social costs; they must be held responsible for the payment of adequate compensation. To the extent to which this principle would be effective in altering the input and output pattern and would prevent or reduce the disposal of pollutants into the environment, the new legislation would have a preventive effect *ex ante*. This 'feedback' effect could be further reinforced if the use of manifestly noxious materials in production or their disposal into air and water (or for that matter the sale of products harmful to human health and human life) were made a criminal offense.

Another legal innovation may take the form of the enunciation of com-

mon or collective property rights with regard to such 'free' and hitherto legally unprotected aspects of the environment as air, water, aesthetic values, etc.

It is also possible to establish a constitutionally guaranteed right to clean air and water as part of other fundamental human rights not subject to abrogation without due process of law. This would be in sharp contrast to the present situation where a human right to clean air and water is not guaranteed and where those who insist upon such a right are in effect treated as if they imposed upon the pollutors an unjustified and unreasonable constraint. Such rights could be established either by constitutional amendments or by reinterpreting existing constitutional provisions. However, no matter how desirable the enunciation of such fundamental rights to an adequate environment may be, problems of definition, interpretation and enforcement may render this approach to legal reform cumbersome, unenforcable, if not entirely ineffective. Without wishing to discourage efforts in this direction, their ultimate effects in protecting the environment are subject to reasonable doubt unless the legal norms are at the same time supported by a new attitude and responsibility towards the environment.

Finally, specific dangers of environmental disruption will ultimately call for new international and in fact world-wide laws of environmental safeguards and protection because, as has been said: 'Pollution respects no boundaries.' Three factors need to be mentioned in this context. First, international waterways, oceans, air currents, etc. carry pollutants across international borders and thus may cause international frictions. Second, different laws of environmental protection and environmental standards in different countries may place some producers at a competitive advantage which may be regarded as a case of concealed price dumping in international trade. Third, there is the acute danger that industries will 'export pollution' by moving polluting plants to other countries. The last factor may be of particular relevance for less developed countries. All three factors will call for the evolution of international legislation, agreements and conventions.

Legislation and international agreements are, of course, integral parts of the political process. Their purpose may be said to consist in substituting public power and the rule of law for the unrestrained pursuit of individual interests and private power. In view of the deterioration of the quality of the environment, new legislation must provide some form of protection for individuals and society against environmental damage, for which the market mechanism offers no reliable avenues of settling conflicting interests and/or for compensatory adjustments. Thus, new obligations and responsibilities will be placed upon individuals and groups with a view to preventing them from polluting the environment shared by all. The struggle for appropriate protective measures and legal constraints

is thus *ipso facto* a political struggle in the course of which conflicting interests will be articulated and opposition to specific laws and legal arrangements will be brought into the open. Laws will have to be enacted and enforced. Their implementation will raise new and familiar issues of collusion and corruption.

Which groups in society can be expected to play an effective role in this political struggle for the protection of the environment? The answer to this question is far from being self-evident. The movement for better sanitary conditions during the Industrial Revolution was inaugurated and supported by Benthamite reformers and had to overcome the resistance of local and private interests. The struggle for better working conditions and social protective legislation had in almost all countries the active support of the labour union movement. Can such support for environmental control and institutional reforms be expected from union quarters? Perhaps. So far, it appears that the struggle for environmental improvements has not found the support of any group in particular. In less developed countries there may be in fact considerable reluctance on the part of organized labour to support the political struggle particularly as long as unions remain weak and convinced that the additional costs of environmental control will be shifted to workers in the form of a reduction of wages. Furthermore, environmental disruption in localized areas may not attract the attention and political interest of people in other areas sufficiently far removed as to remain unaffected by the damages caused. At the same time, environmental disruption raises conflicts and antagonisms which differ in scope and character from those that have marked earlier periods of economic and social development. Environmental disruption affects all members of society. However, it does not affect them equally. Higher and middle income groups may for a time avoid some of the consequences of air, water and noise pollution. They may move out of the most affected areas. But they cannot evade chaotic traffic conditions or the deterioration of certain foods, the pollution of the oceans, etc. Moreover, one industry may be affected by the disposal of toxic materials and residuals by other industrial establishments located further upstream. Their costs, their profits and hence their commercial survival may be jeopardized. Thus, environmental disruption and the distribution of the costs of environmental controls raise conflicts of interests not only between consumers and producers, but between different industries particularly between small and large business units. These new forms of conflict are likely to become more frequent and more characteristic with increasing environmental disruption. For this reason the struggle for environmental improvement is bound to become part of the general political process. Those groups and political parties which promise, enact and implement effective measures of control will be able to mobilize public opinion and thus carry elections.

Within the broad sense in which the term 'institutional requirements'

has been interpreted in the present context, it may not be irrelevant to inquire into the merit of recent suggestions to reduce the rate of growth and to develop an altogether different attitude toward material progress. Under the impact of the progressive deterioration of the environment a doctrine of 'zero growth' has been developed in recent years. Has this doctrine any relevance for less developed countries? Obviously not. For these countries find themselves at poverty levels of consumption for the great majority of their population. They operate with low levels of productivity and face high rates of population increase. These factors make it imperative to increase production and productivity and to make appropriate use of the opportunities offered by new scientific developments and advancing technologies in all fields. Furthermore, to follow the advice implicit in the doctrine of zero growth would increase international disparities between 'rich' and 'poor' countries and support those who proclaim that the economic development of the underdeveloped world is neither possible nor desirable because it would increase the ecological disequilibrium and the environmental disruption on a global scale.

In short, as far as the less developed countries are concerned, the doctrine of zero growth cannot be seriously entertained. Its premises are unrealistic and its promises undesirable and self-defeating. Even if population growth rates and family size could be drastically reduced, population would still continue to increase over the next three decades. Science and technology offer new opportunities of increasing output and productivity. In fact the doctrine of zero growth seems to rest upon a false and oversimplified association of the causes of environmental disruption with modern technologies and population growth. It fails to take account of the fact that it is the complex interaction of technology, production and the allocation mechanism under given institutional arrangements which causes the disruption of the environment. The doctrine fails to take adequate account of the fact that alternative methods of allocation and alternative technologies and input patterns could be developed which would reduce the level of environmental disruption while increasing the level of production. Less developed countries have every reason to reject the doctrine of zero growth.

It is sometimes argued that the protection of the environment depends in the last analysis on man's attitudes towards nature and that less developed counries may follow a less destructive course of action because traditional notions of a fundamental unity of man and nature, and ethical concepts such as man's duties towards the earth, are still strong enough to exert a restraining influence on development policies.

While it is true that attitudes and norms of human behaviour with regard to nature and the environment influence human action and man's awareness of the need for their protection in the interest of present and future generations, it is not safe to rely on the metaphysics of an earlier

age, particularly in an era of rapid social change. No doctrine of a fundamental unity of man and nature and no ethical norm is strong enough to prevent the disruption of the environment when either poverty and famine or the opportunities of private gains militate for the unrestricted exploitation of the 'free gifts of nature'. Neither ethical nor aesthetic norms will arrest this predatory process.

This is not to say that there is no need to develop new attitudes and explicit norms of human behaviour with regard to the environment in contrast to those implicit or explicit norms which had their origin at a time when man perceived nature as hostile and unmanageable and had no other alternative than to adapt himself passively to his environment in view of his limited knowledge and primitive techniques. Today man has acquired the capacity of doing irreparable damage to his environment with far-reaching negative effects for his own well-being and for the survival of the species. Man lives today in an environment which he increasingly creates. Under these circumstances he is in need of a new code of action with explicit responsibilities and new sanctions. This new code of norms and responsibilities towards the environment will have to be based upon the scientific analysis of the interrelationships which connect man's social and economic systems with those physical and biological systems upon which human life on this planet depend. The United Nations and the Stockholm Conference on the Human Environment can make a positive contribution to the development of such a new code of environmental norms.

Environmental indicators as indicators of social use values*

1. ORIGINS AND FUNCTIONS OF SOCIAL INDICATORS

Environmental indicators are social indicators which owe their origin to a growing awareness of the inadequacy of economic indicators expressed in monetary terms. These economic indicators do not measure and are indeed unable to express adequately what takes place in the economic and social sphere. They tend to neglect and even to conceal important negative consequences of the economic process. They disregard the social costs reflected in the deterioration of the human environment in the physical and the social sense of the term.

Of course it has long been evident that economic indicators were not able to provide an adequate measure of what takes place in the economic sphere, even in the limited sense in which the term is used by economists. At the present time we observe in practically all advanced industrial societies a fundamental break between economic changes (measured in GNP) and the actual material and qualitative conditions of human life. This gap has widened under the impact of modern science and technology and has led to the development of alternative measurements of changes in the 'quality of life' and the performance of the economic system in general.[1] In short, the search for social indicators (including environmental indicators) is the expression of a profound malaise shared more or less

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1. I am thinking here of the work carried out by the Batelle Institute, the Institute of the Japanese Labour Federation (Domei), and the Stanford Research Institute. This work aims at developing a single 'synthetic' denominator to express and measure a multitude of extremely heterogeneous phenomena. *Cf.* OECD, *Report on the work seeking the new national goals and social indicators*, Paris, 1971, and Udo S. Simonis, *Qualität des Lebens: Ansätze neuer wirtschafts- und gesellschaftspolitischer Zielsysteme*, Ms., 1972, pp. 11-16 and pp. 20 ff.

by all the social sciences faced with the deterioration of the human environment on a national and international scale. While our traditional economic indicators are not adequately measuring economic and social changes, our theories formulated as they are with reference to the quantitative concepts underlying our national accounts do not provide adequate explanations for what is happening.

Instead of presenting a detailed critique of conventional economic theory, and its approach to the problem of environmental disruption and the formulation of environmental policies, we shall confine ourselves to state simply that we are faced with a growing tension between theory and reality. Conventional economic theory is in danger of losing touch with the requirements of policy-making. This applies particularly to the environmental crisis which calls for effective remedies and preventive action if the dangers to human health, human survival and social reproduction are to be averted. The common feature of work on social indicators is the awareness that economic and environmental planning is no longer sufficient 'to guarantee the regulation of social systems and to protect them against the risks of explosion'.[2] Economic indicators and the conceptual and theoretical apparatus upon which they are based do not provide us with any measurement of the actual extent of the deterioration of the human environment. They do not indicate the number of persons affected by environmental disruption nor the social losses caused thereby. Economic indicators do not inform us about the present state of affairs nor do they offer any help in estimating potential future developments.

Under these circumstances it may be said that the primary function of environmental and other social indicators is to ascertain the present state of affairs in quantitative terms appropriate to the phenomena under consideration. This empirical or informational aspect of indicators is the most obvious one; it is also more or less accepted and widely understood. However, this does not mean that environmental and social indicators, when they affirm a particular aspect of reality or its deterioration, are unambiguous with regard to the information which they provide. Empirical observations and statements of fact (e.g. concerning the presence or absence of violence, the divorce rate or the morbidity rate related to pollution) are, in fact, merely indices which pose a problem and call for research as to its true significance. All this is clearly understood in Grenoble where Y. Barel[3], G. Martin and B. Jobert[4] have carried out extensive research which must serve as a warning against any naive acceptance of social indicators at face value.

2. Y. Barel, *La réproduction sociale*, Grenoble, mimeo, 1972, p. 111.
3. *Ibid.*
4. G. Martin and B. Jobert, *Étude préliminaire à une intégration des indicateurs sociaux dans les modèles de changement social. Essai de méthodes générales*, Grenoble, 1971.

In addition, indicators must be regarded as analytical instruments required for any inventory of the social and environmental situation. This has particular importance with regard to the natural and social environment and its system-wide interdependencies.

At the same time indicators, once established are able to provide us with information concerning the evolution of the quality of the environment (or of the social situation) considered as dynamic processes within a given space and period of time. It is only when indicators are systematically and continually being maintained that it will be possible to obtain the factual information necessary for the analysis of the chain of causation and the emerging trends viewed, of course, in relation to the relevant data concerning the expansion of production, population, consumption, choice of technology and sites of production. In other words, the continuous collection of statistical data in the form of environmental indicators is the *conditio sine qua non* for all prospective studies of the trend of environmental deterioration and with regard to the analysis of the effects of alternative anti-pollution and preventive policies and their effectiveness. That is to say, environmental indicators are essential not only for the purpose of ascertaining the actual state of environmental deterioration but they are also indispensable tools for the confirmation or invalidation of hypotheses relating to the causes of pollution and the relative effectiveness of measures of improvement, protection or prevention.

It seems to me that at this point a few reservations are in order. Research on environmental indicators is beset with difficulties which should not be underestimated. Firstly, the quality of the environment and the extent of its deterioration must be understood as a whole. Thus, the quality of air or water and of living conditions in general is the cumulative outcome of a whole series of emissions of 'pollutants' which may react upon one another. Therefore, ideally speaking the construction of indicators will have to take into consideration the cumulative character of the causal process and the fundamental inter-action and synergism of all 'pollutants' in the widest sense of the term.[5] Secondly, allowance must be made for the fact that there are, not only in the ecological field of the physical environment, but in the social field as well, threshold or critical zones. Until these thresholds are reached, pollutants may be assimilated by the environment and tolerated by man without any major damage.

