

THE SOCIAL COSTS OF ECONOMIC DEVELOPMENT

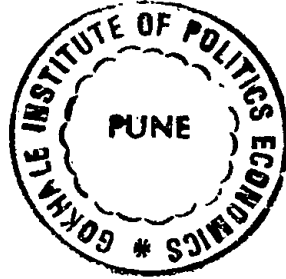
(An Environmentalist Approach to Some Indian Problems)

by

Vijay P. Paranjpye

THE SOCIAL COSTS OF ECONOMIC DEVELOPMENT

(An Environmentalist Approach to Some Indian Problems)



Dissertation
in part fulfilment of
M.Phil. Degree Course

of the

University of Poona

Submitted by :
Vijay P. Paranjpye,
Gokhale Institute of Politics and Economics,
Pune 411 004

1978-79

PREFACE

The purpose of this paper is to dispel the widely prevailing view among economists (especially in our country) that problems of environmental pollution and degradation are matters which concern only engineers and natural scientists, and that they have little to do with economics. This erroneous view has prevailed mainly because the specialists in our discipline have been too engrossed with monetary model-building and abstract theorising to realise that the economic activity in practice is leading to effects and consequences which are not accounted for, and play no active role, in their economic theory. They still do not accept that ^{non-paid} social costs or non-private costs resulting from normal industrial and agricultural development have become so huge that their deletion from the entire market-mechanism-process makes non-sense of the pricing-theory itself. It is more surprising that ^{non-paid} social costs are not accounted for even in our planning process. Our planned outlays, and dams and industrial complexes continue to be located with a blissful disregard to the environmental consequences. Our fresh water sources which are the most scarce factor in agriculture continue to be polluted; our lands, which are also scarce, continue to be cultivated beyond the economic margin, and yet nobody takes a serious stand against the cultivation of sub-marginal land.

This paper has tried to demonstrate that the initial anxiety regarding environmental issues, and social costs of economic development, as expressed by Pigou and other classical writers has been superseded by an overwhelming preoccupation

(ii)

with growth for growth's sake, and that it was only during the last decade that the dangers of indiscriminate industrial development ^{have been} ~~were~~ realised.] We have further discussed the problems of environmental pollution and its estimation, by discussing empirical studies so as to ~~to~~ lend practical value to our ideas.

The most important finding of our study is that the incorporation of environmental criteria into theory, and State Legislation to that effect would actually increase economic efficiency by way of conservation and better use of scarce resources, recovery from waste, recycling of waste and finally reduction of social burden. The interesting aspect of the finding is that, some of these benefits cannot accrue without Environmental Legislation.

I wish to express my gratitude to Prof. Venkatramaiah of the Gokhale Institute of Politics and Economics, Pune, who guided me and helped me organise my ideas into a systematic and intelligible order.

I am also grateful to the Ness Wadia College of Commerce, who granted me a study leave, and the University Grants Commission for offering me a fellowship under the Faculty Improvement Programme. My thanks are also due to members of the staff of the Gokhale Institute. Shri Shashikant M. Kulkarni was kind enough to type this paper neatly and in time. Finally, I am indebted to Prof. Suresh Gajendragadkar of V.J.T.I.(Bombay) for initiating me into taking up this study.

Vijay P. Paranjpye

C O N T E N T S

<u>Chapter</u>	<u>Title</u>	<u>Pages</u>
-	<u>Preface</u>	(i) to (ii)
-	<u>Introduction</u>	1 to 8
I	THE PLACE OF 'SOCIAL COST' IN THE CLASSICAL AND NEO-CLASSICAL THEORY	9 to 31
II	DEFINITION, CLASSIFICATION AND ELABORATION OF ENVIRONMENTAL POLLUTION WITH REFERENCE TO THE GREATER BOMBAY AREA	32 to 56
III	GOVERNMENT LEGISLATION AND ITS IMPACT ON INDUSTRIAL FIRMS WITH REFERENCE TO Dr. BECK & CO. LTD. (INDIA) AND CONCLUSIONS	57 to 69
-	<u>References</u>	70 to 73
-	<u>Bibliography</u>	74 to 77

THE SOCIAL COSTS OF ECONOMIC DEVELOPMENT
(An Environmentalist Approach to Some Indian Problems)

Introduction

1.2 All discussion of India's planned growth and development has till now centered around the ways and means of maximizing the Gross National Product, and this has been under the assumption that GNP maximization is the true and sufficient indicator of National Welfare. The contention of this paper is that this approach, needs to be changed, so that a new approach incorporating certain environmental factors can be developed, which will be a better indicator of the Net National Welfare. The new approach will require an identification of all types of ^{non-paid} 'social costs' incurred in the process of economic development. Further, if an estimation of such costs is made, the 'aggregate social cost' could be deducted from the 'Net National Product' so that we get a realistic idea about the national economic performance. ['Social cost'

has not been accounted so far in our national income calculation, and it may be a long time before we can develop methods of estimating such costs.]

1.2 Chapter I of this paper takes a review of the theoretical discussion on the problem of 'social cost'. Chapter II will define environmental factors, and attempt an identification of such problems in India. The major stress will be on elaborating the problem of environmental pollution as experienced in the Bombay-Pune region during the industrialization

process, in the last few decades. Chapter III discusses the legislative measures on environmental protection and its impact on resource use and resource allocation. The experience of a resin producing firm viz., Dr. Beck and Co. (India) Ltd., Pimpri, is investigated as regards the effects of legislation on the firm's resources. At the end, conclusions and the further areas of work possible in this field are indicated.

Relation of Growth with other indicators

1.3 It has been recognized, (especially in India) that growth must be related to certain other indicators (besides average per capita product), such as the distributive justice, concentration (or dispersion) of developmental efforts, level of employment (unemployment), dependence of foreign aid, and finally economic and monetary stability. This realization can be ^{noticed} ~~observed~~ while going through the five-year plans, the fiscal and monetary policy, industrial policy and the foreign trade policy. But there is one category of factors which has not been paid attention to viz. the endowment of natural factors, problems concerning environmental pollution, depletion of land and forest resources, degradation of environmental amenities and neglect of ecological factors. Unless these indicators are included, growth becomes very lopsided and distorted.

The Problems of Developing Countries

1.4 Briefly, the problem of developing countries can be divided into two groups: 1) the problems of poverty and

the lack of adequate development ~~and~~ and 2) the problems arising out of the process of development itself. The problems the first category e.g. poor housing and sanitation, poor quality of water (potable) and nutrition, public health and other public amenities - are definitely of prime importance in urban as well as rural areas. These can be solved (partly) by the development process itself. But, if this development process ignores crucial environmental factors, the economic growth, while solving some problems, creates new problems which are as severe as the problems it is trying to solve. Economic growth has traditionally and invariably been accompanied by rising disparities in incomes, (both between regions and classes of population) and a deterioration in social and cultural conditions. The sudden and rapid creation of large productive capacities in industry and agriculture, growth of complex systems of transport and communication, ~~and~~ ^{mammoth} city agglomerations, have been accompanied by damage and disruption of the environment, particularly in the industrially advanced countries. An environmentalist approach, we suggest, would greatly avoid, to the extent possible and feasible, the mistakes and distortion that have been characteristic of the western industrialized economies. For the affluent west it was a question (and still is) of the ^{the} quality of life; for us it means our very existence. —

Growth Vs. Environment

1.5 Concern for environment is not counter to, but essentially a complement of our commitment to development. This

fact must be recognized. This awareness will provide a new dimension to the concept of development itself. There are several fields where the environmental objectives coincide with the conventional developmental strategies, and in such cases no conflict would arise (e.g. in case of efficient utilization of raw materials and power, recovery from or recycling of industrial waste, conservation of forests and soil fertility, optimal utilization of water and so on.) But even when the objectives conflict (e.g. the short-run costs and long-run-benefits of certain investments, or the sheer urgency of ~~expediting~~ certain problems) choices could be made after considering all the long term and short-term costs (including social costs) and benefits of the alternatives. The problem will be essentially that of 'time preference'.

1.6 The broader definition of growth and development, would include incorporation of air and water quality standards, protection and conservation of natural resources, avoidance of (or compensation for) ^{non-paid} social costs, nutritional and health standards, greater emphasis on social security, provision of public utilities, and realization of distributive justice. Common policies integrating the developmental and environmental objectives on a) location of industries, b) land and water-use policy, c) comprehensive physical and financial planning (keeping in mind the existence of a strong private sector), d) foreign trade policy etc, ^{would have to be evolved.} The new concept would require modifications in the use of fiscal and monetary

incentives and disincentives, ^{yes,} grants and subsidies. While preparing the plan drafts, the ^{non-paid} 'social costs' of alternative projects and investments ^{would have to be considered} so that public discussion on the pros and cons of alternative projects could take place.

