
Environmental Aspects of Development

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Both Teddy Prager and Philipp Rieger have shown concern for the physical and social environment in which we live. Some thoughts on this subject might therefore be an appropriate contribution to a volume honouring them. Since my main recent work has been concerned with the developing countries, I shall link this environmental concern with development, although I believe that much of what I shall say also applies to the industrialized countries of the North. As in other fields, the initially separate study of the problems of the developing countries has yielded a bonus for the understanding of our industrialized countries.

Threats to the environment of developing countries

The principal threats to the environment of developing countries can be grouped under the following headings.

1. Continuing rapid rates of population growth
2. Accelerating rates of urbanization
3. Atomic energy
4. Damage done by persistent pesticides
5. Damage done by industrial trace materials
6. Destruction of forests and soils

It will be seen that this list overlaps, but is not identical, with a similar list that could be drawn up for developed countries.

The rapid rates of population growth are the result of the introduction of modern death rates, resulting from modern death control, into societies with traditional birth rates, with little birth control. The transition from an equilibrium in which both death rates and birth rates

are high to one in which both are low is both difficult and slow. The implications of this demographic transition have been discussed at length and all that is needed here is to note that it involves heavy environmental pressures in the poorest societies. Population growth in the developing countries is about five times as great as in the developed countries in the second half of this century. By the end of this century, more than three fourths of the world's population of at least 6 billion people will live in poor countries (compared with about two thirds now). If present trends continue, world population will not stabilize until a size of 10 or 11 billion is reached. About 40 per cent of the population in these countries is below 15 years old, compared with 30 per cent in the developed countries. The high dependency ratio implied by such an age distribution puts a heavy burden on the working population, on social services such as education, on the budget and on the ability to mobilize resources for development.

It is anticipated that between now and the year 2000 one billion people will be added to the populations of cities, more than the total number in cities now. The fastest growing cities are in the developing countries, where the ability to cope with the strains is weakest. Here again, the literature is large and it must suffice to mention the high costs of urban services and the threats to the environment from pollution of air and water, congestion, noise, and disease transmission.

The dangers from atomic energy, on which many developing countries are embarking, stem from the threat of proliferation of nuclear weapon capability, reactor failures, the difficulties of disposing of radioactive waste, the possibility of diverting plutonium by terrorist groups and the uncertainty about radiological standards. Perhaps most serious is the potential threat to civil liberties that arises from the need to protect society against terrorists and saboteurs. While all these problems exist also in developed countries, the level of technical competence of dealing with them is lower in developing countries. Some of these dangers have implications that reach beyond national boundaries.

The attraction of using cheap and effective pesticides in agriculture in countries where the pressure to grow more food is very strong is clear, but there are long-term adverse effects which can be immense.

The urgent advance of industrialization will tend to spread trace materials of industrial origin: mercury, cadmium, polychlorinated biphenyls and other substances can have poisoning effects on people.

The destruction of tropical forests with associated adverse effects on soils is now well documented, though the effects on climate and the world's atmosphere are more controversial.

A concern for environmental protection for developing countries is often met with hostility. It is felt that the industrialized countries have achieved high levels of living and now wish to prevent or slow down the same process of industrialization in the developing countries, for the sake of preserving values that are mainly the concern of the rich. Sceptics can also say that preserving the environment has many of the

ingredients beloved of women's magazines – animals, a strong medical interest and a readily identifiable villain. It appears to appeal to the most advanced sociologists and to those who detest change in any form, to old women of both sexes and to the revolting young of unidentifiable sex, to the silent majority and the screaming minority, to the young swingers and to the old danglers. No wonder, then, that the spokesmen for the developing countries have said to those from the developed countries: you have enriched yourselves and now you want to stop the world and want us to get off. We shall worry about the environment when we have become as rich as you.

Such reactions are entirely understandable. It is generally true that the benefits of additional production and incomes are greater the lower the income, and the harm done by pollution is less the lower the level of industrialization, urbanization and production. But it is often cheaper to design processes that are low in destructive material discharges than to try later to modify these wastes and damages, once they have been generated. There is no reason why developing countries should not learn from the mistakes of the now advanced countries and avoid courses of action that they would regret. It has been found that the additional costs attributable to environmental and health safeguards in non-environmental projects has ranged from zero to 3 per cent of total projects costs. Costs are lower the earlier the protective measures are added to the project design. Increasingly, these protective measures are being incorporated in the basic design of projects, such as emission controls for industrial plants. Prevention is much cheaper and more effective than cure. Sound watershed management, for example, which protects reservoirs from siltation and floods, costs much less than rehabilitation of a deforested, eroded watershed.