5. 'Special difficulties arise, for example, from the cumulative character of the causal process which gives rise to environmental disruption and particularly from the fact that different pollutants and toxic substances act and inter-act upon one another. Even if each of these substances is emitted in "tolerable" quantities they may, in their interaction, become dangerous to and incompatible with human health and survival. Moreover, different age and income groups may be affected to very different degrees'. *Supra* p. 109.

However, as soon as these thresholds are reached, additional pollutants have disproportionally harmful effects. This means that the determination of thresholds must not be neglected in the construction and interpretation of environmental indicators nor in the formulation of environmental policy. In any event, the operation with *constant* coefficients of pollution per unit or additional dose of pollutants seems to me to be highly problematical.

These two aspects of environmental deterioration (i.e. the interaction of pollutants and the notion of a total toxological situation) and the existence of critical zones of pollution pose complex problems both for the elaboration of environmental indicators and for their utilization in environmental planning. At the present time I see little evidence that serious attention is being paid to these complexities[6] or that methods are available which might contribute to a satisfactory solution of these problems. As a rule, it is regarded as sufficient to establish environmental indicators for specific levels of pollution, noise, traffic density, etc. Indeed, as already indicated, there is some danger of losing sight of the fact that the quality of the environment is always a complex totality which consists of a whole series of elements which in principle react cumulatively one upon the other (and even synergically).

2. ENVIRONMENTAL INDICATORS AND ENVIRONMENTAL STANDARDS

Environmental indicators are frequently looked upon as normative in character and content. This tendency to identify environmental indicators with environmental goals or standards of action is misleading. Indicators state or affirm a reality or a certain aspect thereof. They are tools of analysis which provide information about a given or evolving situation. They are not goals of action. Their construction and selection may indeed be the result of specific political, moral and hence normative considerations. All social research selects its field of inquiry and creates its conceptual tools of analysis in the light of a perspective based upon a valuation of reality. This holds true for the positivist who accepts reality 'as it is' as well as for those who seek to change it by deliberate policies and measures of control. In this broad sense, the selection of certain indicators to the exclusion of others reflects a normative judgment which may be problematical because it implies a subjective selection of facts and a restriction of one's field of inquiry in as much as certain phenomena are chosen in preference to others. While selection is unavoidable and

6. See however F. Eichholz, *Die toxologische Gesamtsituation auf dem Gebiete der menschlichen Ernährung*, Berlin, 1956; World Health Organization, *Research into environmental pollution*, Geneva, 1968.

necessary, it must be counteracted by keeping the field of inquiry as open as possible, i.e., by not closing it off categorically. This applies also and particularly to the selection of social and environmental indicators. In addition, it would be necessary to make the value premises which guide one's selection of indicators as explicit as possible and not to confine oneself to a narrow range of indicators as for example indicators of air and water pollution.

However, in raising the question of the relationship between environmental indicators and environmental goals or standards of action we propose to take up a more fundamental problem. We wish to deal with the familiar assertion that it is impossible to derive from factual knowledge as to what is normative statements or 'practical' knowledge as to what should be. It is this belief in an unbridgeable gap between 'is' and 'should' which has become a firmly held conviction in contemporary social analysis. And it is this assertion which assumes a particular importance for all those who are concerned with environmental and social indictors.[7]

Within the context of the present discussion the question which concerns us may be stated as follows: Is there a bridge leading from that what is (ascertained by the indicators) to that what should be. In other words, does knowledge of a given state of affairs make it possible to formulate standards or goals of action? Whereas Hegel and Marx seem to provide an affirmative answer to this question – at least they were of the opinion that before transforming and in order to transform reality it is first of all necessary to know it and to subject it to an unrelenting critique[8] – Einstein stated that there was no path leading from that which is to that which should be.

However, even if one assumes that there is no direct path, there is at least an indirect connection which may lead from indicators to goals of action and planning. This connection which links environmental indicators to norms of action depends on knowledge of the thresholds of environmental deterioration beyond which a further degradation is incompatible

7. This modern positivistic assertion of an unbridgeable gap between factual knowledge of what is and practical judgement as to what should be can be traced back to David Hume and Immanuel Kant. Hume merely asserted that factual statements as to what is differ from normative statements as to what ought to be – which is certainly correct – and expressed his general scepticism about the tendency of certain moralists to make an imperceptible transition from 'is' to 'ought'. Kant denied that it is possible to draw normative (practical) judgements from factual positive statements and held the view that normative (moral) judgements are based upon universal moral imperatives which are independent of the special properties of human nature and have their foundation in pure reason and man's conscience – moral imperatives which are accessible to all and are not the privilege of a special aristocracy of learning. *Cf.* Max Black, 'The gap between "is" and "should",' *Philosophical review* (73), 1964, pp. 165-66 and Jean Lacroix, *Kant et le Kantianisme*, Paris, PUF, 1966, pp. 83-87.

8. August Cornu, *Marx et Engels*, vol. II, Paris, PUF, 1958, p. 242.

with human health and survival or, more generally, with social reproduction. Such knowledge relating to danger zones of deterioration may be formulated in terms of specific units appropriate to the phenomena studied (radio-activity; quantity of coli bacilli per 100 cubic cms of water; rise in temperature of the water; degree of contamination of the air measured in units of CO_2 and SO_2, solid particles, toxic metals, presence of DDT etc.) Of course, the carrying capacity of the physical environment needs to be taken into consideration in determining limits of emission adapted to local conditions and the critical limits of ecological disruption. Problems of nutrition and human health call not only for quantitative indicators but also qualitative ones (protein balance and purity of food, etc.). Current work on environmental indicators will have to focus on the selection and definition of environmental quality standards and criteria in terms of which it would be possible to determine limits of tolerance or social minima with respect to the various components of the human environment. Such social minima are not to be considered as permits for pollution. They are criteria of action. They are neither extravagant in scope and under no circumstances can they be regarded as guarantees or prerequisites of 'human happiness' which some participants in the current discussion of growth and the quality of the environment seem to have in mind. They define rather minimum requirements of human life and survival.

These social minima (always defined in the light of our present state of knowledge and hence subject to change) may be transformed into goals of action and planning by the acceptance of a single ethical premise supported by reason and conscience which, if denied opens the door to an all pervasive a-morality and dehumanization of social life. The moral premise which we are referring to is this: that human life and survival are not exchangeable commodities and that their evaluation in terms of market prices is in conflict with reason and human conscience.[9] This, it seems to me, is the indirect path which may lead us from knowledge of what is by way of the moral imperative of human survival to norms of action and to criteria of planning. In order to act and in order to plan ethical premises are necessary and these premises need to be clarified by reason and knowledge, particularly in a period in which systems of production and consumption guided by the monetary calculus threaten not only the quality of life in general but also endanger social reproduction and the survival of the human species.

There are two further conclusions to be drawn:

1) The acceptance of the moral and political issues raised by the deterioration of the quality of life does not dispense us from taking econ-

9. As Kant would have expressed it, commodities have a price because they can be exchanged but that what cannot be exchanged has no price but has an intrinsic and absolute value. *Cf.* Jean Lacroix, *op.cit.*, p. 95.

omic constraints into consideration. That is to say, action and decision-making do not become more simple. There still remain conflicts about goals and, furthermore, there will always be alternative courses of action some of which will be more appropriate, more useful and less costly than others, i.e. more effective from the point of view of society. In other words, there still remains the need to submit the complex situation to an exhaustive and systematic analysis in order to formulate the most important goals and to define the most effective courses of action. It is scarcely necessary to emphasize once again that exchange values are neither adequate nor appropriate as denominators of evaluation in an exercice of this kind. For what are under discussion are social needs and social use values which will have to be defined and evaluated outside the market. Being 'outside the market' they need to be determined at the socio-political level.

2) The selection and the definition of social needs and social use values must be based on an integrative knowledge of the system character of the environment and require a sociological imagination which has not lost hope in man being capable of transforming his institutions and which lacks neither critical awareness nor social and political courage.[10] What is needed is not to maximize profits in monetary terms but to find ways and means for human action and social institutions to cope with the threat to social reproduction for we no longer have at our disposal the time necessary to put our trust in biological evolution and adaptation (Dubos).

Environmental indicators and goals of action must be established by bringing to bear a normative systems approach to scientific research with a view to defining both the desirable goals and the courses of action which are acceptable and vital for social reproduction and man's physical and psychic health. In this sense, ethical and hence normative judgements of what is desirable are indispensable elements for all scientific endeavour in the field of environmental planning.[11]

It will be necessary to go beyond the principles and doctrines of natural law and traditional hedonism. The normative judgements and the definition of what is desirable find their rational and scientific support not only in the environmental crisis but also in the dangers resulting from the growing disparity between 'rich' and 'poor' countries. With the increase of these imbalances and their foreseable consequences the need for the acceptance of normative criteria of planning and for the formulation of goals of action will become more and more urgent.[12]

10. Thomas Maldonado, *Environment et idéologie*, Paris, 1972, pp. 51-52.

11. Hasan Ozbekhan, *Technology and man's future*, Santa Barbara, 1966, pp. 7-8, 10-11, 19-20.

12. *Ibid.*, p. 35 and Ignacy Sachs, *La découverte du tiers monde*, Paris, Flammarion, 1971.

3. ENVIRONMENTAL STANDARDS AND SOCIAL USE VALUES

Y. Barel has shown that the concept of social reproduction originally developed by the physiocrats and later adopted by Marx is an important tool of social analysis. Barel's study makes the point that socio-economic planning is concerned with the management of social contradictions rather than the administration of a consensus. I have no quarrel with this interpretation although it should not be overlooked that the 'management' of social contradicitions includes as a rule the administration of a consensus. In addition, socio-economic planning and particularly the use of environmental indicators and standards may have the effect of bringing about certain changes in the predominant mode of production. Social reproduction constitutes a useful tool for the elaboration of fruitful hypotheses regarding the various defects and inefficiencies of an economic system guided by monetary calculation in terms of market prices.

However, the concept of social reproduction needs to be supplemented by the new concepts of social indicators and environmental standards or goals. As tools of analysis and instruments of information about specific aspects of socio-economic reality, the indicators serve the important purpose of expressing in quantitative terms the limitations of an economic system guided by the monetary calculus.[13] In other words, they bring to light the contradictions and incompatibilities which arise in the performance of an economic system which measures the value of output and costs in terms of the monetary calculus used by individual enterpreneurs. This calculus appraises the value of output and the over-all efficiency of the economy irrespective of negative effects on the ecological and the social system of which the economy is a sub-system. Social and environmental indicators show two things: first that 'growth' measured by market prices and GNP fails to register the social costs of production and, in fact, includes some of these social costs in its aggregates. Thus, they show the contradiction between the objectives of the individual agents of production (and reproduction) and the actual results of the socio-economic processes. Second, they show that the system fails to satisfy essential human needs and requirements; although it gives the appearance and, in fact, claims to be oriented towards their satisfaction it is in fact incapable of doing so because its steering mechanism, i.e. the monetary calculus forces production into a direction which leaves basic human needs unsatisfied and, moreover, undermines the dynamic equilibrium of the ecological system and hence endangers the long-run requirements of socio-

13. For a recent juxtaposition of economic calculation and the monetary calculus in terms of market values, see Charles Bettelheim, *Calcul économique et formes de propriétés,* Paris, Maspéro, 1970.

economic reproduction.[14] Indeed, the environmental crisis may endanger social reproduction and hence the future of the economic system in a much more fundamental sense than the problems of low wages and poverty, unemployment, economic instability and inadequate working conditions which have preoccupied social and economic theory during the 19th and early 20th century. In fact, it is not impossible that the disruption of the human environment which emerged during the 20th century rather than the problems of poverty, unemployment and economic instability assumes such proportions that the continuity of the capitalist market economy is called in question. The prevention of such disruption calls for much more far-reaching methods of control and social changes than those which thus far have been used in the form of protective labor legislation, collective bargaining, anti-cyclical fiscal and monetary, employment and stabilisation policies. In other words, traditional methods of indirect economic controls operating through the market may have to be replaced by direct quantitative controls based upon the enforcement of environmental standards as goals of economic policy and planning with a view to maintaining the satisfaction of essential human needs and of guaranteeing socio-economic reproduction. This outcome is the more likely if we consider the existence of thresholds of environmental disruption and the resulting possibilities of cumulative processes of environmental degradation.

While it is true that the system of business enterprise has shown a high degree of adaptibility in the past it is not infinitely adaptable without undergoing qualitative changes with respect to its characteristic mode of production. The degradation of the human environment and the ensuing disruption of the process of social reproduction may become so serious that the need for direct quantitative controls by socio-economic planning based upon environmental standards can no longer be ruled out in order to avoid the collapse of the economy. What would be the consequences and the long-term significance of environmental planning based upon the systematic use of environmental goals and standards, the formulation of collective objectives and the practical implementation of such standards geared to the satisfaction of essential human requirements as social use values evaluated outside the market, i.e. at the political level? What

14. In view of the fact that the system of production and reproduction depends upon a continuous interchange with the ecological system and that these interchanges remain a vital necessity for the economic system (of production and distribution) it would appear that the phenomena of environmental disruption and social costs possess as fundamental a significance for the future of the economic and social system as those phenomena on which Marx and Engels focussed their attention. From this point of view it is interesting to note that modern marxist analysis is still reluctant to pay serious attention to the phenomena of social costs and environmental disruption as a contributing if not major factor leading to the potential change of the predominant mode of production.

changes would result from such planning and policy-making at the level of institutional structures, the control and behavior of the firm, and the capitalist mode of production? While I am aware that these are hypothetical and speculative questions and may perhaps have an utopian ring, an attempt to answer them may throw additional light on the real meaning and potential significance of environmental standards.