Environmental Education

1.7 Environmental awareness cannot come automatically, but has to be introduced consciously at all levels of the education system, so that ideas and awareness can percolate into the actual industrial and agricultural practices. Today, there is no faculty which provides comprehensive courses in environmental studies. Introduction of new papers (e.g. Economics of Environment) could be introduced at the graduate and post-graduate levels. There is also a need for research in environmental education so that it does not get restricted to a few branches like engineering, microbiology, biochemistry etc.

Environmentalism and international trade

1.8 It must be realized immediately that environmental legislation in developed countries will have a great influence and impact on the trade of developing countries (often adversely) e.g. restrictions on exports and imports, resource and energy use strategy and so on.

Legislation in India

1.9 The first such Act was passed in ~~1912~~ ¹⁹¹² and was known as the Bombay Smoke Nuisance Act. It has of course been modified upto March 1972. The other important legislation in India is "The Maharashtra Prevention of Water Pollution Act

1969". Besides these two we have the Tree Act, the I.S.I. specifications and so on. Rather surprisingly, the administrative awareness appears to be greater than ^{that} in the academic and theoretical discussions in India. This situation ought to be changed as early as possible, so that more people become aware of these problems.

The main cause

1.10 The general neglect of, and apathy towards environment concern, is rooted (theoretically) in the problem of 'Externality' - which is discussed as a minor ~~cause~~ ^{aberration} having only academic interest in our conventional economic theory. It is the main purpose of this study to try and elevate this concept to a position of respectability, from its present place as a minor cause of 'market failure'. The misunderstanding regarding 'externality' has been caused by ~~the~~ ^{the} mistaken classification of air, water, and privately unowned land, as "free goods" in the classical and neo-classical terminology. These factors should have legitimately been called 'social goods', having the property of scarcity, as much as all other commodities. The result of this mistake has been (historically) an indiscriminate exploitation of air, water and forest (land) resources, and overexploitation of mineral resources. The second important result has been the total deletion of ^{non-paid} 'social costs' arising from such economic activity, from the cost calculations of entrepreneurs. ~~In~~ ⁱⁿ ~~this connection,~~ ¹ ~~it is~~ ^{-there for} no wonder that the existing 'product-mix' and 'use of technology' does not reflect either the

'cost to society' or the resource endowment of our country. Indian producers have "shifted" the burden of external costs on to the society ^{simply} because it ~~was~~ ^{has been} very easy to do so.

Unawareness of the social burden

1.11 The society at large has been either unaware of this fact or has been unable to counteract against it through the prevailing market framework. The practical difficulty of correcting this injustice is the lack of time-series data for calculating ^{non-paid} ~~the~~ social costs (or at least imputing them objectively). A lot of research can be done in this field.

The basic idea of constructing and using the social cost calculus is to make all individual enterprises (and also individual farmers) responsible to the society, and treat

national resources with respect. ^{But this idea seems to be absent,} ~~This makes it essential to~~ ^{It has therefore become necessary to include such} ~~include social~~ costs in the traditional cost-benefit analysis.

Distributive justice

1.12 Perhaps the need for distributive justice is the most powerful argument for the environmental ^{ist} approach. Experience shows that the benefits of growth viz. availability of comfort and luxury items, accrue mainly to the rich in India. They can also afford to ward off the pollution effects of growth. The

^{non-paid} 'costs of growth' have to be borne more by the poor in the form of filthy living conditions, air and water pollution, loss of natural amenities, impairment of health, congestion and so on. Therefore, the question is not - Can a poor country afford to invest for environmental protection? but is a

developing country justified in bringing about growth for the rich at the expense of the poor in the society? Environmental protection, restrictions on enterprises and provision of better facilities is ^{only} a small step towards the correction of distributive injustice.

Economic necessity

1.13 Finally, concern for environmental variables is important not only from the social and aesthetic point of view but also as a tool ^{for} maximizing efficiency in production *and* ~~as well~~ as resource utilization.

THE PLACE OF 'SOCIAL COST' IN THE CLASSICAL
AND NEO-CLASSICAL THEORY

Heis

Neglect of Social Cost in theory

2.1 The main contention of this chapter is that there is very little evidence to suggest that 'social cost' (and returns) ^{have} never found the recognition they deserved in the classical and Neo-classical economic thinking. During this period writers were not paying enough attention to the fact that unregulated competitive condition gives rise to ^{unpaid} ~~social~~ costs' which are not accounted for in the entrepreneurial outlays, but are in fact shifted to and borne by the society as a whole.¹ We feel that this is an important limitation of the Classical and Neo-classical value theory, because it leads to distortion in the calculations of entrepreneurs, the quantities of different commodities actually produced, the allocation of resources and the distribution of income and wealth.

Unplanned Market Economy

2.2 We can forward two more reasons for the inability of an unplanned market economy to achieve the maximization of the want satisfying power of scarce resources. 1) A large number of obstacles to the ^rational behaviour of consumers and entrepreneurs. (viz. The pressures of advertising, monopolies and monopsonies etc.) 2) The existence of 'social returns', ^{or} which are diffused throughout society as they cannot be sold in money terms, are also neglected by enterprises.

The Externality Problem

2.3 By the 'Externality Problem', we mean the realization that increasing returns owing to internal and external economies of scale can lead to a faulty resource allocation.²

We, therefore, define social costs as all direct and indirect, ^(paid or non-paid) costs suffered by the society as a result of production activities of individual enterprise (both private and public).

The 'external diseconomies', can arise due to the growth of one industry, or due to the growth of all industries in a restricted area. ^{Such non-paid} ~~The~~ costs to the society can be looked at as a benefit to ^{private} enterprises or even to entire industries, because costs which they should legitimately bear are 'shifted' on to the society. The prime cause of the existence of such

costs is ~~the~~ 'non-payment'³ for the factors of production like air and water, ^{or under-payment for extracted} ~~finite~~ ^{finite} natural resources based on Awareness of social costs

2.4 Although ^{the concept of} ~~social costs~~ ^{was} ~~were~~ not included in the main body of economics by most Classical and Neo-classical thinkers, many of them had conceived the problem and discussed it briefly. We will now review only these [†] portions of their writing which dealt with such ideas. These ideas were often referred to as 'non-market interdependence'. The problems which they discussed ^{were} often of a normative nature, and as it was difficult to make money calculations about them, they were classified as a part of welfare economics.

Adam Smith's reliance on moral sentiments

2.5 It is well known that Adam Smith⁴ believed in the benevolent character of 'free competition', and the supremacy of each individual's 'self interest' as the guiding forces of the economy. But, his qualification that competitors should be restrained in their action by sympathy and moral restraint, is often forgotten by the banal protagonists of 'the protestant ethic of individual supremacy and private accumulation'.

Smith's reliance on moral sentiments and social necessities were ignored and even denied by later writers. *[For example he often used the terms 'private' and 'non-private' costs]*

The Historicists

2.6 Comte and Schmoller denied the thesis that the principle of self-interest is able to promote social welfare, or that there is no need for government planning and regulation. They described many evils of competition, viz. extreme inequality, social insecurity and destitution of old and sick, and pleaded for social and economic reforms.

The Socialists

2.7 Marx,⁵ the best known socialist demonstrated the existence of the inevitable conflict between labour and capitalist order due to exploitation, and explicitly stated the concept of surplus value due to which the price of labour tends to fall. He elaborated the social costs arising from technological improvements, which lead to immense losses and hardships when firms broke down and capital was withdrawn. The social costs, he said, also occur when the firms move from one

level of technology to another (during transition). The other socialists Robert Owen⁶ and Charles Kinsley⁷ were also aware of severe evils inflicted on certain sections of society.

These Marxist ideas of unaccounted social burden inflicted by the very nature of private enterprise are too wellknown to need elaboration. Perhaps the most systematic investigation into "human costs" of the Industrial Revolution was conducted by Friedrich Engels. He spoke eloquently of the damages of air pollution. "Two hundred and fifty thousand fires," he said... "crowded upon an area three to four miles square, consume an enormous amount of oxygen which is replaced with difficulty because the methods of building cities in itself impedes ventillation. The carbonic acid gas, engendered by respiration and fire, remains in the streets by reason of its specific gravity, and the chief air current passes, over the roof of the city. The lungs of the inhabitants fail to receive the due supply of oxygen and the consequence is mental and physical lassitude". This passage is as relevant today as it was in Engel's times.