In order to appraise the detrimental impact of certain policies on the environment and the costs of avoiding it, the application of social cost-benefit analysis has been proposed. In the following sections, I shall discuss its scope and limits.

Cost-benefit analysis and the environment – the problem

“Cost-benefit analysis is a practical way of assessing the desirability of projects, where it is important to take a long view (in the sense of looking at repercussions in the further, as well as the nearer, future) and a wide view (in the sense of allowing for side-effects of many kinds on many persons, industries, regions, etc.), i. e. it implies the enumeration and evaluation of all the relevant costs and benefits¹.” A stream of future social benefits and a stream of future social costs, properly adjusted for uncertainties, are discounted by a social rate of time preference and then compared.

Applied to the environment in underdeveloped countries, the problem is how to strike a balance between the benefits of raising the level of living of the mass of the people in poor countries, and its costs in terms

of the deterioration of the environment. The basic criterion for deciding how much to spend on reducing the deterioration of the environment, e. g. by choosing a more costly site for a dam, can be stated as follows. The deterioration should be reduced to the point where the costs of doing so are covered by the benefits from this reduction². This formal statement – being a tautology – is immensely easier than its practical application. Two points of elaboration are in order. First, there are many aspects of a deteriorating environment, and these are spread over time. It is therefore important not to apply the analysis to one aspect in isolation. Intertemporal and interspatial interdependence must be allowed for, so that, for example, a program designed to bring water does not later lead to excessive salination, or a program to increase electricity supply to the excessive spread of schistosomiasis, or chemical pest control to the excessive killing of the destroyers of the pest. Second, priorities relating to the desirable objectives must be supplemented and modified by considerations of costs. Thus a high priority objective of environmental improvement which is very costly may have to give way to a lower priority one which imposes lower costs.

Applied to, say, river development projects, the need is to identify options and to estimate the benefits and costs in the light of social priorities. Environmental safeguards, such as the preservation of fishing facilities, of farming land for existing tribes, the avoidance of canal-borne diseases, of aquatic weeds or of secondary poisoning of the killers of pests, are costly. These additional costs are acceptable if, but only if, the added benefits exceed them.

Plainly, planning the environment and balancing control of the environment against other objectives of policy, require a comprehensive analysis and calculation of the costs and benefits involved.

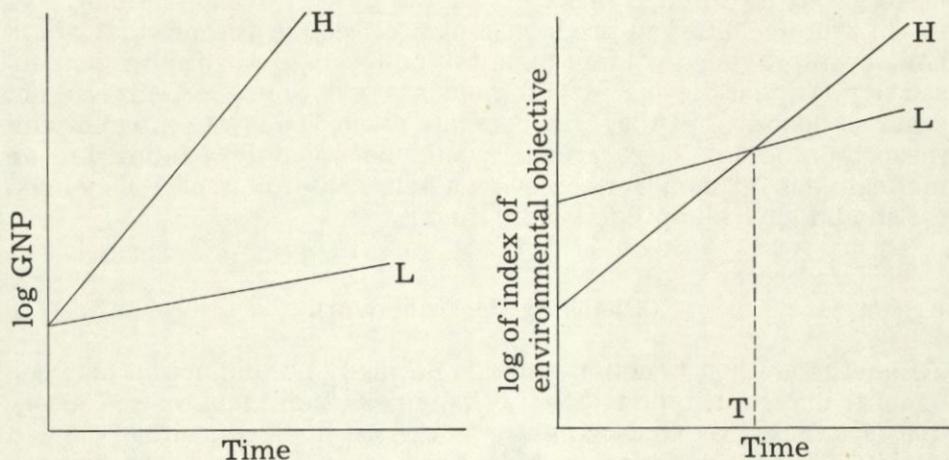
Growth versus environment

Some writers have presented to us a choice between preserving the environment and promoting economic growth. Growth, the argument goes, pollutes. As normally calculated, the growth of GNP does not allow for these social costs of growth. A more welfare-orientated policy would decelerate growth – some even argue for zero GNP growth – in order to preserve or restore a purer environment.