First of all it stands to reason that environmental planning geared to essential human needs and the maintenance of dynamic states of ecological equilibrium would call for far-reaching controls and changes of the behavior of private and public enterprise. Rules of action especially with respect to the choice of inputs, techniques and sites of production would have to be formulated and enforced in the light of environmental standards. Alternative and less destructive technologies would have to be developed and introduced. Recycling would have to be promoted not in the light of the monetary calculus of the individual firm but in the light of a comparison of the social benefits or use-values which could thus be realised. Public goods and amenities of all sorts would have to be placed at the disposal of consumers regardless of their income, i.e. their capacity to pay. Fiscal measures would therefore be necessary in order to cover the costs of these communal facilities. In lieu of the formal concept of economic rationality formulated in terms of the traditional monetary calculus economic decision-making will have to be guided by a substantive concept of rationality; such a concept would be based upon a direct social evaluation (at the political level) of essential human needs and their relative social importance and the real costs evaluated in terms of available, unutilized and potential resources (including unutilized taxable capacities resulting for instance from unearned and speculative incomes) as well as the possibility of sharply restricting or abandoning the pursuit of less essential objectives. Among these objectives we would list the production of luxury goods, the pursuit of costly programs of space travel and nuclear weapon systems the relative social importance of which has never been evaluated and compared with the social need of safeguarding the dynamic equilibrium of the environment.

If and in so far as these social needs would be taken into consideration thanks to the systematic development and enforcement of environmental social minimum standards it seems to me that policy-making would be based upon principles and criteria which are not only new but anti-thetical to those of the market principle of monetary calculation. Instead of exchange values social use values (values which are socially i.e. politically appraised and determined) would begin to guide the process of production and allocation while calling simultaneously for the setting-up of the necessary institutional arrangements.

In order to illustrate the significance of such a development I cannot think of a better procedure than to refer to a few isolated, rudimentary and

forgotten observations made by the founders of socialism. Engels and Marx were of the opinion that supply and demand (i.e. exchange values) would not guide the evaluation of the relative importance of goods and services and consequently the formulation of priorities in a socialist system of planning. They did not believe that exchange values could serve as appropriate criteria of evaluation and action in a socialist economy. Furthermore – and this is frequently overlooked – they did not consider that socially necessary labor would continue to determine exchange values as was the case according to their theory of value in the capitalist exchange economy. In fact, what both Marx and Engels envisaged was the disappearance of exchange values at least in a developed socialist economic system. Engels anticipated the possibility of eliminating not only exchange values but also the transformation of production (outputs) into market products (commodities). He, in fact, was the first – probably under the influence of the French socialists – to announce that society would be capable of dispensing with exchange values altogether. 'The socialist society will arrange its plan of production in terms of its means of production and particularly in terms of its labour capacity. The "useful effects" of various consumer goods will be compared with each other [apparently directly and not by way of a common denominator] and with the amount of labour necessary for their production; these comparisons will determine the plan . . . without prices or exchange values entering into it'.[15] Engels gave no indication as to how one might obtain the information necessary for the comparisons nor how a socialist society might be able to translate this information into priorities and norms of action. Leaving aside these important questions, Engels simply stated that the central criterion of decision-making would be the balancing of useful effects with the amount of labour necessary and that this balancing would be all that would be left of the much-vaunted politico-economic concept of value in the communist society.[16]

Marx put forward similar ideas. However, he stated explicitly that use values were the source of all real wealth[17] and declared that its true measure would no longer be the amount of socially necessary labour but 'disposable time'.[18] For, as soon as labour ceases to be the source of use value, it also ceases to be the source of exchange value and consequently the exchange value ceases to be the measure of use value.[19]

Why do we refer to Engels and Marx in the context of a discussion on social indicators? The reason is precisely in order to put forward and illustrate our thesis concerning the function and the significance of the

15. Friedrich Engels, *Anti-Dühring,* Moscow, 1954, pp. 429-30.
16. *Ibid.,* p. 430n.
17. Karl Marx, *Kritik des Gothaer Programms,* MEW, Bd. 19, p. 15.
18. Karl Marx, *Grundrisse der Kritik der politischen Ökonomie,* 1859, p. 592.
19. *Ibid.,* p. 593.

utilization of environmental indicators and standards for environmental planning and social reproduction. The so-called free-market economy, in which exchanges and prices have long ceased to be free and have in fact been transformed into prices administered by oligopolists, may be compelled to transform itself under the pressure of the exigencies of the environmental crisis and the deterioration of living conditions into an economy which increasingly will have to take into consideration the social use values or the quality of life. Social and environmental indicators provide indices on the basis of which society would have to formulate environmental goals and arrive at comparative normative judgements. It is on the basis of these goals that society could make decisions relating to priorities and planning including the choice of appropriate courses of action to be pursued with regard to the selection of alternative technologies, inputs, production sites, and rules of behaviour for firms and individuals. This form of planning would not follow from a preference for control but from the incapacity of the market to resolve the problems of environmental disruption and the necessity of securing economic and social reproduction. This interpretation does not presuppose the existence of a state of abundance or of an advanced state of socialism. It is based, on the contrary, on the realisation of the fact that the gratification of collective environmental needs and the maintenance of the quality of life are essential to social reproduction. That is to say what Marx and Engels considered to be the characteristic mode of production of a socialist economy, in which social use values would become the source of social wealth, may be achieved partly under the pressure of the deterioration of the environment and the dangers resulting from unregulated economic development and technology in the advanced stage of capitalist industrial society. If this interpretation of the evolution of the economy is accepted, we have an explanation for the manner in which elements of a socialist mode of production might be able to take root actually within the capitalist economy based on market values. In conclusion, I must emphasize that such a thesis does not oblige us to accept the theory of convergence. It would merely make it necessary to take seriously what Marx and Engels pointed out on many occasions namely that new modes of production tend to impose themselves on social and economic systems which are still characterized by the dominant modes of production just as the exchange economy evolved amid the dominant mode of production of feudalism.

The author has no illusions about the fact that such a transformation will come about by itself and without struggle. It calls for a genuine democratisation of the state (that is to say, of the center of political power) and of the economy at all levels, i.e. at the micro level of the firm, the regional and the central level of policy-making.

The disruption and protection of the environment: Economics and politics*

1. ENVIRONMENT AND WORKING CONDITIONS

The improvement of the quality of life cannot be separated from the improvement of the conditions under which people have to work. Hence from the point of view of the majority of the population environment and working conditions are closely interrelated. In fact, the environment relevant for the worker includes the hours and intensity of work, the frequencies of occupational diseases and accidents, and the instability of employment. It is misleading to use the terms environment and quality of life as purely physical concepts independent of the working conditions – possibly under the fallacious impression that these problems have found a solution in Western market economies. Despite social legislation working conditions in modern industries endanger the physical and psychological health of the worker in more than one way. A heavy toll of accidents and occupational diseases continue to be levied upon workers which official statistical data do not fully register due to a failure by management to report lost time by accidents and illness. Techniques and materials are becoming more complex and dangerous and the incidence of work injuries and accidents has not declined. Inspection and enforcement of standards of protective labor legislation are lagging behind and inflation has continued to erode the adequacy of compensation payments. Adequate social indicators showing the costs and frequencies of accidents and occupational diseases in monetary and in terms of physical and psychic pain to the individual do not exist. Moreover, automation opens the door to further speed-ups and an intensification of the work process. Thus, a recent investigation of a strike by automobile workers at the General Motors Vega Factories in Lordstown, Ohio, in February 1972 showed

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that until recently 60 cars passed the worker per hour, whereas a newly introduced system increased this number to 100. The arrangement of parts, the parts themselves, the work to be accomplished had been so simplified that each part could be added by more or less qualified workers in record time. The aim of this new system is the increase of the 'work content' and the reduction of time spent idly. The president of the local automobile workers union called the system the fastest line in the world which gives each worker between 36 and 40 seconds to accomplish what he has to do. This may sound perhaps harmless on paper. Actually it calls for an increased concentration on the part of the worker; it means greater monotony at the job – and quicker exhaustion of the laborer, growing dissatisfaction, an increase of 'dead-end' jobs, possibly higher accident rates, more frequent changes of jobs and rising absenteeism. If each worker with General Motors adds only ½ second per hour to active work the additional net savings per year – after deduction of taxes – are reported to amount to half a million dollars.[1]

However, not only are working conditions often detrimental to the physical and psychic health of the laborer. He and his family have to live in crowded and polluted urban areas with higher rates of concentration of pollutants; in addition the average worker has fewer opportunities for recreation than members of the middle and higher income groups. Even if some industrial workers in the United States and Europe have succeeded in moving to the less polluted suburbs, they are commuting daily in chaotic traffic conditions often over distances of 20 to 30 miles.

2. UNEQUAL DISTRIBUTION OF THE EFFECTS OF ENVIRONMENTAL DISRUPTION

Just as the industrial worker carried the brunt of the social costs of the first Industrial Revolution in the form of low wages, long hours of work, high accident rates, occupational diseases and unhealthy living conditions, the social costs of the current disruption of the social and physical environment are also borne unequally. It is true, middle and high income groups are not exempted from the effects of air- and water pollution, noise, polluted city centres and chaotic traffic conditions. However, these income groups are able to avoid the full impact of the disruption of the environment by moving to less polluted suburbs and by spending their holidays in less affected areas, while poorer income groups are forced to live and work in polluted city centres. This applies particularly to Blacks (in the U.S.) and foreign laborers in Europe who, due to inadequate education and training are severely handicapped in their job opportunities

1. Emma Rothschild, 'GM in trouble', *The New York review of books*, March 23, 1972, pp. 18-21.

and hence in their social mobility. These income groups are exposed to the noise of factories and cities as well as more pollution and less adequate opportunities for recreation; in short, they carry the brunt of the disruption of the environment to a greater extent than middle and higher income groups.

'The Gary, Indiana, steelworker is not only subject to debilitating working conditions in the foundry, but is more than likely forced to breathe the air pollution from U.S. Steel's smokestacks in his own home. His respite to Lake Michigan beaches has also been impaired, thereby limiting his weekend recreation. Only during his annual vacation can he and his family escape the worst ravages of environmental deterioration. On the other hand, the owners and top managers of U.S. Steel do not have to live near the plant itself. Rather they can choose to live where they wish and still reap the benefits of absentee ownership of the giant steel producing corporation.'[2]

3. THE ORIGINS OF THE ENVIRONMENTAL CRISIS

The fact that the deterioration of the environment and of the quality of life in specific regions tends to grow faster than GNP and that 450 million Americans and Europeans add more to the degradation of the environment than 700 million Chinese would seem to indicate that we have to be more careful in making use of extrapolations of global growth rates of GNP and population as a basis for a causal explanation of the origin of the environmental crisis. What the extrapolators often fail to consider is the fact that their 'dynamic' models are governed by a type of linear thinking in terms of aggregates which are far too undifferentiated to account for what has actually happened and what may happen in the future. The analytical tools used do not and in my estimation cannot take into account that specific technical and institutional factors have played a preponderant role in creating the environmental crisis and that these factors could be changed and are in fact subject to socio-political control. In other words, their apparently non-political equations support a causal analysis and lead to predictions and policies of a highly political character. Instead of directing attention to those factors which are actually responsible for the present environmental disruption, and of exploring ways and means of arresting the deterioration of the social and natural environment we are told once again that economic development in general and all population growth must be slowed down or stopped if mankind is

2. Richard England and Barry Bluestone, 'Ecology and class conflict', *Review of radical political economics* 3 (4), 1971. See also Paul C. Craig, and Edward Berlin, 'The air of poverty', *Environment*, 13 (5), June 1971, pp. 2-9.

to survive. After decades of euphoric predictions of unlimited possibilities of economic growth we seem to be entering a new age of dismal thinking which holds that conditions cannot be improved and that the poor at home and abroad must be satisfied with *the status quo* or even less. Let me exaggerate a little by pointing out that if in 1872 one had used a computer to calculate the environmental impact of the growth of population, the increase of production, the rising number of horse-drawn carriages and the accumulation of horse dung for the next 100 years, one might have come up with the conclusion that the number of horse-drawn carriages in 1972 would be such as to block the city streets and that the removal of horse dung alone would place the city population of 1972 before quite some formidable problems. While there has been a considerable increase of population since 1872 techniques of production and means of transportation have changed radically – since 1872 – and we know that our present problems have nothing to do with the blockage of streets by horse-drawn carriages. That is to say we have applied much more dangerous technologies and it is the *manner* in which we have applied and are still applying these new technologies without considering their destructive impact on the environment that has brought about the present crisis. What has taken place during the last 20 to 30 years under the impact of World War II and the rapid development of science and technology is nothing less than a *qualitative* change of the techniques which have altered the quality of our environment in such a way as to seriously and increasingly endanger our physical and psychological health.[3]

What needs to be realized is the fact that both the environment and the economy are open systems closely interrelated and influencing each other. Eco-systems like soil, water and air, for instance, are complex circulatory systems which are capable of renewing and maintaining themselves provided they are not disturbed and destroyed by dangerous techniques and processes of production which emit residual and partly toxic waste materials. Some of these materials such as certain synthetics are not degradable at all or if so only over very long periods of time. In other words, our natural environment – like air and water, has definite limits of absorption; if these limits are reached or surpassed we have to expect a disproportional impairment of human health and of the quality of life. This is exactly what has happened during the last decades. This thesis is not invalidated by the occurrence of pollution in earlier centuries, which – while often bad enough – did not surpass the carrying and self-renewing

3. For a cogent demonstration of this thesis, see Barry Commoner, *The closing circle*, New York, 1971; see also, Barry Commoner, 'The origins of the environmental crisis', *Council of Europe*, Second Symposium of Members of Parliament Specialists in Public Health, Stockholm, July 1, 1971 (mimeographed) p. 8.

capacity of the environment. In short, the environmental crisis must be understood as the result of the application of definite, qualitatively new technological processes, new inputs and a choice of location of industries without prior exploration of their negative consequences for the environment.