The social costs in Agriculture

2.8 The social costs in agriculture were recognised by Charles ^{ou}Furrier. While discussing man's attitude toward the soil he said "we fall far below the savages.... for we do not, like them, confine ourselves to leaving them (forests) uncultivated in their primitive state, but bring the ^{axe} ~~axe~~ of destruction, and the result is landslides, denuding of mountain-sides, and the deterioration of climate. This evil, by destroy-

ing the springs and multiplying storms is in two ways the cause of disorder in the system. Our rivers constantly alternating, one extreme to the other, from sudden swellings to protracted droughts, are able to support only a very small quantity of fish, which people take care to destroy at their birth reducing their number to a tenth of what they ought to produce. Thus in the management of waters we are complete savages."⁹ A passage like this one has been rarely surpassed in clarity and comprehension. In the same vein, Justus von Liebig gave a warning that if we do not succeed in making the farmer aware of the conditions under which he produces, it will lead to a ruin of agriculture. As Marx has said, "all progress in capitalist culture is a progress in the art of not only robbing the labourer, but also robbing the soil, all progress in increasing the fertility of the soil for a given time is a progress towards ruining the lasting sources of that fertility." The Fabian socialists in Britain : Hobson¹⁰ and the two Webbs¹¹ focussed their attention on the social costs of industrial location. Oskar Lange¹² went a step further and said that one important distinguishing feature of a socialist economy is the comprehensiveness of the items entering into the price system, such as maintenance of the unemployed, provisions for the victims of occupational disease and industrial accidents. J.M. Clark the famous institutionalist, demonstrated that such costs in a private enterprise system get diverted into social overhead costs.

Divergence between marginal social and marginal private product

2.9 Undoubtedly the most important work which still serves as an inspiration to all students of non-market interdependence is the classic volume by Pigou, "The Economics of Welfare" and his later work "Socialism Versus Capitalism".¹⁴ The welfare of society he said is the product of a large number of economic factors (all those which are explicitly subject to monetary quantification), and the non-economic factors (those which are either beyond money calculations e.g. subjective value judgements, or those which are non-quantifiable today due to an absence of necessary factual data, or a paucity of adequate mathematical and statistical tools - e.g. inter-personal comparisons of utility, calculation of the social costs of resource depletion or environmental degradation.) Of course Edwin Canan had aptly pointed out that this distinction is not demarcated by a precise line, but is often overlapping. He was the first thinker to state explicitly that the effects produced on that part of welfare that can be brought into relations with the measuring rod of money may be cancelled out by effects of a contrary kind brought about in other aspects of welfare, And ^{that} if this happens, the practical usefulness of economics would be wholly destroyed. He realised that 'Economic welfare' alone cannot serve as a barometer or index of total welfare, because conscious life is a complex of economic satisfactions and dissatisfactions, along with cognitions, emotions and desires. "Environmental causes", he said "operating

to change economic satisfactions, may, therefore, either in the same act or as a consequence of it, alter some of these other elements". This was the first comprehensive resurrection of "The Environmentalist Doctrine" of Hippocrates.

(To this he added the dimension of income distribution.)

He said further that, Non-economic welfare is liable to be modified by the manner in which income is earned", because the surroundings of work react upon the quality of life.

Pigou has here quoted Mukerjee, ¹³ who described the Indian village. "The collaboration of family members", he says,

...."not only economises expenses but sweetens labour". Pigou's ^{or} sensitivity is observed when he says that "In modern competitive economic activity, trickery and mutual suspicion become important values, and this circumstance has its influence on the general tone of life. To cheat becomes normal and honesty and loyalty attain a secondary place.....", ".... the personal alienation of the employer from his fellowmen" takes place. Pigou's ideas that a) it is not only the production process but even consumption itself - e.g. different types of consumption, vices, luxurious ^{and} sensual enjoyment, opium eating etc. have different effects on the quality and tone of life; and b) the elaboration of "time preference" - i.e. desires and satisfaction work themselves out by checking the creation of new capital, and encouraging people to use up existing capital to such a degree that large future advantages are sacrificed for smaller present ones; - are the burning issues today which all countries are facing. He felt that the

natural tendency of people to devote too much of their resources to present service, and too little to the future service is bound to have an adverse impact on welfare in the long run. And consequently he proposed that the state should take up the interest of future generations, against the effects of our irrational discounting and our preference for ourselves over our descendants. The only way to maintain the capital in tact, he felt, was to make good the loss of capital stock due to physical deterioration.

Perhaps the most crucial contribution of Pigou was his analysis of the causes leading to 'divergences between marginal social net product and marginal private' net product. He stated that in general, industrialists are interested, not in the social but only in the private net product of their operations, and self interest tends to bring about equality in the values of the marginal private net products of resources invested in different ways. "But this ^{he said} by itself cannot bring about equality in the values of 'marginal social net products, except when marginal private net product, and marginal social net product are identical, and as this is rarely possible, a divergence between the two arises." "The source of the general divergences", he explained.... "is the fact that, in some occupations a part of the product of a unit of resources consists of something which, instead of coming to the person who invests the unit, comes instead, as a positive or negative item to other people". He listed a number of illustrations e.g. Divergence due to the overrun of a neighbour's land by

rabbits originating from game preserves; the ^ed~~i~~struction of the amenities of neighbouring sites, by the construction of a factory in residential districts, weaning out of roads by motor cars, increased expenditure on police and prisons due to the production and sale of intoxicants, the cost of competitive advertising, and the various negative effects of monopolistic practices. Thus Pigou's was the first systematic attempt to integrate the concept of social cost in the entire analysis of value and distribution.

The stock and flow of natural resources

2.8 There are two more important writers who studied this concept in the classical and neo-classical framework. K. William Kapp,¹⁴ although operating in the neo-classical style was the first to put in empirical content in the theory of social costs. Methodically and systematically he unfolded the various types of social costs that had arisen in the course of American Economic development. It was indeed very apt that the first attempt at empirical analysis and monetary quantification of social costs should be done in a country where natural resources (free goods) were not just exploited but ravaged and plundered. The protestant ethic of individual success, achievement and aggrandisement had reached its zenith in the American way of life. For the first time, Kapp dealt with air, water and land pollution as important economic issues, devoid of all the unnecessary theoretical trappings. He integrated the concept of "ecological balance" and "environmental degradation" into sound theoretical economics, and insisted that environmentalism was not merely protection of 'wild-life', but sound economics concerning optimal utilization of renewable (flow)

and non-renewable (stock) resources. It is very interesting to note that economic theory has used the 'stock' and 'flow' concepts while dealing with the monetary analysis of income and wealth, but one does not come across any reference to natural resources in this fashion. Most economic literature begins with "given the natural resources" as if resources are fixed once and for all. The reason for this is obvious. Unless one fully understands the principles of eco-system; i.e. the fact (a) that resources like forests, water reservoirs, live-stock are really flows and (b) that if they are properly managed and exploited can be perennially used and that (c) there is a definite proportionality, dependence and a cycle within and between the physical and living organisms; ~~the~~ ~~understanding~~ the analysis of the material factors of production *would* ~~be~~ *be* meaningless. Kapp was one of the first to make use of statistical data to attempt a quantification of social costs. e.g. the wage loss compensated by insurance companies due to various medical reasons, in dollar terms, or the estimation in money terms, of the loss of ~~petroleum~~ ^S ~~reserved~~ due to premature plugging or drilling of too many wells in a small area. This shows that once a social cost is identified, its calculation is possible if time-series data are available on sectors concerned. Was not Malthus's¹⁵ celebrated thesis on population a manifestation of this kind of total perception? But Malthus has been unfortunately forgotten by economic theory as only a minor dissenter. It is only today, when the population growth has crossed the bounds of ecological proportion

that the study of demography has gained prominence. And yet economic theory considers demography as an 'exogenous' factor. These attitudes are obviously the shortcomings of the prevailing economic theory. It is a matter of dismay and regret that, unless a phenomenon fits neatly into an econometric model, or can form a part of 'price-mechanism' framework it is not considered respectable economics. The irony is that we have a host of specialists, in our discipline, who can systematically work out the different parts, but very few generalists who can sensibly put all these parts of the puzzle together. And the few that exist are deprived of any position of respectability in the elite circle of economists. K. William Kapp was one such man.