Many things are wrong with this argument. Perhaps the most basic objection to it is that growth, *properly composed and properly weighted*, can be complementary with environmental protection. Industrial anti-pollution devices and the technology that produces them are part of the GNP. And faster growth renders obsolescent more rapidly such polluting agents as the motor car. It is true that both pollution and the reduction of pollution are a function of the level of "income". The argument presented here depends upon the condition that the proportion of income devoted to anti-pollution devices or pollution-free innovations exceeds the proportion of income adding to pollution. If the

appropriate social weights are attached to the components of income, measured "income growth" will show up as genuine growth only if the condition laid down in the previous sentence is met.

On the other hand, there is almost certainly some trade-off between environmental objectives and growth in the short- and medium-long run. The following diagrams illustrate possible temporal growth paths of GNP and of something to be measured by an index of the preservation of the environment (or of reduced pollution). He is the high growth path, L the low growth path.



Until time T the high growth strategy sacrifices the environment. But at T and for ever after, high growth promotes a purer environment. Which path is chosen will depend upon the rate of time discount for environmental purity, compared with that for GNP. Since the marginal utility of consumption declines with rising income, whereas the relative value attached to reducing pollution increases with rising income, the rate of time discount for the environment is likely to be lower than that for GNP. If this is so, those who lay much store by the environment ought to advocate a higher, not a lower, growth strategy than that dictated by optimising consumption over time. Only then can devices to protect the environment (a new growth industry) and the technology that evolves anti-pollution techniques, processes and products develop sufficiently rapidly.

The problem of growth versus the environment is, however, wrongly posed. Growth is simply the inter-temporal dimension of any strategy and should be the result, not the aim of a rational economic policy. It may well be that proper environmental protection calls for *more*, not less growth.

Four options should be considered. First, we may abstain from producing as much as we otherwise would in order to reduce pollution. We opt for fewer goods in order to be saddled with fewer bads. Second, we may devote resources that might have produced goods to produce

products that combat pollution: more anti-bads. Whether this means stepping up national product, slowing it down or changing its composition depends on conventions of national income accounting. Much that is now counted as part of GNP should be deducted as intermediate products, as anti-bads, required to combat the bads produced in the course of generating the GNP. There is something to be said for the creation of a society for the promotion of anti-bads. Third, we may step up the production of goods, notwithstanding the fact that they aggravate pollution, to a degree that compensates for the growth of pollution: more goods in order to make up for the growth of bads. Finally, we might produce different products, not as attractive as those that would have been produced without regard to pollution, but with the compensating merit that they carry with them less pollution: goods that are not quite so "good", but that also generate fewer "bads". Compared with these four options, zero growth would be not only a blunt, but an ineffective instrument for achieving a better environment. Policy makers should have all options before them.

Choosing the framework

Benefits are just benefits. There is normally no distinction between benefits that contribute to positive happiness, those that reduce misery that is inflicted by God or nature and those that reduce man-created misery. The blackmailer or kidnapper creates a nuisance, for the removal of which he extracts payment. Depending upon the assumptions and the terms of reference of the framework, the benefits derived from the removal of man-created nuisances count in the same way as the benefits that add to the net enjoyment of life. Social life is full of situations that can be comprehended only by the economics of blackmail or kidnapping: desires created by envy, by advertising, by habit formation, by the conspicuous consumption of others, by the prevailing income distribution; or needs generated by emissions of noise, dirty air or dirty water or just dirt. On the other hand, clearly not all man-created desires fall into the blackmail of kidnapping category. It is the purpose of education to generate desires for truth, goodness and beauty, which can never be fully satisfied. Both the highest and the lowest wants are the result of want creation, of the generation of a void for whose filling someone can extract a charge that may count as a benefit. The point is that benefits cannot be aggregated without a series of value judgments in addition to the simple one that it is good that people should have more of what they want. The wants and their causes themselves must be subjected to a critical evaluation before we can apply a true cost-benefit calculus. If, as J. S. Mill thought, it is better to be Socrates dissatisfied than a satisfied pig, it may, in some cases, be better to widen the gap between "bads" and "goods". In other cases, the production of "anti-bads", to abate the nuisance caused by the generation of "bads", does not add to welfare.