Of course this transformation of technology with its destructive impact on the ecological balance has been promoted by the conventional system of economic calculation in terms of market prices based upon the principle of cost minimization or profit maximization. That is to say the underlying causal processes are at the same time physical and economic; they are sanctioned by an institutionalized 'market mentality' and the resulting patterns of behavior which are in conformity with the price system. Thus, technical processes of production together with a choice of location of industries in harmony with the prevailing economic calculation have led to profitable increases of production and productivity and have doubtless increased our *material* level of living measured in terms of traditional methods of national accounting. They may be considered, therefore, as 'successful' and 'rational' in terms of the conventional concept of rationality expressed in market costs and returns. However, in view of the fact that substantial social costs are being shifted to, and borne by third persons, society and future generations we are faced with a serious case of miscalculation. In the light of the increasing destruction of the ecological balance and the deterioration of the quality of life, these increases of production and productivity constitute in fact an ecological failure which in some countries and regions come close to an ecological bankruptcy.[4]

4. ENVIRONMENTAL POLICIES

The protection of the social and natural environment and the formulation of effective environmental policies call for a detailed analysis and diagnosis of the multiple factors which have given rise to the current environmental crisis. Such an analysis must take into account the quantitative increase of production, the increasing application of dangerous technologies, the residual and often toxic materials emitted into the environment as well as the institutional factors at work. Realistic environmental goals and an effective control of the pollutants can be established only after a detailed diagnosis of the specific factors which have led to the current deterioration of the environment. To repeat, this deterioration is the result of the development and application of dangerous technologies which have taken place within the framework of conventional methods of economic

4. Commoner, *The closing circle,* op.cit., p. 151.

calculation expressed in market prices. This system of economic calculation registers neither the social costs of production nor does it measure the social benefits of an improvement of the environment and the quality of life. The price system tells us nothing about the relative urgency and importance for human life of clean air and water, the necessity of avoiding excessive noise, the deleterious consequences of traffic congestion and the value of the aesthetic quality of a landscape or the architectural design of a city. Since the market calculus registers neither environmental damages nor the positive effects of the environment there is, as a rule, no incentive to reduce these damages (e.g. by developing and introducting technologies with less damaging effects or by avoiding further concentrations of industries in large urban agglomerations where the limits of tolerance of pollution have been reached.

In view of the obvious complexity of the causal relationships which have led to the present disruption of the environment, it is not surprising that a number of partial causal explanation are being advanced and that there exists no unanimity regarding the most effective policy for safeguarding the environment. A broad spectrum of measures from indirect controls which are 'in conformity' with the market system are being advocated (for instance taxes, subsidies, charges for the emission of toxic materials) to direct prohibitions and controls. I believe that adequate strategies and policies for the protection of the environment cannot be found somewhere between these 'minimal' and 'maximal' positions. Such strategies call for a new type of thinking in terms of systems interdependencies and hence new criteria of policy formulation, starting with a continuous assessment of the state of the environment, on a regional, national and international basis. With the aid of such an inventory of the ecological effects of productive activities it would be necessary, and in my opinion, possible to formulate environmental standards or norms in the sense of maximum tolerable levels of pollutants. Such norms will have to be formulated in the light of the existing knowledge; they will have to be adjusted to new knowledge and new conditions and will have to take into account the available means including the productive and technical resources of society and their alternative uses. Environmental norms call for a socio-political evaluation; they need to be sanctioned by society in a process of political decision-making with the active and continuous participation of all including particularly those who are directly affected by the deterioration of the quality of life and by measures for its improvement. This kind of decision-making or 'participatory planning' will have to be institutionalized if we wish to counteract the role of technocrats and policy-makers who like to rely all too readily on the advice of experts. The enforcement of such socially formulated and politically sanctioned norms calls for the development of new tools for the formulation of economic policies. Above all we will need *direct* controls including im-

mediate prohibitions and rationing of the production, emission and use of toxic substances which have a damaging effect on human health particularly those pollutants which are suspected to cause cancer or to lead to genetic mutations. Such direct controls will have to be introduced also with respect to the choice of location by a licencing and a stricter zoning system. They may even call for the closing down of productive facilities in particularly congested and endangered areas; in fact such measures have already been applied in Japan. A secondary line of approach to the protection of the environment would be the use of indirect controls (subsidies, high and accelerated depreciation allowances, taxes and effluent charges). However, the efficacy of indirect controls may be slow and in any event uncertain quite apart from the fact that there is no way of determining beforehand how high taxes and subsidies must be in order to achieve a desired level of environmental protection. Nevertheless, indirect controls need not be ruled out as complementary measures.

A special warning seems to be in order against proposals to make the adoption of protective environmental policies dependent upon the individual consumer's willingness to pay for protective measures. First, the individual is not able to appraise the full range of the negative consequences of pollution; nor is he in a position to realize and evaluate the full range of benefits resulting from the improvement of the quality of life. He may even become adjusted to pollution except if he is confronted with catastrophic situations as those of the Donora or Los Angeles incidents. Above all, he is unable to anticipate the latent and only slowly emerging negative effects of pollution. If the required curtailment of production or the closing down of factories and thus the possible loss of his job and the prosperity of a whole region are at stake, it is likely that the danger of unemployment will determine the individual's decision irrespective of the social consequences of pollution. Similarly, the individual can hardly be expected to appreciate the advantages of an improvement of the quality of life before he has experienced them. For instance, how can an individual driver of an automobile who is used to the mobility and convenience of his car judge the advantages of a public system of rapid and efficient transportation which he has never experienced. The same holds true for clean air and water. Even if the individual has an idea of the damages and benefits of an improvement of the quality of life there still remains the unequal distribution of income and thus the unequal purchasing power which speak against the reliance upon the individual's readiness to pay as a basis for the evaluation and introduction of measures of environmental control. Those who nevertheless insist upon this test advocate nothing less than the maintenance of the *status quo* even though they may be primarily concerned with the avoidance of bureaucratic controls, private incentives and economic efficiency in a market system. I think we have to realize that in dealing with environmental needs and their satisfaction we

are concerned with communal goods. In other words, what is at stake are essential physical requirements for the maintenance of life which it would be 'cognitively irresponsible'[5] to evaluate in terms of the individual's willingness to pay, or for that matter in monetary or market terms. Social costs and social benefits lie outside the market nexus and call for a socio-political evaluation. Such an appraisal will have to take place in real terms or standards appropriate to their characteristics. The appraisal has to take account of the physical damages and the specific benefits to be expected as a result of the improvement of the environment. Thus we will have to extend or replace the narrow monetary calculus by calculations of actual total costs and total benefits. Only in this way will it be possible to replace the present institutionalized concept of a *formal* rationality (expressed in monetary terms) by a concept of *substantive* rationality expressed in terms of the extent and the improvement of the satisfaction of existential human needs and requirements. Such a substitution of the formal by a concept of substantive social rationality is a prerequisite for humanizing the economic system and of improving the quality of our society. In practice the protection and improvement of the environment will call for:

a) the systematic development and introduction of less dangerous techniques including methods of production which permit the recovery and recycling of waste materials of all sorts. In this context, we shall have to develop new public policies of guiding R+D expenditures according to social and environmental criteria rather than criteria of private returns and costs.

b) the control of investments including the choice of input and location; investments will have to stand the ecological test; i.e. they must be assessed in the light of the capacity of the environment to absorb additional amounts of pollutants in specific (e.g. regional) environmental systems with a view to preventing the further disruption of the ecological balance upon which depends not only the quality of life but the kind of society we want to live in.

A careful assessement and evaluation *in advance* of the costs and impact of the necessary environmental control measures must go hand in hand with the appraisal of the required improvements of the quality of the environment. Current estimates although still rather rudimentary indicate that the monetary costs of reducing environmental disruption differ greatly in different industries both as a percentage of the value of total product and of investment. They do not have to be prohibitive although they will affect different firms unequally. The full impact of environmental controls on employment, total production as well as their incidence on costs and on different income groups have hardly been investigated so far. In certain

5. St. C. Pepper, *The sources of value*, Berkeley, 1958, pp. 277-279.

industries the introduction of measures for the protection of the environment will lead to an increase of costs which may give rise to a reduction of the working force and possibly to a further concentration of production. At the same time there may be compensating influences due to the fact that industries producing new technologies and less dangerous inputs will need to be expanded. In other words, employment, wages and demand for workers are bound to increase in these industries. In any event, effective environmental controls are bound to change the composition of the total product. They need not reduce it.

5. CONCLUSIONS

Policies of environmental protection and the improvement of the quality of life must become part of the democratic decision-making process. This applies both to the setting up of goals and the methods of their implementation. To this end we need more than newspaper reporting on incidents of pollution but an enlightened public opinion. This requires more than the inclusion of ecological and environmental problems in the curriculae of schools and universities. Above all we need a shift in political structures and processes with a view to providing greater participation of the public in the decision-making process. Of course, we also need precise scientific data and estimates on the effects of specific environmental pollutants and these can only be provided by experts. However, which risk we are willing to take as far as human health and survival are concerned and which sacrifices we regard as tolerable or intolerable these questions are political and hence require moral decisions which do not call for 'expert' knowledge but can be judged by all who are directly or indirectly affected. Indeed, here we are faced with new tasks and a new field for the mobilization of public opinion and for political decision-making. Only if citizen groups on a regional basis, labor unions and political parties within the national democratic process, international organizations on a global scale take an active part in mobilizing public opinion by influencing the process of political decision-making can the prerequisitives for a more effective policy of environmental planning be established.

The deterioration of the environment calls for a radical change of our traditional notions of determining what is economically justified. It calls for a basic modification of economic calculation; it poses at various levels the question as to the need of establishing new institutions and new methods of economic controls designed to safeguard and improve the quality of life. In this sense the crisis of the environment contains all the elements for a fundamental change of our prevailing form of economic organization. If we do not succeed in redirecting the development of science and technology and in shaping productive activities in a manner

adapted to the maintenance of some ecological balance and of the quality of life it is likely that the disruption of the physical and social environment will reach critical proportions the full impact of which will surpass the implications of the first Industrial Revolution because it would put in question the very foundation of human life and survival. It is correct that man, just as other organisms, is able to adapt himself within limits to a deteriorating environment but such an adaptation requires longer periods of time than are at our disposal in view of the rapid development and change of modern technology. Moreover, man's capacity to adapt is not unlimited quite apart from the fact that a life with gas masks as envisaged by the Director of the Japanese Research Institute for Environmental Control for the inhabitants of Tokyo would represent a dehumanization of life and an alienation of man in a more fundamental sense than has hitherto been anticipated, even by Marx.

In defense of institutional economics*

The task which I have set myself today is to throw some light on the nature and significance of institutional economics; to show its major preoccupations and its methodological procedures; to indicate how it differs from alternative approaches to economic analysis; and finally to point to the contributions it can make to the study of economic development.

Parenthetically I should perhaps mention that American institutionalists have abandoned the term 'institutional economics' in favor of 'evolutionary economics' in their desire to stress the fact that they are concerned above all with the dynamic character of economic processes and systems including problems of economic development and underdevelopment.[1]

1. TOWARD A DEFINITION OF INSTITUTIONAL ECONOMICS

Perhaps you expect first a precise definition of institutional or evolutionary economics; such a definition has been formulated. It contrasts sharply with that of pure economics which Lionel Robbins advanced as far back as 1932. You will no doubt recall that Robbins defined economics as the study of a particular form of behavior, namely human conduct under the influence of scarcity or, as he also expressed it, the study of 'human behavior as a relationship between ends and scarce means which have alternative uses'.[2] In contrast with this definition of economic science which I think characterizes very well the prevailing preoccupations of many economists, institutional economics has been defined as 'the study of the structure and functioning of the evolving field of human relations which is concerned with the provison of material goods and ser-

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1. In fact, American institutionalists have recently founded an Association of Evolutionary Economics, with a membership of more than seven hundred. *Cf.* also David Hamilton, 'Why is institutional economics not institutional', *American journal of economics and sociology*, 21 (3), 1962, pp. 309-318.