Coase's objection to state intervention

2.9 Another important thinker who has contributed to the theory of social costs is Prof. R.H. Coase¹⁶ who in his short but brilliant article on "The Problem of Social Cost" has added a new dimension to the understanding of the concept. Pigou and Kapp had made a strong case for state intervention and legislation, and Coase argued against it. His arguments were based on a few legal cases, and he argued that in some cases it was possible that legislation could lead to losses to individual firms which were greater than the advantage gained by society. But such cases being exceptional, one cannot say that legislation would be socially disadvantageous. Being of a legal bent of mind, he demonstrated with the help of several empirical cases that the problem is not restricted to the one

way relationship between the party responsible and the recipient, (or the affected party) of the 'bads'. He shows that the conventional "tax-bounty approach" (i.e. equalizing the costs and benefits by compensations and taxes) is inadequate. He explained that, that which is 'bad' for one is 'good' for another, and hence by compensating one we may be harming the other, so while framing policy the different causes and effect and their reciprocity must be taken into account. He further added that legislation or state-intervention may lead to a different resource utilization or consumption pattern which may not be preferable to the earlier one. Now the logic of his arguments is absolutely impeccable; but (fortunately) his conclusions have been belied to quite an extent during the last two decades. The experience (post legislation) shows that social legislation has done far more good to the cause of balanced growth and public welfare, than the disadvantages or losses it has caused to private entrepreneurs or consumers who cause the 'bads' (e.g. petrol consumers). Another analytically important point he made was that (as observed above) the problem is not merely that of identifying or locating the parties concerned, because of the mixed and complex nature of the effects. It is well nigh impossible to isolate and quantify the 'social cost' (and benefit). Hence he says the problem is that of education and awareness (rather than legislation and state intervention). This view held by Coase is of course open to argument. But what is more important is the fact that his paper led to a very vigorous debate during

the 60's and 70's, which has not yet ended.

The Turning Point

2.10 In the preceding analysis we have shown that the environmental issues had been perceived by many thinkers and that in the works of Pigou and K. William Kapp we find most of the crucial ideas, though in the form of digression from the main body of economics. Now the question is, why did this knowledge and awareness ^{not} percolate from the theoretical constructs to the actual industrial practices? We can think of two reasons.

One could be that realisation of these ideas was not of 'immediate' interest to the private (or even public) entrepreneurs, because they preferred present income from capital and private property, rather than higher income at a future date. Secondly at the social level, the problems of social costs had not reached dimensions which could force the intelligentsia to reflect in retrospect. This reason was inherent in the very character^{of} of 'social cost' which is cumulative.

Thirdly the cumulative process has the implication of acceleration. In the past, the misuse of land or emission of smoke would become cognizable ^{only} after one generation or even more. But after the 50's the cumulative effects have reached a proportion which leads to environmental degradation within a few years.

The Environmentalist's Decade

2.11 The late sixties and the early seventies witnessed events which were so disconcerting, ~~that~~ ^{that} it affected not just the economic thinking but the very concept of economic growth and social progress. The West was suffering from

obesity and the east was fighting for survival and existence. The divergence and the disparity between the two worlds had become phenomenal. The other major crisis, was the one that created the 'opec' oil-cartel. The world suddenly realised (though rather late) that it was moving too fast, that it was using up, nay plundering, natural resources at an unprecedented speed, and that the problems arising out of the very process of growth were becoming intolerable.

The Club of Rome

2.12 It was no surprise that 'The Club of Rome'¹⁷ came up with a report on the 'Predicament of Mankind' which unnerved the scientists and jarred the economic growth mania^cs in the year 1972. In April 1968, thirty brilliant men from ten countries gathered in the Accademia dei Lincei in Rome at the instigation of Dr. Aurelio Peccei and passed a verdict on the present and future predicament of men, and the project was completed by the end of 1971. The crisis had come, and in 1969 U Thant declared that "The Members of the United Nations have perhaps ten years left in which to subordinate their ancient quarrels and launch a global partnership to curb the arms race, to improve the human environment, to diffuse the population explosion, and to supply the required momentum to development efforts. If such a global partnership is not forged within the next decade, then I very much fear that the problems I have mentioned will be beyond our capacity to control."

The Early Warnings

2.13 It is very heartwarming to note that it was an economist

- Dr. E.J. Mishan¹⁸ who had anticipated the essence of the Club of Rome debate in 1966 itself. 'Mishan's scepticism about economic growth' appeared in a review of a volume edited by Agarwala and Singh.¹⁹ Since then he has not looked back. He has given a definition of economic efficiency which is most unorthodox; and highly satisfying to the generalist. Galbraith²⁰ with his critique of "The Affluent Society" and Mishan's book on "The Costs of Economic Growth" are excellent reminders of the fact that "more is not necessarily better", and in the same vein that "less is also not necessarily better". Mishan begins with an attack on growth-maniacs, and when asked the question - what is the alternative to economic growth? he gives the rhetorical (but profound) answer - not rushing for growth. Following K. William Kapp's cue, he has analysed the process of marginal cost pricing in a modern economy; and reached the conclusion that one can no longer take it for granted that the market price of a good is an index of its marginal value to the society. Analytically of course this is an old story by now, but the important contribution is the idea that, even if all the social costs arising due to the externalities were exactly and perfectly calculated and the exact balance established between the costs and benefits; what is the guarantee that the increased gross product necessarily increases the welfare of the society? (Keeping the time horizon in mind). The process of growth has brought about a pattern of consumption that does not necessarily indicate an improvement in the quality of life. He says, if the heap of electronic gadgets and the

synthetic material could make us happier there would be no problem, but it doesn't. It only reduces our sensitivity to what is really beautiful in nature, it makes us incapable of enjoying what really counts - i.e. a healthy life, clean air and water and a sense of purpose. It alienates us from what we need most - a sense of mutual harmony and balance, and peace within oneself and with the rest of the world. We know, he says all about the world, but practically nothing about our neighbours. Goodwill and camaraderie are replaced by deceit and competition, sharing is replaced by one-upmanship. This discussion quickly reminds ^sup of Pigou's statement "Efforts devoted to the production of people who are good instruments, may involve a failure to produce people who are good men". We can conclude this subsection by saying that at last enough had been said to make the doyens of theory accept the 'non-market-interdependence' as a factor to be reckoned with, and, we see its incorporation in Samuelson's "Positive Economics"²¹. The idea has crossed the fence, and in due course it will settle down and get accounted for in the main body of economic theory.

The Birth of Environmental Economics

2.14 Several thinkers during the seventies suddenly realised that trying to explain economic efficiency within the straight-jacket of market mechanism was both difficult and unnecessary. We have to look for a more satisfactory indicators of human welfare. This would involve a great amount of research and fact finding, development of time series data on a) effects of

pollution on physical and mental impairment of human and other life forms, b) effects of new agricultural techniques on geomorphic - cycles and soil-quality depletion. c) anticipating natural readjustments bio-evolutionary reactions in the form of flash floods, earthquakes, changes in rain-cycles mutations in insects - animals - fish and bird species, d) and finally estimating the dimensions of these kick-backs.

Natural resources and National Welfare

2.15 We now propose here a new environmentalist model of economic activity to replace the G.N.P. maximizing model.

Conventional ~~Old~~ Model

- I. Natural Resources (Stock)
 - II. Human activity and Economic processes
 - III. Final Product
 - IV. Minus waste and other social costs of growth
 - V. = Net National Welfare
-

New Environmentalist Model

- I. Natural Resources (Stock) & (Flow)
 - II. Economic Process
 - III. Final Product
 - IV. Minus waste and other social costs of economic growth
 - V. a) Plus, Recovery from waste
 b) Plus Renewal of Resources
 c) Plus positive effects of Environmental protection
 d) Plus recycling of product & waste
 - VI. = Net National Welfare
-

Old Model

2.16 In the old model, Net National Welfare is derived from a given stock of National resources. When the national resources get depleted the flow of final goods also gets reduced. There is no link or feed-back from economic activity to resources. In other words it does not maintain the capital (Natural Resources) intact.

The New Environmentalist Model

2.17 In the new model natural resources are renewed, product waste is recycled, new products are recovered from waste and an attempt is made to conserve the capital (Natural resources) and maintain it intact. In other words there is a flow-back from economic activity to Natural resource. Net National Welfare are linked in both directions.

2x18Main elements of the New Model

- 2.18 The pioneers in this field have concentrated mainly on :
- a) Defination, Estimation of resource-use and pollution costs to society in Industry, Agriculture, Trade/Transport (Internal and External)
 - b) Examination of alternative possibilities as regards
 - i) Minimum resource utilization of material resources
 - ii) Changing and innovating production processes for minimising material waste and pollution (as against profit maximization, which of course continues to predominate)
 - iii) Recovery of products from waste, cost of recovery and benefits thereof.
 - c) Evolving policy measures and environmental standards
 - d) Studying the impact of environmental policy on the pattern of trade (international)

(4) Application of the "Stock" and "Flow" concepts to all natural resources — i.e. looking at such resources not as 'free bounties of nature', but as capital which can depreciate and/or get depleted.

e) Evolving macro-economic policy for an optimal growth path (by reducing consumption of non-renewable resource, and increasing public outlay on regeneration of renewable resources)

f) Evolving an inter-disciplinary approach so as to integrate the conclusions and analysis in almost all other natural and social, sciences (mainly integrating the principles of 'ecology' into the economic-systems and stressing the environmental interdependence between physical and living sub-systems, and the element of proportionality.