Cost-benefit analysis must be conducted within a framework which selects certain relationships by putting them into equations, and involves moral, political and social considerations. This means that valuations enter; that they have to be selected, and then quantified. In locating an airport, for instance, such disparate considerations as surface travelling time, loss of agricultural land, differential impact of losses on rich and poor, the value to future generations of historic churches and houses, the loss of wildlife, as well as the more obvious capital construction costs and revenues collected, all have to be brought together. It is quite true that cost-benefit methods help to establish a logical framework for decision-making. The framework determines the outcome. It is bound to be less than fully comprehensive and by selecting some and leaving out other considerations biases the results.

Partial versus general equilibrium analysis

Formally, cost-benefit analyses can be made to fit all cases. In practice, it ceases to be usable for decisions that change what are normally taken as parameters of the system. This means that, if decisions affect the values of the variables in the rest of the economy, the partial equilibrium approach or the micro-approach, on which the analysis is based, breaks down and only a general equilibrium analysis will do. This sets severe limits to its application to underdeveloped countries.

Suppose that a river development project depends for its benefits not only on expenditure on investment and the external costs that became evident in the Aswan dam, but also on the incentives of farmers, in turn a function of the system of land tenure, and on their willingness and ability to adopt new methods of cultivation. These may be a function of the speed of modernization of the whole economy, itself partly dependent upon the river development project.

Conversion of political into technical choice

Cost-benefit analysis has a tendency to convert political, social and moral choices into pseudo-technical ones. Hence its psychological appeal to administrators, but also hence its logical flaw, evident to those trained in the analysis of choice. If two objectives conflict, say the requirements of industrial growth and the protection of the environment, someone will have to choose. The choice may be democratic or dictatorial or oligarchic, but choice it must be. It is possible to make the conflicting objectives commensurate by attaching numerical weights to them and then estimating how these weighted values are affected by different courses of action, allowing for interdependences, cross effects and intertemporal connections. Different values can thus apparently be reduced to a single value: the maximization of the numerical excess of

"benefits" over "costs". But the clash has not disappeared. It has been concealed in the relative values (often highly arbitrary) attached to the objectives. The judgement is no more "objective". On the contrary, I would argue that policy makers should be fully aware of the choices and should not be confronted with fudged, predigested and prejudged pseudo-technical results. It is, for instance, formally possible to lump together the effects of a project on (a) income distribution, (b) the balance of payments and (c) the growth of industrial production. Shadow pricing of inputs and outputs can embrace all these objectives. But unless there is a clear and precise consensus upon the relative weights to be attached to these objectives (e. g. to an extra dollar that goes to a rich and a poor man), a planner has a clearer picture by having the issues set out separately rather than being served with single figures that conceal the preferences. All interests are rarely in harmony. A decomposed set of indices will lead to better decisions than a composite index.

When exchange values are non-operational

One of the characteristics of cost-benefit analysis is that it attaches money values to choices that have never been and never will be subjected to the test of an exchange situation. In the first place, the money calculus cannot be applied if objectives are not commensurable; if we are not prepared to give up any amount of one thing for a little more of another. "Everything has its price" is just not true. If we regard human slavery or prostitution as incompatible with human dignity, or if we regard them as incompatible with certain inalienable human rights, the proof that these institutions come out well in a cost-benefit analysis is irrelevant. Secondly, even where there is commensurability, to attach values to choices that will never be put to a test is essentially arbitrary. Sensitivity analysis can determine what difference would be made by varying the values and, if we are lucky, certain variations will make little difference to the outcome. But others will be crucial. Interviews and hypothetical questions about what value we attach to time saved or beautiful flora and fauna preserved do not help much. We all know about the gap between words and deeds, particularly if we can never be faced with the deeds. Thirdly, whenever ends are not given but explored, modified or discovered in the process of allocating resources, the model that confronts given competing ends with scarce means does not fit the facts.

The cost of information

A full cost-benefit analysis requires not only a carefully constructed analytical framework, but also a vast amount of quantitative data. The construction and gathering of this knowledge take time and skilled

manpower, which is very scarce in underdeveloped countries. The costs of acquiring the information and knowledge to maximize net benefits must be weighed against the extra benefits to be derived from them. It may then be perfectly *rational* to stop short of being *perfectly* rational.