2. Lionel Robbins, *The nature and significance of economic science*, London, 1932, p. 16.

vices for the satisfaction of human wants.' . . . [it is] 'the study of the changing patterns of cultural relations which deal with the creation and disposal of scarce material goods and services by individuals and *groups* in the light of their private and *public* aims.'[3]

The contrast between this and Robbins' definition of economics is obvious and needs hardly any emphasis. Whereas Robbins selects a particular form of behavior and insists that we define the subject matter of economics with reference to scarcity and rational conduct, the definition of institutional economics focusses on the study of the structure and functioning of an *evolving* system of human or cultural relations, and includes explicitly in addition to individual behavior and individual wants, the consideration of *group* behavior and *public* aims. In other words, institutional economics is not confined to the study and explication of deliberate rational behavior, or to use Jevons' felicitous phrase, to 'the mechanics of self-interest and utility,' but includes also other forms of behavior such as traditional behavior patterns of individuals and groups, i.e. patterns which derive their relative stability and uniformity from the fact that they have become institutionalized. While the Robbinsian definition in effect enthrones *homo oeconomicus* institutional economics replaces the concept of the economic man by something which we may call the 'institutional man'. Both these concepts are, of course, abstractions – but whereas the former is constructed by isolating and accentuating one conceivable aspect of human behavior, the latter is derived from observation of concrete behavior patterns and leaves room for the consideration of different forms of behavior in different societies. Indeed, institutional economics rejects the thesis that economic science must confine its theoretical analysis to the study of rational human conduct.[4]

In this context you may also ask what are 'institutions'? I shall make no attempt to offer a satisfactory definition of institutions because to do so would call for a philosophical or rather an anthropological inquiry into the mutual relationship of man and culture, which it would be foolhardy to attempt within the time at our disposal. However, let me say at least that the concept of institution in this context does not refer to legal forms of organization as for instance, to use a primitive example, the Federal Reserve System; the term is to be understood rather as referring to stabilized forms of behavior, habits of thought and conduct including group habits and behavior patterns which have been developed in, and are taken

3. A. G. Gruchy, *Modern economic thought*, New York, 1947, pp. 550, 552.

4. In fact, there are some economists who hold the view that the tendency of using formal rationality as the exclusive perspective for the study of human behavior has unduly narrowed the scope of economic inquiry and that the assumption of rationality should be dropped from economics as a permissible assumption. Arthur Schweitzer, *The method of social economics*, (mimeographed and privately circulated) p. 48, see also pp. 16-17.

over from the past and are enduring in the present. Needless to add that institutions understood in this fashion have their origin in the nature of man and are human and social achievements. And yet, as more or less stabilized forms of behavior they tend to assume an autonomy of their own and mould human conduct. For Veblen it was, therefore, axiomatic that institutionalized behavior patterns may be more or less out of date at any given point of time.

Having thus attempted to offer a definition of what I am supposed to defend let me point out immediately that I am not a great believer in definitions of this kind. For definitions of a particular discipline or a field of study are rarely as informative as they claim to be; frequently they remain vague and their usefulness is at best limited. In fact they may be positively harmful, particularly if they are used as a pseudo-scientific justification for the convenient practice of considering evidence against particular conclusions as irrelevant or inadmissable on the ground that it falls outside the proper scope of the discipline. Even more harmful is the practice of using such definitions as an instrument to channel research into one direction only or, whether consciously or unconsciously, to suppress evidence altogether. For this reason I believe that definitions of the nature and scope of a particular field of study acquire their full meaning and precision only as our acquaintance with the problems under study expands.

2. THE CRITIQUE OF INSTITUTIONAL ECONOMICS

Having thus sketched the nature and scope of institutional economics, it is doubtless high time to proceed to its defense. For you probably have already thought of several reservations against a type of economics which does not confine itself to the 'mechanics of self-interest and utility' and claims as its province no less than the study of the structure and functioning of the evolving field of human relations concerned with the provision of material goods and services for the satisfaction of human wants. You may, for example, regard institutional economics rather as a kind of sociology or anthropology. Or, you may say that anybody who undertakes such an ambitious program of study reaches for the moon and will not be able to go beyond empirical studies describing perhaps this or that aspect of socio-economic reality without ever being able to achieve a generalized analysis and explication of economic phenomena. This, in fact, has been the major criticism advanced against institutional economics. Indeed, institutionalists have been called naïve empiricists who are said to have no clear realization that the crux of all science is a combination of theory and observation with a view to their ultimate confrontation.

Let me admit that this line of criticism has had some validity parti-

cularly during the earlier stages of the development of institutionalism. However, as I shall endeavor to show, it is not *generally* valid – it did *not* apply to Veblen – nor does it to institutionalists of a more recent vintage. Closely connected with this critique is a second line of argument frequently advanced against institutional economics: namely that it is a collection of apparently unconnected ideas and doctrines which cannot claim any logical consistency of its basic theories. In other words, it is argued that institutional economics lacks the character of a systematic body of thought in the sense of a framework of concepts and propositions logically related to one another. To this point I shall come back in my concluding remarks.

Institutional economists have also been attacked on the ground that despite their persistent criticism of utility and price analysis they have not been able to develop any alternative theory of price formation. Here I would say that the critics of institutionalism are in the peculiar position of a person who uses his own standards of theoretical excellence as a criterion for the evaluation of alternative forms of generalizations. It is as if a fortune teller whose crystal gazing you criticize as a method of predicting the future tells you that you have no better way of doing it. Actually we have today alternatives to the conventional theory of price – alternatives which have discarded the maximization hypothesis and are orientated toward an institutional approach. In fact, there are several hypotheses such as the desire to increase or, in other instances, to maintain the share of the market, the maximization of turnover, or even the domination principle of Perroux, which are institutional in character.[5]

Similarly the rate of savings and investments has been explained in the light of institutionalized behavior. Thus what an economy saves and invests is not determined simply by the level of income but also by what individuals and groups as members of a given society consider as essential or non-essential consumption. If a society regards expenditures for ceremonial purposes, or for the maintenance of rank and status, or for the conduct of war as essential, this obviously has an influence on the rate of savings and investments. In short, whether an economy has an investible

5. It should perhaps be added that institutional economists have not been particularly interested in the question of prices of particular commodities or price relations in general. This does not mean that they are without an explanation of relative prices. Why a Cadillac should sell for a higher price than a Volkswagen is certainly not an unimportant problem and doubtless 'supply' and 'demand' are useful concepts to account for these differences. However, the institutionalist would not be satisfied to derive these fundamental categories from axioms of rational conduct, marginal rates of substitution and static production functions but would push the analysis beyond supply and demand by inquiring into the factors of market power and market domination including high pressure salesmanship and would point out that goods and services also derive their relative importance from the fact that they serve as symbols of rank and status. *Cf.* J. S. Gambs, *Beyond supply and demand: A reappraisal of institutional economics*, New York, 1946.

surplus – over and above the actual cost of producing the goods and services required for the satisfaction of essential needs – is not only a function of its income but also of its institutionalized value structure which thus plays an important role in determining the proportion of outlays used for productive investments or for non-productive purposes, and hence of the size of the national product. In fact, many institutional economists would take the position that not only in traditional societies but also in modern economies the decision to invest increasingly precedes and determines the act and the volume and therefore, the rate of saving. It needs hardly to be added that this way of looking at saving and investment implies a specific theory of capital formation which throws a very different light on the scarcity of capital and the problem of development in underdeveloped areas than do most traditional theories of capital.[6]

3. MAIN PREOCCUPATIONS AND MAJOR CONTRIBUTIONS OF INSTITUTIONAL ECONOMICS

It is important to emphasize first that institutionalism starts from a basis of dissent, – i.e. a common critique of the conventional wisdom, to use the well-known term of Galbraith. I shall not enter into a detailed discussion of this dissent but will confine myself rather to two observations about its general direction and significance. In this respect, it is perhaps not sufficiently realized that American pragmatism and particularly Charles Peirce and John Dewey have left their mark on American Institutionalism and especially on Veblen. I shall mention here only two major epistemological insights:

1) That scientific inquiry always proceeds within a cultural matrix – in other words, all theorizing operates within a framework of preconceptions which is not of our own making but is taken over from society – a whole apparatus of concepts and categories within which individual thinking is compelled to move.[7]. These inherited preconceptions which are at the root of all our knowledge – including our scientific knowledge – need to be made explicit, and must be held up for critical examination. In fact, any improvement of our scientific knowledge presupposes such critical awareness.[8]

6. On Veblen's highly original theory of capital see Thorstein Veblen, 'On the nature of capital: The productivity of capital goods', *The quarterly journal of economics*, Vol. XXII, 1908 and Vol. XXIII, 1909. See also Thorstein Veblen, *The vested interests and the common man*, New York, 1919, esp. pp. 35-64.

7. John Dewey, *Logic: The theory of inquiry*, New York, 1938, p. 487 and F. M. Cornford, *From religion to philosophy*. Torchbook ed., New York 1957 (original edition 1912), p. 45.

8. I admit that such a critical attitude may not be sufficient but it is a first and

2) A second contribution of American pragmatism to institutional economics is its scepticism toward any quest for certainty. This scepticism questions the widespread belief that social processes move toward a pre-established and determinate end – a fixed telos; instead of this teleological bias pragmatists stress indeterminacy and uncertainty as basic characteristics of all processes, including and particularly social processes. The critical genius of Veblen accepted these tenets of American pragmatism. In fact, Veblen started his career as an economist and social scientist with a series of inquiries into what he called the 'preconceptions' of classical, neo-classical, marxist and historical economics.[9] But he went also beyond pragmatism by emphasizing again and again the 'ineradicable propensity of the human mind for self-delusion'[10] and he never tired to focus attention on the patterns of social irrationality existing behind a front of formal rationality imputed to small segments of social processes as for example the price system.

No other American dissenter with the possible exception of Galbraith has carried the systematic critique of conventional economic theory as far as Veblen – a critique which in Europe has been voiced with equal conviction by Myrdal's earlier analysis of the hidden normative elements of classical and neo-classical economics and, more recently by Hans Albert in Germany.[11] I do not intend to give a detailed account of this critique not because I consider it unimportant but because it is well known, even though conventional theory has tended to ignore or to neutralize it by introducing new assumptions and definitions.

I shall dwell at greater length on the second characteristic of institutional economics i.e. its common way of looking at the structure and functioning of economic systems and economic processes. This common perspective which unifies institutional economics and differentiates it from

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essential step without which we cannot hope to improve our scientific procedures and formulations. Critique in this sense is therefore an essential part of scientific analysis.

9. Thorstein Veblen, 'The preconceptions of economic science', *The quarterly journal of economics,* Vol. XIII, July 1899; 'The socialist economics of Karl Marx', *The quarterly journal of economics, Vol.* XX, August 1906; 'The limitations of marginal utility', *The quarterly journal of economics,* Vol. XVIII, 1909; see also Veblen's earlier article 'Why is economics not an evolutionary science?', *The quarterly journal of economics,* Vol. XII, July 1898.

10. Louis Schneider, *The Freudian psychology and Veblen's social theory,* New York, 1948, p. 55.

11. Gunnar Myrdal, Das politische Element in der nationalökonomischen Doktrinbildung, Berlin, 1932, and Hans Albert, 'Das Ende der Wohlfahrtsökonomik', *Gewerkschaftliche Monatshefte,* Januar 1958, pp. 33-36 and 'Die Problematik der ökonomischen Perspektive', *Zeitschrift für die gesamte Staatswissenschaft,* 1961, *cf.* also Sidney Schoeffler, *The failures of economics: A diagnostic study,* Cambridge, 1955.

the conventional theory is based on the conviction that economic systems are open and dynamic systems and must be treated as such by our conceptual theoretical frameworks. Let me try to make this point clear. The economy has, of course, long been viewed as a *system* of production and distribution. In fact, to have done so is the particular achievement of macro- and micro-economic analysis from the Physiocrats to Adam Smith, Marx, the Neo-Classicists and the Keynesian and Post-Keynesian model builders. Their models and particularly today's macro-economic growth models are meant to be conceptual representations of *economic systems* with specific determinate relationships between a few variables. As theoretical representations they make use and frequently consist of nothing else but algebraic functions i.e. a set of relations between numbers or ratios or coefficients. But consider for a moment how many factors are assumed to be given or are kept constant i.e. treated as parameters: there is first the factor population; then the state of knowledge and of the industrial arts (technology); the tastes, preferences and behavior of consumers; the conduct of enterpreneurs, the distribution of power between different social groups (such as employers' and labor organizations, or classes, castes, landlords and tenants), all of these and more are treated as data or are held deliberately constant. In fact, it would be no exaggeration to say, that the entire social and institutional system is simply taken as constant; in other words, for analytical purposes the economy is viewed as a closed system. In the economics of the model building variety we select so few interrelationships and treat so many variables as 'constants' that our students probably have not the faintest idea as to which and how many factors have been deliberately left out. I am sometimes wondering whether the model builders themselves are fully aware of these omissions. For many of them, and certainly for most of the average students of theoretical economics society seems hardly to exist or has become a synonym for a set of variables kept constant or outside the analysis.