This new framework provides the basis for finding out whether the social costs are greater or less than the benefits from economic growth.

Review Research of Recent Literature

2.19 There has been a mushroom growth of literature on this subject and perhaps in the last decade this branch has grown at a speed (both in volume and substance) unprecedented in other branches of economics. It would be beyond the scope of this study to review the entire literature, and hence we will restrict ourselves to the better-known authors on each of the aspects mentioned in (4.2).

2x20 Materials/Energy Balance Principle

2.20 The aspects of definition and estimation will be dealt with more elaborately in the next chapter where the work done by several writers will be referred to, to buttress our attempt at calculating (very crudely) and identifying (systematically) environmental pollution in our country.

One volume by Robert U. Ayres²² on the applications of the Materials/Energy Balance Principle titled "Resources, Environment and Economics" is in our opinion, technically the

most competent work attempted so far acquainting us ^awith environmental systems analysis. He has elaborated certain methodological issues dealing with econometric models that can be used for estimating costs. Ayres is himself sceptical about the reliability of such statistical methods, and especially for our economy it will be quite some time ~~z~~ before we have historically significant data for using such methods. But the book is and will be ^agreat help in showing where and how the interdisciplinary fusion can be accomplished in the construction of large scale realistic economic models for policy analysis. Being trained in mathematical physics, he ^{has} beautifully integrated the problems of social cost calculation, with production functions for material processing activities, returns to scale, isoquants, output and substitution elasticity and the "First Law" Concepts of economic efficiency. Much of the theoretical analysis and linear programming models for energy allocation and residuals management is too intricate and cannot be explained (or easily understood) within the scope and limits of this paper.

Quantification of Pollution

2.21 It will be appreciated that measurement of the 'social cost' comprehensively, ~~xi~~ is, as of today, an almost impossible task. But at less ambitious levels, the costs of pollution control, expenditure on health (rather, illhealth caused by pollution) expenditure on reclaiming or rejuv^einating deformed or degraded resources, public expenditure on recreational facilities where 'outdoors' are out of reach, costs of protecting

wild life national parks and sanctuaries can all be calculated reasonably well. Estimates of this sort are available in Virginia Brodine's²³ "Airpollution" - ed. by Barry Commoner, Shorter papers by Peter Bohm²⁴, Mailer²⁵, and Lave and Seskin²⁶, all analyse the problems of estimating demand for public goods, social benefits from pollution control and health hazards of pollution. An excellent ^{ex}position of the economic analysis of Environmental pollution is contained in a paper by Allen V. Kneese.²⁷ The most voluminous work on these aspects has been on behalf of "Resource for the Future Inc." in the United States.

Policy and Environment

2.22 On Policy and Economics of Environment, a good work dealing with Emission Standards, Taxes Civic Sewage treatment, water and air quality standards is available in Freeman, Haveman Kneese's book "Economics of Environmental Policy."²⁸ The classic volumes on air pollution standards ^{are} ~~is~~ by Stern.²⁹ On water pollution the best guiding document is the "Canada Water Act"³⁰ passed in 1970. Another important work is a volume published by United Nation on the ECE "Symposium on problems relating to Environment"³¹ where a lot of stress has been given ^{on} ~~to~~ issues relating to international co-operation for resource-use and management, pollution abatement policy, and the legislative experiences of several countries including the European Socialist countries. An important direction in which the study moves is concerned with impact of Environmental Legislation on International Trade patterns.

Pollution in Capitalist and Socialist Systems

2.23 An important conclusion of analytical importance which one can reach after reading the U.N. document is that Environmental degradation can be attacked as effectively in capitalist countries as in Socialist countries, after it has arisen as a problem. But, socialist countries (after becoming aware of the problems) can prevent further degradation far more effectively due to the inherent comprehensiveness of their planned investment, production and consumption, as there is much less friction [?] between public and private awareness.³² The systematic reclamation of disused lignite mines, integration ^{of} environmental factors in the national master plans, and legislation for optimal water-use and pollution abatement are brilliant examples of the socialist method of tackling such problem in the German Democratic Republic.

Industrialization and Environment

2.24 The preceding discussion might lead one to a conclusion that environmental degradation is a problem of the industrialised west. But the truth is far from it. On the issue whether developing countries can afford to invest scarce capital on environment protection, the decisive conclusion is that, for developing countries the need for efficient resource management and pollution abatement is even greater than the industrialized west; because with us the paucity of resources (per capita) is even greater. But this will be discussed more in the next chapter.

National Vs. International interests

2.25 And lastly we refer to the "Studies in International Environmental Economics" by Ingo Water,³³ wherein there are

papers on controls on international trade, possibilities of conflict between national environmental policy and international interests. Of notable importance, are the articles by Jaleel Ahmed, William J. Baumol, and David Pearce.

Conclusion

2.26 In the foregoing paragraphs we have reviewed the ideas of most of the important contributions to the theory of (Environmentalist) social costs and it leads us to infer that.

a) Many of the classical and neoclassical writers were aware of these problems but their work did not gain a substantial position till almost the end of 1960s, and even after that the problems (perhaps due their inherent difficulties) have been discussed more as an embarrassing adjunct. The change is, that no serious discussion of current economic problems can be discussed without reference to the social costs of environmental pollution. Perhaps what is more significant is that many economists have broken away from the economic establishment and created a separate place for themselves. — *as environmental economics*

We had started with the statement that environmental issues had not been given their due place, and ~~and~~ ^{and even} after going through the work of various writers, the initial statement still stands. Even today's textbooks on economic theory call air and water "free goods". Now let us begin the next chapter, where we will start by defining the concept of 'environmental pollution', and elaborate its various forms, and then go on to identify the different problems in the Indian economy.

Chapter II

Definition, Classification ~~of~~ and elaboration of
Environmental Pollution, with reference to
Greater Bombay area.

Omit-

Environment

3.1 We define 'environment' as the sum total of all the external conditions and factors influencing the development and existence of an organism. The organism, on its part, may also influence the environment in a greater or smaller proportion, depending on the scale and nature of its activities. Thus the organism and its environment are not mutually exclusive. The concept of 'ecosystem' is wider, and also very useful as it includes all living organisms as well as the abiotic factors of the environment in which the organism lives. It is necessary to understand that the factors affecting the organism (and the effects of the organism's existence of) may be either easily perceptible to us, or may be very imperceptible. This qualification is important because an important cause of the neglect of environmental problems can be ^{traced} ~~traced~~ to this imperceptibility. Similarly, man's environment includes not only the physical and living organisms around him but also the social phenomena like culture, language etc.

Man - the new geological force

3.2 What is important for our study is the fact that man, more than any other life forms, had developed the ability to modify his environment faster (and greater) than the environments ability to affect him. He has caused the existence of a new "biome", or an ecological formation - i.e. a landscape altered by man, where previous vegetation is cleared, lands are ~~run~~ plowed, the courses of rivers are changed or dammed, and dry

deserts bloom. Man has dominated this biome so much that other organisms have been affected greatly. He has exterminated some species and domesticated and bred other with unprecedented rapidity. The biome includes widely varying subsystems like cities, towns, plantation, irrigation networks etc. almost completely under his control. Man has become a new geological force.

Will Nature tolerate man?

3.3 Now the question is, is man changing his environment in consonance with ^{his} ultimate purposes and goals? Or, does he realise all the reactions (or retaliations!) which his actions may lead to? Or how long can he go on dominating the environment without there being a disastrous kickback, that could prove to be a danger to his very existence?

The Ecological Balance

3.4 Knowledge gained so far suggests that he can continue to guide and control his environment so long as he does not substantially disturb the delicate ecological balances. But evidence also suggests that man has not always followed the rules of this game, ^{⊗ Add — see over leaf} and has not consciously done much to maintain these balances, for improving and securing the prospects of his own existence.

Pollution

3.5 Let us then define 'environmental pollution' as any addition to the natural environment of any substance, energy (sound, heat) or life form in excess of, or at a rate that results in higher than natural concentrations of that substance.

In case of substance the definition can be more easily understood, as some time series data or 'stock' data may be available, but in case of energy and living organisms, natural concentrations may be difficult to determine, e.g. is the existing human population a natural concentration? No easy answer can be given. A more practical definition in the human context may be given as - any addition to man's environment of substances, energy or other life forms, at a rate that is detrimental to human wellbeing or existence is pollution.