Allowances for uncertainty can be made in three ways:

(1) in the assessment of annual levels of benefits and costs; (2) in the assumption about length of life; and (3) in the discount rate. The first is most appropriate if the risk dispersion of outcomes (or inputs) is irregularly, rather than regularly, distributed with time. If the main risk is that there may be a sudden day of reckoning when benefits disappear or costs soar, the second type of adjustment is needed. The third correction, a premium on the discount rate, is appropriate where uncertainty is a strictly compounding function of time³.

Even if chances of success and failure could be calculated actuarially, disastrous outcomes put an end to further "trials". Professor Shackle has proposed to replace probability distributions by his highly original concept of "potential surprise". Ignorance as to which of many possible events will occur, according to Professor Shackle, is reflected as a low potential surprise value of each, not, unwarrantedly, as a low "probability" of each. He has substituted for mean value and dispersion his concepts of "focus gain" and "focus loss" – the most attractive and the most repellent outcomes, thus rejecting the addition of mutually incompatible hypotheses.

It might be argued that these innovations do not apply to public investment projects. Many of these will have only very small effects on average income per head of the population or on those of a particular group. It may therefore be thought that, where a probability distribution is known, actuarial risk can be applied. On the other hand, the kind of projects that we are concerned with will be sufficiently large and localized to have considerable effects on groups of people and the possibility of disastrous outcomes may be important. Focus values of the type proposed by Professor Shackle will then be more appropriate than adjustments to actuarial risk. Furthermore, in conditions of uncertainty, built-in flexibility will be appropriate. Even though costs for any given outcome will be higher or benefits lower than they would have been, had this outcome been expected with certainty, costs will be lower or benefits higher if outcomes deviate from the expected values. No method that uses certainty equivalents can deal correctly with this phenomenon.

Attitudes to uncertainty

Many people like a small chance of a large gain combined with a large chance of a small loss (hence gambling) even though the actuarial value of the lottery ticket is negative, but dislike the combination of a small chance of a large loss combined with a large chance of small gain (hence insurance) even if the actuarial value of the combination is positive.

What should we do if a certain course of action presents us with a very small chance of a vast disaster, possibly in the distant future, combined with the near certainty of substantial gains over a long period. Pascal argued that if we are uncertain about the existence of God we should believe in Him. For if He does not exist and we do believe, no harm is done; whereas if He does exist and we don't believe, we are condemned to eternal hell. A strategy of minimizing potential maximum losses therefore leads to a belief in God. Some of the opposition to nuclear energy or to the emission of excessive amounts of carbon dioxide with the possible result of destroying the ozone layer can be explained in such attitudes to uncertainty.

Implications for aid-giving

By looking at aid-giving in isolation, we have not taken into account the possible harmful effects on the environment in poor countries which are caused by the transfer of our technologies. I have tried to enumerate some of these in *Development in a Divided World* (Pelican Original, edited by Dudley Seers and Leonard Joy, 1971). The most important is the introduction of cheap and effective methods of reducing death rates, without a correspondingly cheap and effective technology to reduce birth rates. This has upset the population equilibrium and has vastly contributed to the difficulties of development. Other examples are the capital-intensive techniques of production which aggravate the unemployment problem, the transfer of Western institutions such as trade unions and modern social services, and most recently the new high-yielding seed varieties. Not only have we isolated aid-giving from its total effects in recipient countries, but we have also isolated it from our other national policies which have an impact on development. Vast sums are spent on research and development which make the primary products obsolete, on whose exports developing countries depend; we prevent them from selling more manufactured products in our markets by cascading tariffs, rising with the stage of processing, and impose quotas and other non-tariff barriers on imports when they show signs of being successful; we encourage the immigration of scarce professionals whom these countries have trained, while shutting our frontiers to unskilled immigrants; we conduct our foreign policy in a manner which imposes added burdens on the poor countries. No cost-benefit analysis has yet embraced these highly relevant considerations of the total relationship between rich and poor countries.

Environment and basic needs

One of the principal objectives of development policy – to meet the basic needs of all within a relatively short period, say twenty years – provides a powerful organizing and integrating principle for a number

of separate issues, including those of the protection of the environment. If we start with this objective in mind, i.e. giving very high priority to poverty eradication, apparently intractable problems become more amenable to a solution. "Basic Needs" will therefore be taken as the integrating concept in the subsequent analysis.