Now, from the viewpoint of an institutional economist this tendency of systematically isolating the economic system from the social system, even if only for purposes of analysis, constitutes much more than a neglect of many of the factors which have an ascertainable effect on the outcome of economic processes. Indeed, this deliberate concentration on two or three key relationships treated moreover under specific assumptions or simply axioms as to human behavior which individuals in a particular social system may or may not follow – does indeed make possible the use of a quantitative mathematical treatment and facilitates the search for determinate levels of stable equilibrium but it is a form of loose theorizing based upon concepts which have no clear empirical counterpart – a procedure which most institutionalists would regard as a misuse of the method of simplification and abstraction. In fact they consider this procedure not only as a misuse of theoretical analysis but as a potentially

dangerous trivialization of the use of reason which is rapidly making of economics a technique rather than a social science. They take this position *not* because they are naïve empiricists interested only in an ideographic description of particular events or because they are hostile to theory or fail to appreciate the importance of abstraction, measurement and quantification,[12] but because they consider the economic system as part of a more inclusive physical and social system with which the economic process is interrelated by numerous channels and from which it receives some of its most important impulses and inhibitions in ascertainable ways and with ascertainable effects. I shall come back to this matter in connection with my observations on institutional economics as a kind of social systems analysis with particular reference to underdeveloped areas. Here I shall push on immediately to the third common characteristic of institutional economics: namely its main working hypothesis for the study of economic processes.

Institutionalists interested in the analysis of the economic system viewed as part of a social system need not only specific concepts and categories but, as every scientist, a theoretical framework capable of conceptually representing in a generalizing and yet relevant and adequate fashion the various elements which in their interaction constitute the unit of investigation. Whereas traditional economics uses the concept and the theory of stable equilibrium as an instrument of analysis in its study of small segments of isolated subsystems (as for instance supply and demand[13]) institutional economists use the hypothesis of circular causation as an analytical instrument which they regard as particularly appropriate for the analysis of complex and dynamic systems. This principle is of course an outgrowth and a logical consequence of the institutionalists' perspective

12. It would be erroneous to believe that institutionalists are opposed to measurement and quantification. In fact, they called from the very beginning for greater precision and measurement of economic observations particularly in national income and business cycle analysis. But they rarely lost sight of the difficulties and the proximate character of most measurements of socio-economic phenomena. Good illustrations are Veblen's early suggestions as to how to measure and account for what he called with Adam Smith the 'annual production' or the productivity of the industrial process and the 'disposable net margin' on the one hand, *cf. The vested interests and the common man*, op. cit., p. 48 and W. C. Mitchell's plea for a quantitative analysis of the business cycle on the other; *cf.* W. C. Mitchell, 'Quantitative analysis in economic theory', *The American economic review*, 15 (1), pp. 1-12. On the need for measurement see also Arthur Spiethoff, *Die wirtschaftlichen Wechsellagen*, Vols. 1 and 2, Tübingen-Zürich, 1955.

13. Institutionalists do not deny that for the analysis of small segments of deliberately closed systems the concepts of stable equilibrium and disequilibrium may have their usefulness. However, they have repeatedly pointed out that equilibrium analysis has an apparently inevitable tendency of making economic analysis itself static or of confining such analysis to processes which are self-correcting with the additional danger that evidence to the contrary may be overlooked or suppressed.

which views economic processes as a complex of factors in mutual interaction. The particular usefulness of the hypothesis of circular causation also stems from the fact that institutional economics is interested primarily in the analysis of the dynamics of economic processes including the development process and the analysis of structural changes. In fact, there is probably no institutionalist who has not shown some impatience with the traditional preoccupation with problems of economic statics to which the widespread use of the equilibrium concept and the search for levels of stable equilibria have given rise. Indeed, I have a hunch that most institutionalists would question the theoretical usefulness of the distinction of statics and dynamics – both as a classificatory scheme and as categories of social analysis.[14] They would with E. Lindahl regard static theory at best as a special and highly complex tool hardly appropriate as a point of departure for the development of a general dynamic theory which they consider to be the logical starting point for social analysis.[15] Moreover, most institutional economists would probably take the position that variables change discontinously and that even our empirical and statistical observations are not continuous but refer only to a particular period of point in time.[16]

As an analytical instrument the principle of circular causation seems to be of Scandinavian origin – if you include Veblen in this context among the Scandinavians. Both Veblen's *Theory of business enterprise* which coincides roughly in time with Wicksell's analysis of the influence of credit and the interest rate on the price level use a principle of circular causation. Ever since, this principle has played an important role in economic analysis particularly in business cycle and macro-economic analysis. (I need only refer to the accelerator, the multiplier, the study of speculation and inventory accumulation etc.) However, whereas these applications of the principle consider only a relatively narrow set of variables viewed often in a rather mechanical interrelationship with one another, it is in the hands of institutionalists and particularly since Myrdal's systematic exposition of its methodological foundation and practical implications in his *American dilemma* (1944) that the principle of cumulative causation has assumed its present comprehensive form in which it includes not only so-called economic variables but at the same time the frequently powerful social and political elements operative in a social system. In Stockholm it is perhaps superfluous to enter into a more detailed discussion of this central hypothesis of institutional economics. I shall come back to it,

14. Th. W. Adorno, 'Static and dynamic as sociological categories', *Diogenes*, No. 33, 1961.

15. E. Lindahl, *Studies in the theory of money and banking*, London, 1939, pp. 31-35.

16. W. J. Baumol, *Economic dynamics*, New York, 1951, p. 123.

however, in connection with my discussion of institutional economics as a social systems analysis.

In short, then, we may say that institutional economics is marked by three major characteristics:

1. a common critique of the preconceptions and hidden normative elements of traditional economic analysis;
2. a common view of the economic process as an open system and as part of a broader socio-cultural network of relationships;
3. a common acceptance of the principle of circular causation as the main hypothesis for the explanation of dynamic economic processes including the process of underdevelopment and development.

While I regard these three elements as the central distinguishing characteristics of institutionalism my discussion would be incomplete if I did not mention, however briefly, several additional features which are integral parts of institutional economics. Among these I would list:

4. a pervasive concern with the role and significance of conflict, coercion and power in economic and social life;
5. a rejection of price or market values as exclusive indices of individual and social welfare and as criteria of the efficiency of allocation and the 'optimality' of decision-making in general;
6. an early and persistent interest in problems of instability as characteristic of an economy of business enterprise dominated by modern technology;
7. a continuous preoccupation with the problems raised by the phenomena of social costs and social benefits or, what the conventional theory – misappropriating a term of Marshall – likes to call somewhat innocently 'externalities' or external diseconomies and economies;
8. an early and systematic recognition of the central role which science and technology play as determinants of the productivity of human labor and capital goods and as dynamic factors of development; and, last but not least
9. a commitment to a critical analysis of the quality of individual and social life in an industrial civilization in terms of such explicit values as the elimination of poverty, the equalization of opportunities regardless of race, color and creed, the maintenance of peace and democratic rule.

This concern with the role of conflict, coercion and power in economic life is in America an intellectual heritage which dates back to the Federalists and their European mentors. Among institutionalists the voices of dissent against the tendency of conventional economic analysis to ignore the influence and frequently central significance of conflict, domination and power in economic processes are associated with such names as Veblen, Commons, and C. F. Ayres. Veblen's early *Theory of the leisure class* and his later concept of 'vested interests' runs parallel with Com-

mons' analysis of the role of power in economic life, of the role of the state, his later studies of the legal foundations of capitalism, his preoccupation with collective bargaining and public utility regulations which antedate the doctrine of countervailing power of Galbraith in his *American capitalism.* Only François Perroux[17] it seems to me, has carried the systematic analysis of power and domination beyond the level of generality which it had reached in the writings of American institutionalists.

In harmony with their critique of the preconceptions and normative elements of neo-classical utility and price theory institutional economists have always shown a healthy scepticism towards those criteria in terms of which business enterprise evaluates its success and efficiency of allocating scarce resources and in terms of which traditional price theory also tends to define the rationality and 'optimality' of economic decisions. Institutionalists were among those earlier dissenters who pointed to such social costs as the destruction of the ecological balance, air and water pollution and other harmful effects of private economic activities which tend to be shifted to third persons or to society as a whole. They analyzed relatively early the increasing significance of technology and overhead costs, the threat of excess and unused capacity and the resulting trend toward high pressure salesmanship, built-in obsolescense of consumer's goods and the pressure toward 'unproductive' consumption in affluent societies. It seems to me that none of these increasingly significant phenomena can be adequately accommodated by the traditional theory for example by putting them in Marshall's conceptual box of 'externalities'.

Because most institutional economists share the value premises of the Age of Reason, they have rarely found it possible to confine themselves to a positivistic analysis of given conditions or an uncritical acceptance of the *status quo.* On the contrary, they have invariably felt it necessary to raise the question of the quality and the rationality of human and social life in a technical civilization. Indeed, institutional economists, unlike positive economists, are convinced that as social scientists committed to certain values they have a responsibility to indicate when and in which way socio-economic processes may endanger human values and human life.[18] In this sense I would not hesitate to characterize institutional economics as working within the tradition of a rational humanism which takes its stand for the preservation of human life and the full development of the human personality (Maslow) without any insidious reservations, whether conscious or unconscious, relating to class, color, creed or nationality.

17. Francois Perroux, 'The domination effect', *Social research,* Vol. 17, 2 June 1950, pp. 188-206 and *L'Economie du XXe siècle,* Paris, 1964.

18. C. E. Ayres, *Towards a reasonable society: The values of industrial civilization,* Austin, 1961.

4. INSTITUTIONAL ECONOMICS AND THE DEVELOPMENT PROCESS IN UNDERDEVELOPED AREAS

Having thus far identified the major preoccupations of institutional economics, I shall, in conclusion, try to indicate the institutional approach by a brief analysis of its potential contributions to the study of the development process in underdeveloped areas. I ought to warn you, however, that this part of my presentation reflects rather my own view as to the potentialities of institutionalism and no institutionalist living or dead should be blamed for its shortcomings.

Let me start with some of the more successful examples of economic development in recent times as illustrated by the cases of Japan, the Soviet Union and Israel. In each of these instances the discerning social scientist will soon discover that relatively high rates of capital formation and output-capital ratios and hence rates of economic growth can be accounted for only in terms of a complex interaction of economic and socio-cultural factors and powerful political elements. In short, the economic development process received some of its most important impulses from the social and political system; in other words the economic system was anything but isolated. Let me single out the highly exceptional and yet particularly instructive case of Israel. Her national and external political environment can hardly be said to have been favorable to economic development. And yet, 'nowhere else in the Middle East and nowhere among the presently 'underdeveloped nations' can there be found a combination of cultural values, institutions, and linkages so conducive to rapid economic growth.'[19] The cultural values in the case of Israel have included such important attitudes as *'nationalism,* based upon a burning sense of historical wrongs that have been suffered . . . and the biblical vision of a return to a "Holy Land" . . . *instrumental activism,* the attitude that people can change the world instead of having to accept a predestined order; and *collectivism,* in the sense of an orientation toward group action . . . rather than purely individual activity. The institutional structure of the Jewish community in Israel . . . has included a remarkable set of powerful trade unions, political parties, pressure groups, and economic enterprises . . . Finally, the country has enjoyed organized support from a large number of Jews in other countries – support that has evidenced itself not only in direct assistance but also in favorable action by the governments of these countries.'[20]

A similar interaction of cultural values, institutions and economic factors – although not necessarily of the same character and content can be

19. B. M. Gross, 'Planning as crisis managements', Preface to Benjamin Akzin and Yehezkel Dror, *Israel: High-pressure planning,* Syracuse, 1966, reprinted in *Mitteilungen der List Gesellschaft,* Fasc. 6, Nr. 1, 1967, p. 18.

20. *Ibid.,* p. 18.

identified in the case of Japan[21] and the Soviet Union as well as other Soviet-type economies. Conversely, the much less rapid rate of growth in some of the Arab countries, in India, Indonesia and many others can be accounted for in terms of institutionalized traditional value orientations and social arrangements which either may not give sufficient support to the development effort or may actually delay or even inhibit the process of development.

These factual conditions and their interpretation lead me to the conclusion that instead of viewing the development process as an isolated *economic* system, it would be more appropriate to view it, particularly in traditional societies, from the very outset as part of a complex social system with various components in mutual or circular interaction.

Anybody who has had firsthand experience with traditional societies has been impressed not only by the fundamental differences between *their* social systems and those of modern societies but also by the high degree of internal coherence of their patterns of ideas, values, and their socio-political arrangements. Their patterns of motivation, their attitudes, knowledge, technology, the power system and the kinship system *do* represent more or less organized entities. Let me be specific: Fatalistic or even animistic world views support disbeliefs in opportunities for improvements; they are correlated with pre-scientific systems of knowledge and a technology which account for the relatively low productivity of labor and capital goods in farming thereby making it necessary to retain a high percentage of the population in agricultural production in order to provide the necessary agricultural products. This in turn reinforces and perpetuates a power system of which the prevailing land tenancy relations are only the most obvious manifestations. This power system affects not only the distribution of the national product; it also limits the internal purchasing power, restricts the extent of domestic markets for manufactured products and accounts for the absence of sufficiently strong incentives for modernization. Add to this power system a pattern of traditional values which attribute considerable importance to expenditures for ceremonial, ostentatious and national prestige or even war purposes and you will find the reason why the domestic rate of saving and investment remains inadequate or why the country's potential investible surplus is not adequately mobilized and utilized for productive purposes. At the same time the still relatively high death rate, together with the household or peasant character[22] of the agricultural sector, and probably other factors related to traditional patterns of values and attitudes continue to put a

21. Takekazu Ogura (ed.), *Agricultural development in modern Japan,* Tokyo, Japan FAO Association, 1963 and S. Tobata (ed.), *The modernization of Japan,* Vol. 1, Tokyo, The Institute of Asian Economic Affairs, 1966.