Types of Pollution

3.6 We can group the pollution types as per (a) the resource affected, i.e. air, water, or land [e.g. dumping of toxics & non-degradable substances]. Some pollutants may affect all three; while some can be classified as short-lived (sound) or long-lived (non-biodegradable waste - D.D.T.) (b) Some pollutants are 'ecosystemic' - being rapidly absorbed and concentrated by living organisms. Such pollutants (e.g. insecticides, toxic mercury compounds) enter biological food-chains through micro-organisms (e.g. algae), and move upwards, as successively larger organisms prey on smaller ones. The pollutant concentrations may increase hundred folds at each stage of the food chain, so that the predator at the top (often man) is the most affected.

Effects of Pollution on man

3.7 The extent to which a given form of pollution is tolerated by man depends on a) the properties of the pollutant, b) the degree of exposure or concentration. c) and the resistance and the ability to acclimatize to a given pollutant. An important

characteristic of pollutants is ~~its~~^{their} persistence and cumulative nature (e.g. heat removed from metals or other substances is transferred to air or water waste disposal by burning adds smoke to the atmosphere.)

The case for Environmental Economics in India

3.8 The significance of the preceding paragraphs to economies is that (a) production and consumption the most important economic activities, are the major causes of environmental pollution, (b) that economic activity affects even the abiotic factor which sooner or later affect the economic activity itself. Therefore, while analysing economic problem of any economy the consideration of environmental factor becomes imperative for the following reasons:

1) Principally, the recognition and obeysance of the environmental factors implies an effort towards economic efficiency and optimality (e.g. changes in production processes leading to efficient resource use, recovery from industrial and agricultural waste and input composition which reflects resource endowment). This, by itself is enough reason for its justification.

2) The recognition of ^{non-paid} social costs, (externality), its identification, estimation, and incorporation into the national income accounting will give a more realistic picture of our annual economic performance, as it will remove the distortions originating from the neglect of ^{non-paid} social cost.

3) Inclusion of external costs in the entrepreneurial outlays (of both public and private firms) will correct the distortions in the product valuation (pricing) allocation of resource and determination of output. The above reasons (i.e. 2 and 3) give enough justification of environmental studies, even from the purely theoretical angle.

4) Understanding of the environmental variable will give the badly needed stress on the 'long run' criterion, which will provide for our future generation. It will lead to greater investment in "maintaining capital in tact", in the Pigouvian sense, and even generate more resources. We are aware that in a poor country like ours 'preference' for present consumption has to be recognised, but it does not mean that the future should be totally neglected. It would be criminal not to provide for the future, especially when we know that people then will be facing greater economic and demographic pressure than those existing today.

3.9 It is often argued that in developing countries, the size of the national product is small and the level of industrialization is so low that, pollution is not a major problem. But it will be appreciated that reasons 1 to 4 are as relevant to the underdeveloped countries as to the industrially advanced countries. Moreover our countries (underdeveloped) by recognizing the problem in advance have a chance of avoiding the blunders committed by the west. Though the general level of industrialization is low, we have highly industrialised metropolitan conglomerations where the problems have already become quite

serious. These large cities account for a very large population (most of which is below the poverty line). Thus for these pockets of misery, environmental issues become very relevant, and gradually this impact will be transmitted to larger adjoining areas. Thus in addition to the above-mentioned reasons, there are the following causes which apply particularly to developing countries.

5) Environmental standards, imposition of taxes and subsidies (and public expenditure) will lead to greater distributive justice by compensating the poorer sections for bearing the social cost of growth. In India evidence suggests that most of the benefits of growth (expansion of production range, and consumption of luxury goods) accrue to a small rich minority (say 10%), while the ^{non-paid} social cost in the form of air and water quality deterioration, poorer nutrition levels, congestion and cultural deterioration, and depletion of environmental amenities... has to be borne by the poor. Thus in our country, more than economic efficiency, legislation will lead to greater social & justice.

6) Similarly, experience of such legislation in India has compelled the entrepreneurs to evolve new techniques and processes which have led to import substitution, greater tendency to use natural raw materials rather than synthetic ones, tendency to recycle, and recover useful products from waste which have caused in several cases higher efficiency. (This important finding will be elaborated later).

7) Finally we have the so called non-economic criteria e.g. deterioration of human values and relationships (easily noticeable in larger cities), disappearance of natural and beautiful environments, a destruction of aesthetic sensitivity, and for many, a total alienation from the socio-economic mainstream of life. One might ask whether these are important things today, but if in the process of solving economic problems we destroy the very aims and values which we wish to attain finally, the economic progress would be self-defeating. Our children might have a few more rupees to spend in the future, (and even that is doubtful) but they may have no clean streams to bathe in, no ponds with fish, and birds chirping around, no woods to roam in, no values to live by. We cannot afford to be blind to these facts. As economist we may become expert analyst and model builders, jugglers of monetary variables, but hopeless human beings.

3.10 We will now come to the most important aspect of this paper. The identification and elaboration of environmental problems in India. We will begin with the ^{non-paid} social costs incurred in the agricultural processes in India (including forestry) ~~but will not be able to provide an exhaustive empirical account of it due to the limits of time and space of this paper.~~ ~~Further will deal with the industrial problem in greater detail.~~

Pollution in Indian Agriculture

3.11 As per our classification of types of pollution in Chapter II (2.3), the ecosystemic pollutants which affect

living organisms become important issues for our economy because they are concerned with agriculture which contributes a major part of our national income. We have gradually transformed our low-productivity system into relatively higher productive-systems, involving changes in cultivation practices. These changes are crucial but they also generate environmental side-effects of varying degree and importance. These effects it must be stressed may occur even in the traditional systems under pressure of population growth.

1) In our tropical regions the rapid leaching of ~~a~~ nutrients and degradation of planted farmland following^s the removal of forests. 2) There is also a rapid depletion of soil due to ~~continuous~~ ^{continuous} ~~permanent~~ cultivation which the relative ~~poor~~ ^{poor} infertility of soil cannot support without the addition of nutrients. 3) Soil erosion through variable and heavy rainfall and prolonged droughts and flash-floods also takes places. 4) Forest resources, are slashed and burnt quite indiscriminately. When poor villagers collect and burn firewood for self-sustenance, the position is understandable (Though measures adopted to grow special fire-wood groves for each village would considerably reduce this problem). But when contractors (often with licences given by the concerned ministries) wipe out forest after forest without being in any way obliged to plant any trees, the phenomenon is not pardonable. These measures (i.e. afforestation) may take some time, but if not taken they would become irreversible. The fragility of tropical ecosystem causes environmental deterioration to proceed rapidly and

recovery is very slow. It takes 40,000 years to form 1 inch of topsoil and if the forest cover and top-sod is removed it takes one monsoon season to wash it away. The floods ^{carrying} ~~carrying~~ huge quantities of silt, and ^{the increasingly} frequent landslides during the last years, ^{say since} (1978) were evidences of such systematic ^{ic} ~~ic~~ effects.

Himachal Pradesh and Uttar Khand (U.P.) were ravaged and the ^{non-paid} social costs of such phenomena are very great and obvious, though difficult to compute. Who is to bear this cost? The poor population of course. And who benefits from this? The logging contractors (and ^{perhaps} ~~may~~ be some revenue to the government).

Modern Agriculture

3.12 In certain parts of our country, modern agriculture throws up the problem which originates in the use of chemical fertilizers and toxic insecticides and pesticides. Of these the effects of fertilizers are more deceptive as it takes some years before the harm is noticed in the form of fertility depletion and damage to soil structure. Modern canal irrigation leading to salination (due to raising of the water-table) affected millions of acres in our country during the last two decades. Water-logging problems, similarly are also quite well recognised. Pesticides and insecticides, are highly toxic and persistent, and enter food-chains (as explained earlier) and may have unexpected and disastrous effects. Twenty years have elapsed since Rachel Carson sounded the alarm ~~in~~ ~~her~~ ~~book~~ ~~"Silent Spring"~~ in her book "Silent Spring", and yet the use of highly toxic pesticides continues unabated. We must reiterate here

that, chemical fertilizers and pesticides ^{may} ~~have to~~ be used for modern agriculture, ^{especially} for the cultivation of High Yielding Varieties of seeds, but it is very important that their side effects be taken into account. A neglect will mean unpleasant surprises in the future, ^{in the form of fertility-loss and drastic falls in productivity.}

A calculation of such damages is difficult and lot of research and data compilation will be necessary before any estimation is arrived at. ^{But this cannot be an excuse for its neglect. (X) Overleaf}

A digression

3.12 One often hears the antagonists of environment saying that the expenditure on the "Project Tiger" by the government is an utter waste. Such criticism is rooted in ignorance of the fact that the tigers are at the apex of our ecological pyramid, and a reduction in their numbers is an effective indicator of the overall reduction in all the lower life forms down to the forests and grasses. Their population (increase or decrease) is as good (or bad) an indicator of the state of our environment, as national income is of our economic well-being. "Less tigers' means less natural resources for us" sounds rather absurd but is very true. A greater understanding and appreciation of the concept of national parks is necessary.