Neither the contemporary discussion of the environment nor the energy crisis has led to clear and soundly argued conclusions. The first and most important lesson is that late industrial starters can learn from the mistakes made by the early starters. It is possible to avoid in the beginning the creation of the environmental damage that the advanced industrial countries have inflicted upon themselves and the wasteful uses of energy that the Western style of industrialization has involved. It is the heavy dependence upon oil supplies that has contributed to the present crisis in the high-income countries. A style of industrialization less hooked on the private motor car, more concerned with conservation, and more directed at the use of indigenous sources of energy and materials would lead towards greater self-reliance.

Another important set of policy questions relates to the international location of dirty processes. Just as differences in factor endowment guide the allocation of resources according to comparative advantage, so differences in social pollution costs should in principle guide international specialization of industry. The costs of pollution will tend to be lower in many developing countries and the benefits to be derived from industrial production will tend to be higher, because incomes are lower. For both these reasons, a shift of polluting activities from the industrial countries to the developing countries can be envisaged.

A careful distinction should be drawn between *local*, *regional* and *global* pollution. *Global* pollution includes the spread of persistent pesticide residues that can be carried far beyond national frontiers; the burning of fossil fuels that affects the atmosphere; the pollution of the oceans through oil spillage or dumping from ships; the pollution of air streams by jets, and induced changes in the global climate.

Regional pollution arises from geophysical linkages between several countries, such as river pollution, desertification and regional air pollution.

Local pollution is confined within nation boundaries, such as the eutrophication of a lake from fertilizer or sewage discharge. It would be legitimate to restrict activities and products that lead to global pollution but such restrictions must not be used as a pretext for protectionism by the industrial countries where the pollution is purely local and remains confined to the area of production in the developing countries. Taxes imposed by industrialized countries on their own pollution-intensive activities can be used by them as an excuse to exclude imports from countries which can conduct these activities at lower social costs without harm to the importing countries. The "sweated environment" argument would be as fallacious as the "sweated labor" argument for protection. The international free trade unions are misguided (or act in the interest of rich country unions) in advocating a clause in GATT

which would insist on the same environmental standards for all countries, so as not to give an "unfair" advantage to poor countries.

A third set of policy questions relates to the return to the use of some natural products that had been hit by the invention of synthetics, but where the costs of pollution from producing the synthetic product had not been allowed for in the cost-benefit calculus. Pyrethrum against DDT is one illustration; natural fibres against synthetic fibres, another. Some of these natural products have the advantage not only of being free from pollution but also of being labor-intensive (often female labor-intensive) and contributing to rural development, and therefore contributing to the solution of the employment and the rural-urban migration problems.

A fourth set of questions concerns the actions that developing countries can take in the face of the scarcity of non-renewable natural resources. Many of these have not been priced according to their scarcity, taking into account a proper social time discount rate and risk premium. A correct pricing policy would provide incentives for more economical use of these products, for switching to products that use less of these materials or none, for a search for new sources of these materials and for the development of substitutes. Meanwhile the higher revenue earned by the material-exporting developing countries should be used for diversification and development as long as poor countries dependent on their imports and without corresponding high-priced exports are insured against damage from high prices.

But it is not enough to estimate the possibility of exhaustion and to attach a value to these materials, allowing for time and uncertainty; what is also needed is coordinated action between the developing countries in which these materials are to be found. Incentives and penalties are required to secure joint action and rules about how increases in revenue derived from joint scarcity pricing should be shared and used for development, and in particular in ways that do not harm developing countries dependent on imports of these materials.

A fifth set of questions concerns the use of transnational companies for environmental policy. In the new international division of labor which would be guided by differential pollution costs in different countries, the location of certain "dirty" processes in developing countries could be one of the functions of the transnational corporation. This could be done either by the firm locating "dirty" processes within its vertically integrated system of operations in a developing country where the social costs of pollution would be lower and the benefits from industrialization higher, or by transferring the whole operation to such a country. The argument would be analogous to that of locating unskilled or semi-skilled-labor-intensive processes and products in developing countries. One important point to be investigated here is whether and if so how the transnational corporation can be used as a pressure group to ensure access for the products to the markets of the developed countries.

Notes

- 1 A. R. Prest and R. Turvey, "Cost-Benefit Analysis: A Survey", *Surveys of Economic Theory*, vol. III (Macmillan, 1966) p. 155.
- 2 First Report of the Royal Commission on Environmental Pollution, Cmnd. 4585, HMSO 1971, para. 20, p. 6.
- 3 Prest and Turvey, *op. cit.*, p. 171.