22. In Chajanov's sense of the term. *Cf.* A. V. Chajanov, *The theory of peasant economy,* New York, 1966.

premium on the maintenance of an extended family system which favors high fertility.[23]

Of course, all this sounds like the famous vicious circle and, indeed it is precisely this. But it is at the same time an illustration of the institutional and hence system character of the process of underdevelopment and development. It illustrates the impact of the process of circular causation on economic development; it suggests a framework of analysis which does *not* single out one or two factors as the primary causes of the process.

As far as the theoretical representation of the process of circular causation is concerned, I agree with Myrdal that 'the ideal solution would be to formulate the functional relationships between the various parts in the form of an interconnected set of equations describing the movement – and the internal changes – of the system studied under the various influences which are at work in it.'[24] I doubt, however, that the type of mathematics needed for the formulation of equations and coefficients describing the relationships of the process of mutual interaction of the various subsystems in a social system is yet at hand.[25] Moreover, I doubt, as Myrdal incidentally also does, that we will be able, in the foreseeable future, to acquire the complete and quantitative information required for a representation of the fundamental relationships in the form of an interconnected set of equations describing the structure and the internal changes of a social system. However, even without such complete and precise knowledge the institutional approach can contribute a good deal not only to the diagnosis but also to the planning of the development process. Even explanations in principle of the nature of relevant relationships or the general direction of the possible changes can be of considerable importance. One thing seems to me to be certain: any search for a primary cause of development must be regarded as futile – as futile indeed as the conventional concentration on the rate of investment as the determining factor of development. Instead, what is needed, and all one can hope for, is to be able to identify decisive strategic factors i.e. factors which can be more easily influenced than others and are themselves capable of changing the pattern of interaction in the direction of economic development. My own hunch is that improvements in technology, in land use and tenancy relations, measures

23. Kingsley Davis, 'Institutional patterns favouring high fertility in underdeveloped areas', *Eugenics quarterly*, 2 (1), March 1955, pp. 33-39 reprinted in Lyle W. Shanon, *Underdeveloped areas*, New York, 1957, pp. 88-95.

24. Gunnar Myrdal, *Economic theory and under-developed regions*, London, 1957, p. 19.

25. Certainly the mathematics of the calculus and of differential equations which are adequate for the description of tendencies towards stable equilibria offer no solution to the analytical description of the process of circular or inextricable interdependencies 'where cause and effect interweave', as Pareto called it. See V. Pareto, 'On the economic phenomenon: A reply to Benedetto Croce', reprinted in *International economic papers*, No. 3, New York, 1953, p. 185.

designed to reduce inequalities of opportunities, techniques to control the birth rate, improvement in education and public administration offer such possibilities of change and thus constitute strategic factors. There may be others which an empirical study of specific social systems in concrete societies may be able to identify.

Social systems do attain states of relative constancy in which the system as a whole does not change its character. In fact, this constancy may be a state of stagnation in which even stimulating impulses (as for example new techniques) may be counteracted by the inhibitory effects of institutions, cultural values, attitudes, power systems and other elements. However, such states of constancy are no guarantee against the emergence of disturbances. In fact, the very inertia of the system may create disturbances such as population pressures and famines. It is under the pressure of such disturbances that social systems may be compelled to change and to adapt themselves by creating new institutional arrangements. In fact, such modifications seem to me to be the *prerequisite* of change and development In other words, social systems have a dynamics;[26] they are in process in the course of which there emerge internal tensions and conflicts between different components of the system. While extreme forms of conflict may destroy a social system – other conflicts and internal tensions tend to set in motion the essential dialectical process through which a creative adaptation of the system to new conditions may take place. Let me add, however, that this is not a simple teleological three step dialectics of thesis, antithesis and synthesis as envisioned by Hegel and Marx, but a much more complex dialectical process with more than one conceivable outcome.

In short, it seems to me that the institutionalist's view of the development process as a social system with several components in circular interaction could provide an alternative to the conventional approach to the study of economic development. Not only does it offer an explanation for many failures of particular development projects and plans but, properly interpreted, could also yield pragmatic indicators for a more successful planning of such projects and of development efforts in general. An illustration may serve to make this point clear. Pre-industrial societies with traditional forms of agriculture, land-tenancy systems, and rates of population growth between 3 and 4 percent are facing formidable problems the full complexity of which can be grasped only in terms of a social system approach. For, all indications point to the conclusion that given their knowledge and technology (as reflected in the available capital goods such as plant and animal varieties and their agricultural techniques), given their climatic and soil conditions, given their inherited land-tenancy

26. On the dynamics of social systems see the pertinent observations of B. M. Gross, *The state of the nation: Social systems accounting* (Social Science Paperbacks), London, 1966, pp. 30-33.

systems as well as credit and marketing organization, given their rates of increase of the number of persons seeking employment, these traditional economies have by and large exhausted the range of their economically profitable investment opportunities in the field of agriculture. Therefore, neither the reliance on private profit incentives, nor the improvement of present marketing and market structures nor the provision of a better infrastructure (irrigation systems, roads etc.), nor institutional reforms, nor even the simple transfer of the highly sophisticated western agricultural methods and technology *taken separately* can be expected to be sufficient or effective. Viewed as a process of circular interdependencies economic underdevelopment can be overcome only by a combination of specific measures designed to bring about the modernization of a traditional agricultural society. The following steps may offer a way out of the dilemma: (1) the development of an agricultural technology by creating new varieties of plants (and animal stock) which under the specific climatic and natural conditions of particular regions would make it possible to overcome the present stagnation of yields per acre; (2) the widespread diffusion of the technical knowledge required to make use of and protect these new capital goods, (3) the choice – as far as possible – of labor intensive methods of cultivation, (4) measures of land reform in the most comprehensive sense of the term, (5) the creation of the strategic infrastructure including the provision of a dependable supply of water as well as transport and distribution facilities and (6) the reform of the present agricultural tax system. I shall mention the necessary industrialization of the economy only in passing despite its obvious importance as a means to reduce the dependence on imports and to provide opportunities for useful employment for the increasing army of unemployed. In short, by stressing the mutual interaction of a complex set of components, the system approach to economic development not only induces us to stay closer to the 'facts' but will help us to develop workable indicators for a more adequate strategy of development planning than any conventional theory formulated in terms of purely economic variables.

Before concluding these observations it may be useful to raise briefly the question of the relationship between institutional economics and the conventional model approach to the study of economic processes. It may be argued that both approaches stress the systems character of the economy. Both identify a number of components of a given situation and aim at a conceptual representation of interrelationships. In this general sense, there are of course similarities between the two approaches which stem from the fact that all science is interested in identifying the relevant components of a 'problematical' situation and to show that and how these components 'hang together'. However, the fact remains that the institutional approach, unlike the conventional model approach, considers the economy from the very outset as a part of a larger socio-cultural entity, a

fact which calls – as we have pointed out – for special categories, concepts and theories.

Nevertheless, it might still be argued that the whole difference between the institutional and the model approach to the study of economic development boils down to a broadening of the framework of analysis and the incorporation of additional variables and additional sets of equation into the model. Take for instance the various consistency models which relate the rate of growth (g) with the rate of capital formation (α) and the average rate of productivity of investments (β) i.e. the marginal output-capital ratio. No one will deny the formal, tautological correctness of the relationship $g = \alpha \times \beta$ under given conditions of techniques, skills, attitudes and knowledge and other factors which, at any given time determine the rate of investment and the productivity of labor and capital goods. The institutionalist may indeed be said to be concerned with the analysis of these latter factors which influence the rate of capital formation, the average productivity and hence the rate of growth. He raises questions which the conventional model builder does not raise. In this sense it is indeed possible to say that he broadens the framework of analysis. This way of interpreting the relationship between institutional economics and the construction of models would not be objectionable if the functional relationship which exists between the many components which make α and β what they are, could actually be expressed in the form of algebraic functions. I have indicated why I believe that this solution will escape us at least for the foreseeable future. We have neither the mathematics nor the needed factual knowledge and measurements of the relevant relations.

There is one additional reason which makes it problematical to incorporate the institutional approach into the traditional growth models or vice versa. Consistency models operate with such aggregates as savings, investments, capital formation, productivity of investment or for that matter with productive capacity, employment, unemployment and underemployment. These aggregates may have a precise, ascertainable and hence measurable content in the reality of market economies. In non-market, traditional economies savings and investments as well as productivity and employment and particularly underemployment are much less easily determinable.

The institutionalist is convinced that the indeterminacy and the lack of precision are only partly the result of gaps in our knowledge about the relevant causal relations. They constitute rather an inescapable residuum of indeterminacy which has its basis in the factual conditions, and is inherent in the inextricable interdependencies and the lack of homogeneous human valuations.[27] The attempt to overcome this inescapable indeter-

27. On this whole problem see Gunnar Myrdal, '"Value loaded" concepts', in H. Hegeland (ed.), *Money, growth and methodology*, Essays in Honor of J. Åkerman,

minacy by formulating concepts with greater precision than is justified by the factual conditions would be evidence not of logical clarity but of logical error and of hidden bias – i.e. a kind of loose thinking which is detrimental to scientific analysis. These considerations concerning the inescapable indeterminacy of many aggregate concepts and measurements used in models of the conventional variety raise serious questions not only with regard to their relevance and adequacy but also with regard to the alleged compatibility of the institutional approach with the conventional wisdom.

5. SUMMARY AND CONCLUSIONS

I hope to have succeeded not only in defending institutional economics against its critics but also to have shown that institutionalism offers a way out of the present impasse into which our discipline has been led by a misuse of abstraction from social reality. Far from reflecting a naïve empiricism and far from any hostility to theorizing, institutionalism views the economy as an open system the analysis of which calls for new categories, concepts and perspectives which must be found outside the conventional apparatus of static and teleological theories. Thus institutionalists have developed, as an alternative to the concept and the theory of stable equilibrium, the principle of circular causation as a basic theoretical framework in terms of which it is possible to arrive at a generalized explication and understanding of the *modus operandi* of complex open social systems including their structural changes.

In addition, institutionalists have been preoccupied with such unorthodox issues as the role of conflict, coercion and power in economic life; they are doubtful about market prices as an index of individual and social welfare and as criteria of substantive efficiency in allocating scarce resources; they have explored the phenomena of social costs and they have placed major emphasis on the role which science, shared knowledge and technology play as determinants of the productivity of human labor and capital goods and, finally, they are committed to a critical analysis of the quality of individual and social life in a technical civilization.

It seems to me that institutional economics needs not so much a defense as a systematization. For if the critics of institutional economics are wrong in regarding it as hostile to theory, they are correct in pointing out that institutionalism is not yet a systematic body of thought. I do not think that either the nature of the subject matter or gaps in our knowledge make

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Lund, 1962, pp. 273-275 and Paul Streeten, 'The use and abuse of models in development planning', in Kurt Martin and John Knapp (eds.), *The teaching of development economics*, London, 1967, pp. 60-65.

such a systematization impossible. It may be due rather to the fact that as dissenters institutionalists have been preoccupied with a host of issues and have certainly not written the kind of massive textbooks which tend to systematize and to perpetuate a dominant school. While this may have protected them against a premature dogmatization of their ideas, it has laid them open to a partly legitimate questioning of the coherence of their concepts and theories. I think that the time is ripe for a systematization of institutional economic thought.

Apart from this, one of the most urgent needs for institutional economists today is to overcome their relative isolation. Instead of withdrawing into the lonely position of the dissenter they will have to work together in closer contact not only with one another but also with other social scientists because they will have to know more of what is known in related relevant disciplines than the pure economist.