2x Industrial Pollution

3.13 Let us now turn our attention to industrial pollution. This category falls in the type (a) as mentioned in (2.3) i.e. as per the source affected. We will deal with air pollution

and water pollution and then land pollution in that order. We have selected the Bombay-Pune industrial belt and refer to work done in Maharashtra by public and private institutions in this field. The choice of the area is obvious because of its proximity and also because ~~as~~ it is the most highly developed area industrially. The other reason is that Maharashtra is the only state where there has been effective anti-pollution legislation.

Air Pollution

3.14 We will define this term as an accumulation of any substances in the air, in concentrations sufficient to produce a measurable effect on man, animals, vegetation or materials which can be called detrimental to the welfare of the population in a given region (i.e. Bombay and Pune). This also includes the transmission of effects to adjoining areas. Any material or gas, natural or artificial, and capable of being air-borne is an 'air-pollutant'. Primary pollutants are substances emitted directly into the atmosphere from 'identifiable sources', and include aerosols such as carbon particles metallic dust industrial smoke (also cigarette smoke). This includes particles greater than .1 millimetre e.g. soot, sulphur, nitrogen and oxygen compounds important in forming various types of smog, halogen compounds and radio active compounds.

Secondary Pollution

3.15 Secondary pollution refers to the interaction between two or more pollutants or by reaction with normal atmospheric constituents in the air, with or without the aid of sunlight,

e.g. photochemical smog, when nitrogen oxides and hydrocarbons undergo reactions producing ozone and other agents that are chemical oxidizers. The major air pollutants are - hydrocarbons, nitrogen dioxides, organic acids, tars etc. (Automobile exhausts are a major agent besides the smoke emitting factories in Bombay.) Burning of fossil fuels for energy cause most of the air pollution.

Air Pollution Survey of Bombay

3.16 Having defined air-pollution we will now review the conclusions reached and the recommendations made by the "Air Pollution Survey of Greater Bombay"³⁶ 1970-1973 sponsored by the Bombay Municipal Corporation and prepared by the National Environmental Engineering Research Institute, Nagpur. This is the first report of its kind in India. It may also be interesting to note that the first legislation in this regard in India was in 1912, known as the "Bombay Smoke Nuisance Act" (in India). Later it was amended several times to accommodate ~~to~~ and adjust to the changing circumstances. It must be borne in mind that Bombay has roughly $\frac{1}{4}$ th of all industries in India. (i.e. it has 5,000 large and medium concerns in a small area of 437 sq.Km., and a population of over 6 million, with a density of 14,000 persons per sq.Km. (Note: The average all India density is 178 persons per sq.km.) and ranks 12th in the world. In addition a fertilizer unit of F.C.I. at Trombay along with other two refineries, petrochemical industries and a large thermal power station form the major industrial complex. There are over 1,50,000 vehicles emitting exhausts. In addition

the domestic fuel consumption (i.e. coal, kerosene, gas, fire-wood) also forms a major air pollutant. The survey, besides revealing the air quality status and contamination of atmosphere, ~~the survey~~ presents a typical situation as is likely to occur in the process of locating industries without a proper segregation of urban and industrial growth.

The primary objectives of this survey were 1) To establish a baseline air quality with respect to Greater Bombay and 2) To identify the sources of pollution.

The essence of the programme was to make observations on the pollution parameters, such as suspended particulate matter, sulphur dioxide oxides of nitrogen, oxidation, sulphation etc.; by monitoring the parameter at different stations. Auto-exhaust pollution, and emission inventory of different sources including transport and households.

The observations can be summarised as follows :

(1) Ambient air quality shows predominance of suspended dust with sulphur dioxide as a secondary pollutant in the area, dust content being $330 \mu\text{g}/\text{m}^3$ and sulphur dioxide being $61 \mu\text{g}/\text{m}^3$ on 24 hr. basis for greater Bombay. Pollution levels are higher during winter and lower during monsoon. Pollution increases at night and is the highest at sunrise and is the lowest at 4 p.m.

(2) Lalbaug area shows the highest level of pollution followed by Chembur-trombay.

(3) Hydrogen levels are $6 \mu\text{g}/\text{m}^3$ i.e. just below the permissible level i.e. $7 \mu\text{g}/\text{m}^3$.

(4) Emission inventory reveals industries, power regeneration and transport contribute the major share, and suspended dust and sulphur dioxide come from transport and industry respectively. Totally 260 tonnes of carbon monoxide is emitted every day, but inspite of this the level of carbon monoxide at junctions was less than 30 ppm. However, dust nitrogen oxides and organic compounds have been found in large concentrations. About 1000 tonnes of pollutant are released in Bombay's atmosphere every day, of which carbon monoxide constitutes 38.4, sulphur dioxide 34.4% and the balance is due to various other pollutants.

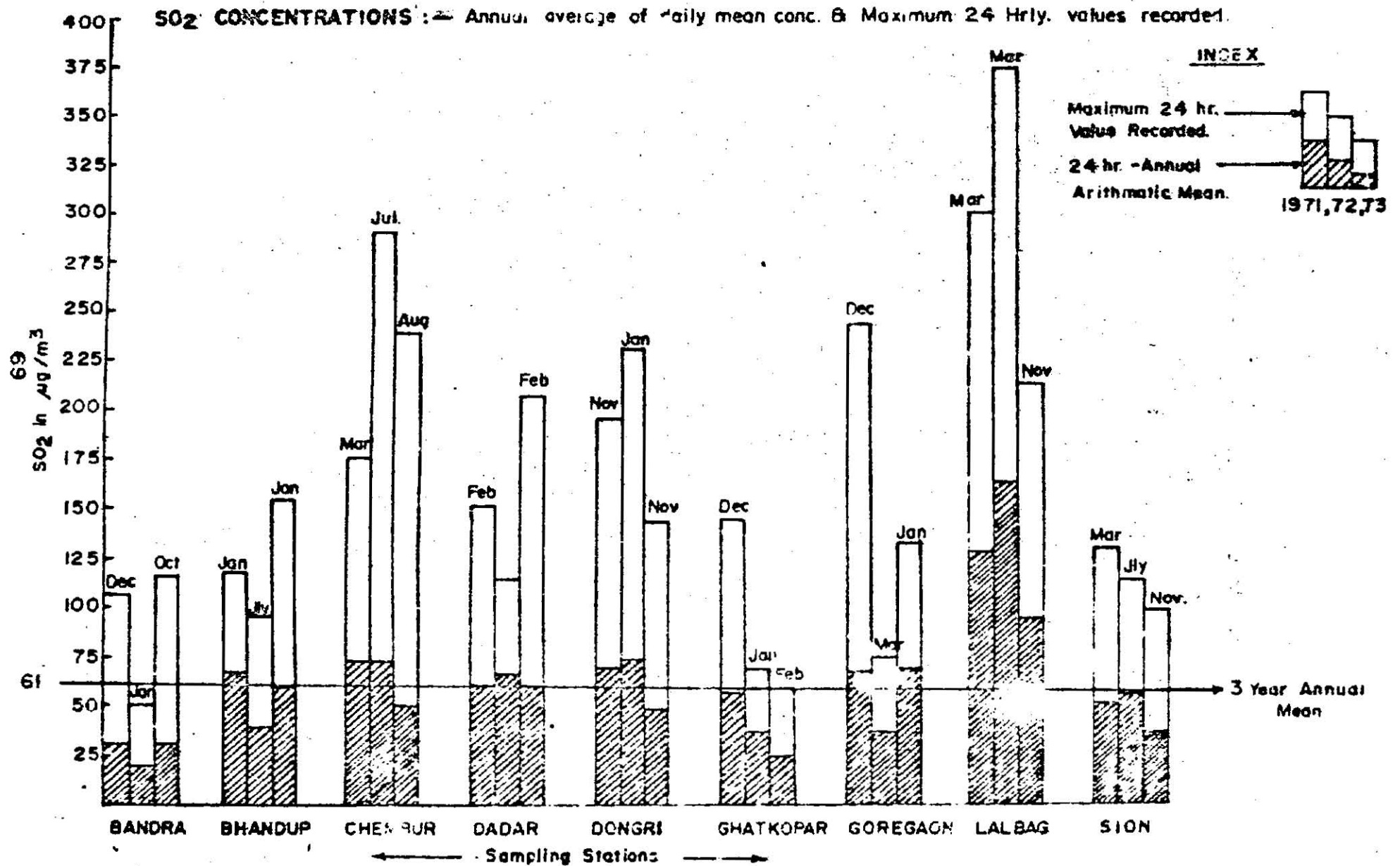
(5) The major advantage which Bombay has due to its coastal climate and island configuration, the ~~am~~ afternoon breeze helps to scavenge the pollutants, thus maintaining a relatively low level of pollution level in the air over the city.