Above all, they must not permit the weight of the conventional wisdom to silence them. While they must maintain an appropriate humility before the manifold problems and their complexity – this humility does not justify an undue defensiveness about their position and their work. For even if some of their conclusions may remain imprecise it is better to have imprecise or approximate answers to the right questions than to have precise answers to the wrong questions.[28] I would go even one step further. I think that the time has come for institutionalists in developed and underdeveloped countries to unite and to become more assertative than the majority of institutional economists, with few notable exceptions, have been in the past. They need not shout or become strident in their arguments, but they should not mumble.[29]

28. Peter Wiles, *The political economy of communism*, Cambridge, 1962, pp. 246-247.

29. D. F. Down, 'On Veblen, Mills and the decline and criticism', *Dissent*, Winter 1964, p. 37.

Environmental crisis and political economy*

In the course of its relatively long history, economic science has repeatedly failed to anticipate important issues of great social and practical significance. The environmental crisis is neither the first nor will it be the last issue that was not anticipated by conventional economic theory. This failure is due to a number of reasons related to certain deep-rooted value premises which have led most economists to identify market equilibria with optimal solutions of the economic problem. These premises have shaped and continue to shape their methodological commitment to considering the economy as a closed or semi-closed system. The environmental crisis and the practical and political necessity of coming to terms with its consequences is bound to have a far-reaching impact on economic analysis in the future. Economic theory will be forced to treat economic systems as fundamentally open systems; for, what has always been the case has now become evident: Namely, that production and hence consumption depend upon ecological systems into which the former emit residual wastes and highly poisonous, often non-degradable matter capable of seriously interfering with the dynamic balances of the ecological systems. Since production (allocation, choice of technology, inputs and location, distribution, etc.) depends for its continued functioning and for the reproduction of the entire socio-economic system upon the proper maintenance of the dynamic stability of ecological systems, the actual and potential disruption of the latter has a manifest direct and indirect impact upon the economy itself, i.e., production and reproduction, and hence upon human life and survival. It is this systemic interdependence of economic and eco-systems which constitutes the fundamental challenge to conventional economic theory. Of course, even this is not a new phenomenon; science and technology, population increase and production have given rise to continuous transformations of man's natural and social environment, and nobody will argue that environmental systems can or need to be maintained in their 'original' state. However, rapid changes of science and technology, the

* Abridged and translated version of 'Umweltkrise und Nationalökonomie', *Schweizerische Zeitschrift für Volkswirtschaft und Statistik*, 108 (3), Sept. 1972, pp. 231-249.

development and utilization of ecologically highly dangerous techniques guided by institutionalized patterns of behavior and an economic calculus in terms of monetary denominators (exchange values) has resulted in the neglect of important social costs; there has been a rapid exhaustion of scarce resources and a concentration of productive activities leading to serious disturbances of eco-systems. This applies particularly to 'decentralized' market economies; but even centrally planned economies in which similar principles of decision-making have been relied upon in order to 'rationalize' production by using material incentives for managers of micro-economic units in accordance with monetary cost-benefit principles have taken their toll in social costs and disruption of the environment in certain regions.

While eco-systems possess self-renewing and self-balancing capacities and, moreover, may be said to have a capacity of carrying and absorbing a certain amount of pollutants without serious effects on these self-renewing or self-balancing tendencies, these capacities are subject to definite limits. Once these limits are reached, further emissions of pollutants will have a cumulatively disruptive impact with disproportionate negative effects per unit of additional pollutants. Hence it is unsafe to assume the existence of constant pollution coefficients derived from global observations of relationships which held true in the past. In addition, the degradation of the environment and of the quality of life are the result of specific chains of causation depending on many physical and institutional variables of specific regions. For this reason we feel that predictions and extrapolations based upon global models are not appropriate as instruments of diagnostic analysis and as a basis for remedial action. In fact, what is needed are not simply remedial measures after the damage has occurred but preventive action in the light of the concrete and specific conditions in specific regions. To this end two things will be necessary: 1) Knowledge of the special conditions in particular areas and 2) the definition of specific norms and objectives as well as the elaboration of adequate criteria appropriate for the evaluation of such norms. In our estimation such norms and criteria must be based upon what is desirable and necessary for human life and human survival. In other words, they must be formulated in the light of essential human needs. This process of defining and evaluating objectives and norms can be left neither to markets nor to experts alone but will require an active political participation and consultation of citizens outside the traditional market process in which demand and willingness to pay are necessarily determined by income and capacity to pay. Needless to say, costs in the sense of alternatives sacrificed are important and must not be neglected, but the question of the importance of these alternatives and the decision as to which of them are to be sacrificed (and to which extent) – as for instance military expenditures, space travel, goods satisfying needs of a less-essential

character, etc. – these are questions which need to be subjected to the political rather than the traditional market test. That is to say, it will be necessary to consider costs not in isolation but in relation to the social benefits or social use values.

What would be the implications of this type of approach to the environmental crisis for the future of economics? They would be far-reaching, indeed. In the first place it would be necessary to abandon the conventional approach of treating economic systems as closed or semi-closed systems and to adopt a systems approach to the analysis of economic processes. That is to say, what would be required is 'to follow the lead of the subject matter' and to draw the methodological conclusions from the fact that economic systems are fundamentally open systems in reciprocal interrelations with and dependence upon eco-systems. It is this complex interdependence of systems with possibly mutually destructive effects which makes it necessary to abandon the closed-systems approach in economics in favor of an approach which enables the economist to take account of the reciprocal interdependencies of several systems, each subject to specific principles of organisation. While systems thinking is not a 'theory', it nevertheless provides a new perspective (paradigm) for a theoretical representation of the complex interrelationships between the economy and the human environment (in the broad sense in which the term needs to be used). To think in terms of interdependencies is one of the prerequisites for a realistic perception of the economy, for the guiding of empirical observations, for the development of an adequate language, for concept formation and for theory building. Systems thinking is also a precondition for the adequate perception of the causal chains which give rise to environmental disruption. This is of particular importance for a realistic appraisal of protective and preventive measures and the formulation of substantive environmental norms and objectives and their social ranking, i.e., their evaluation in relation to other social and individual objectives. Finally, systems thinking prepares the way for the development of new paradigms for the formulation of strategies of environmental planning. We are only at the beginning of systems thinking, the difficulties of which are considerable and should not be underestimated.

Second, it is important to realize that the relations between man and his environment are not exchange or market relations. Envionmental damages emerge outside the nexus of the market. The individuals and groups affected by environmental damages and social costs are victims of a process over which they have no control. Such damages and social costs develop, so to speak, behind their backs. In this sense social costs and environmental damages are obstacles to the realization of human freedom quite apart from the fact that they represent an enforced shift of 'unpaid' costs primarily, although not exclusively, to economically weaker

groups of society. Social costs are a secondary redistribution of real income.

Third, the fact that economic systems are open systems makes it necessary to reformulate such fundamental concepts of economic theory as costs and benefits and the related concepts of economc optimality and rational action. Costs and benefits, optimality and rational action need to be given a much broader scope and, in fact, have to be reformulated with reference to actual and potential environmental consequences of production, the choice of technology, the allocation of inputs and the choice of location.

Fourth, the current practice of defining optimal choices and rational behavior in the light of given and stable production functions is inadequate and misleading both for analytical and practical purposes. In view of the open character of economic systems and considering that science and technology are subject to rapid change, the question of *which* technologies and inputs are to be selected and combined in which locations and, indeed, which kind of goods are to be produced and in which quantities, can be answered only by taking into account their effects on specific ecosystems and the latter's capacity to absorb additional pollutants. Which technologies and which inputs are to be combined (and in which proportions) remains an important problem; in fact, it is *the* problem that calls for a solution. Instead of treating production functions as given, they are, on the contrary, to be discussed, i.e., they need to be selected, adapted and changed in the light of their environmental consequences.

It must be clear that if we view matters from this perspective, economic science is confronted with entirely new and extremely difficult tasks and problems. These will not be solved by declaring that environmental goods or values are public goods and need to be subjected to collective evaluation. This formulation is today increasingly agreed upon though there is still considerable disagreement as to how this evaluation is to be achieved. And yet this seems to be the key matter. Conventional theory holds the view that this evaluation of environmental values must take place in terms of monetary, i.e., market values and in the light of the individual's willingness to pay, an evaluation which would then form the basis for the adoption of indirect measures operating through the price system as a steering mechanism. As I have tried to show, I look upon this approach with a high degree of scepticism. Environmental goods, values and goals such as human health and the maintenance of the quality of the social and physical environment are not 'small' problems calling for decisions which can be left to the individual. The price system does not offer these environmental goods nor can it adequately evaluate them. The fact that we are dealing with problems of the quality of the social and physical environment for present and future generations does not facilitate the necessary evaluations; on the contrary, it renders them more difficult. The question is not whether it is possible to express or evaluate environmental

damages and social benefits in terms of monetary values but whether and how far monetary evaluations are relevant, i.e., whether they are adjusted to the criteria which define and determine the quality of the environment. In other words, the central problem is whether such monetary values can be accepted as useful and warranted. For several reasons I hold the view that market values and individual willingness to pay cannot be accepted as cognitively responsible criteria. Willingness to pay depends upon the capacity to pay and hence the distribution of income and must therefore lead to problematical evaluations of environmental values and goals. For this reason we do not use them for the evaluation of other public goals.

I do not believe that the environmental crisis can be effectively dealt with by current proposals to 'internalize' social costs through the application of the principle 'the pollutor must pay' by indirect means of control (such as taxes, effluent charges, subsidies, establishment of property rights, accelerated depreciation for protective installations, etc.). This is an attempt to control pollution through the same market mechanism which has been a major factor in creating the environmental crisis in the first place. I am not arguing that indirect measures will have no effect whatever. But these effects are unknown and uncertain. We do not know how high taxes, effluent charges, subsidies, etc., would have to be nor do we know how enterprises of different sizes and with different market power are likely to react. In addition, I question whether such indirect measures and their incidence on costs, prices and income distribution are compatible with the principle of equity as far as the distribution of the additional costs are concerned. The internalization of costs according to the principle 'the pollutor must pay', despite its superficial plausibility and logical attractiveness is inadequate also because it falls back upon imperfect markets for its operation, if indeed it can be made operational in practice. While it may have some remedial effects, its overall effects on the environment are unpredictable. It remains on the whole a reactive response to a deteriorating situation and does not solve the problem by preventing it. For this reason I would advocate a different approach: Instead of the principle of internalization we need to develop explicit environmental norms as objectives of policy and decision-making. This normative approach or the adoption of the principle of setting explicit environmental goals (finality principle) would have to define the quality of the physical and social environment which we seek to maintain or to reach. To this end it would be necessary to develop proper criteria for the definition and quantification of environmental quality in its different dimensions. Such criteria and the resulting quantification need not be formulated in terms of a common denominator such as money; in fact, to do so would, in many instances, be inappropriate and cognitively irresponsible. (It is true, human health and human life can be and are being evaluated in dollars but the fact

that this is possible does not make such an evaluation cognitively responsible and appropriate.)[1]

In view of these considerations I believe that the environmental crisis forces both economic policy and economic theory to start from explicit social goals. Economic theory will have to constitute itself as a normative social and political science orientated towards the formulation and attainment of environmental (and other public) goals. The formulation of such goals requires a high degree of participation and consultation of all citizens directly and indirectly affected. Only in this way can the danger of a purely technocratic and non-democratic formulation of social goals be minimized and the chances of success for the necessary implementation of the goals be maximized. I see one contribution of the economist in the exploration and determination of the costs of alternative goals to be pursued and of alternative measures (courses of action) to be adopted. More concretely, it will be necessary to maintain a continuous diagnostic inventory with the aid of environmental (and social) indicators in given localities and regions. At the same time it will be indispensible to develop the necessary prognoses of future environmental trends and impacts in the light of a systemic, interdisciplinary causal analysis. It would then be necessary and, in my estimation, possible to establish, in the light of the available knowledge and experience concerning the eco-system, environmental quality norms or standards. Such norms or standards will of course differ depending upon the state of the industrial arts (technology), the state of economic development, the distribution of internal power and the means available for the satisfaction of indispensable human needs and requirements. That is to say, they are not simply technical standards or norms but are the result of a socio-political evaluation. Therefore, environmental norms not only differ but change in time and space. In short, countries like the United States, India and China will be able to afford very different environmental quality norms. Nevertheless, such norms reflect in a sense what a given society considers to be indispensable requirements or the maximum acceptable levels of concentration of pollutants – indispensable that is in the light of ecological conditions and from the point of view of human health, human survival and social reproduction.

Once these norms are established and have attained a high degree of consensus the problem is their implementation as operational measures of action and the formulation of environmental strategies and policies. The role of a normative political economy will be primarily to explore the comparative costs and benefits of alternative courses of action without com-

1. See *supra* p. 98. See also my 'Intellectual reconstruction or "conceptual freeze"; Economics in the future', in Kurt Dopfer (ed.), *Economics in the future*, London, Mcmillan (forthcoming).

mitment, either explicitly or implicitly, to the market form of organisation or any other social philosophy. Concretely, this means that normative economics will have a role to play in the search for and the determination of those policies and instruments of control which are called for and which achieve the relatively highest efficiency in order to make production and consumption compatible with the environmental norms and goals. This would indeed be a reversal of past procedures which treated technologies, the combination of inputs (production function) and consumers' preferences as data or independent variables. On the contrary, which techniques, which inputs and in which proportions, which outputs and which locations are to be chosen are questions which call for answers. They are the variables which have to be identified and, if necessary, changed. Probably the most important practical consequences of such a normative approach would be a much greater emphasis on a public policy of research and development of new technologies and inputs including the recovery of 'waste' materials and their systematic recycling. But, in addition, it will be necessary to proceed to immediate prohibitions of the emission into the ecosphere of those toxic substances which are non-recoverable and cannot be recycled (without prohibitive costs) and which lead to a progressive disorganisation or 'entropy' of our bio- and ecospheres.

In conclusion, let me say that the environmental crisis calls for far-reaching measures of intervention into the market process and the establishment of the greatest possible political consensus. Such consensus cannot be established as long as decision-making is concentrated in a few centers of power, and participation and consultation of citizens are at a minimum and not guaranteed. That the enforcement of prescriptions and prohibitions will be experienced at first and for some time to come as a restriction of the present freedom of action by those who have contributed, in accordance with the traditional rules of the market economy, to the disruption of the environment should be openly admitted. But this restriction is the 'price' which producers (and consumers) will have to 'pay' if the majority of society wants to be free of the obstacles and dangers which the current disruption of the eco-system places on their health, their survival and social reproduction.