(6) The ^{re are} 71 large chemical firms concentrated in Chembur-Trombay, and western suburbs. They are an important source of pollution.

(7) The Tata thermal power station, producing 337.5 MW. uses coal and air for firing. It consumes 1600 tonnes of coal and ~~air for firing. It~~ 1234 tonnes of blended furnace oil per day. Its unit generates 20% of the total sulphur dioxide in Greater Bombay, 63% of the total amount of particulates and 46% of the total nitrogen oxides.

(8) The table gives the distribution of pollutants from major industries per day.

Fig 4.5 BOMBAY AIR POLLUTION SURVEY 1971-73



Industry	SO ₂ Tonnes	%	NO Tonnes	%	Particulates Tonnes	%
1) Chemicals	132	44.8	19.3	29.0	8.0	22.56
2) Textiles	74	24.1	12.2	18.2	3.7	9.46
3) Power generation	62	20.9	30.0	30.0 45.9	45.9 28.4	28.4 63.25
4) Others	30	10.2	4.5	6.9	2.2	4.73
Total	298	100.0	66.0	100.0	42.3	100.0

Source : NEERI Report on Pollution (1970-73)

The above table reveals two facts :

- a) That the Tata Power Generation plant had obviously not been located with any regard to its environmental effects. The same can be said about the chemical concerns.
- b) That sans the above two categories, the rest contribute very little to Bombay's air pollution.

(9) The bar diagram depicts concentration of Sulphur dioxide in Bombay based on 3 years observations. The shaded portion gives the average observation of 24 hour mean, and the elevated open bar gives the single 24 hour maximum value recorded. Strangely enough Chembur station recorded the maximum value during the monsoon only, and this was attributed to the wind pattern, which becomes southwesterly and carries FCI emissions in the region of the monitoring station.

BOMBAY AIR POLLUTION SURVEY
SUSPENDED PARTICULATE MATTER CONCENTRATION
(ANNUAL AVERAGE-24 HOUR OBSERVATION—AND MAXIMUM VALUE)
1971-73

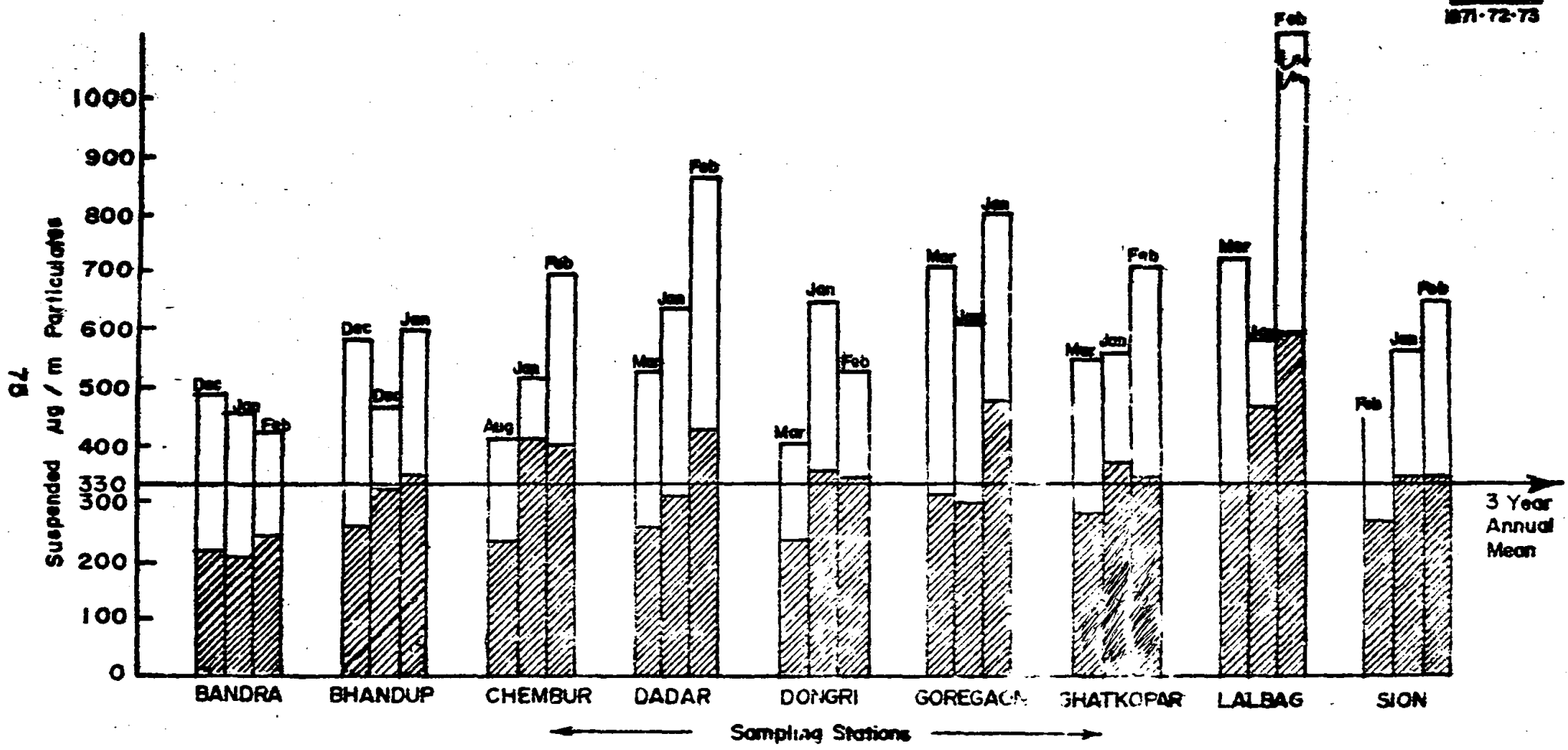


FIG. 4-7

(10) Dust concentration is below $100 \mu\text{g}/\text{m}^3$ in non-polluted atmosphere. The permissible standard for dust has been accepted in conjunction with SO_2 and ranges from 100 to $150 \mu\text{g}/\text{m}^3$ in different countries. With this in mind it is obvious that the dust level in Bombay ($300 \mu\text{g}/\text{m}^3$) is far above the permissible levels, and the maximum recorded (range from 500 to $700 \mu\text{g}/\text{m}^3$). The maximum recorded levels are in the winter months January and February, and even the lowest recording ($200 \mu\text{g}/\text{m}^3$) which are during monsoon, are higher than the standard.

(11) Lead and volatile matter was recorded at $.2 \mu\text{g}/\text{m}^3$ in 1972 and $.32 \mu\text{g}/\text{m}^3$ in 1973. The highest recorded was 5.7 at Goregaon. At Bandra and Dadar the level was 7.9 and $7.4 \mu\text{g}/\text{m}^3$ respectively. Volatile matter was found to be 40% of the total dust.

(12) Other pollutants - nitrogen dioxide, oxidants and hydrogen sulphide were found to be low.

When the above information is analysed in the light of "Air Quality Criteria and Guides for Urban Air Pollutants" - W.H.O. expert committee report No. 506, 1972, we get indications of the possible damage done to human health in different areas of Bombay. WHO defines CO_2 as a pollutant when it exceed .03%. Now, it must be remembered that the relation between pollution is difficult to determine because of several other variable factors, the most important of them being state of individual health. A person in a precarious state of health may succumb to pollution stress which may

be easily tolerated by normal persons. Therefore, WHO suggests that while using air quality criteria, one should ideally have available a complete set of dose response curves for the different air pollutants for different types of populations exposed and for different effects. This requirement is far from the situation prevailing today. But even with these limitations we can make some tentative assessments. The table below gives expected health effects on selected population groups.

Expected health effects on selected population groups

Pollution	I Excess Mortality and hospitalization (daily average)	II Worsening of patients with pulmonary illness	III Respiratory symptoms	IV Visibility annoyance etc.
SO ₂	500 $\mu\text{g}/\text{m}^3$	500 - 250 $\mu\text{g}/\text{m}^3$	100 $\mu\text{g}/\text{m}^3$	80 $\mu\text{g}/\text{m}^3$
Smoke	500 $\mu\text{g}/\text{m}^3$	250 $\mu\text{g}/\text{m}^3$ daily average	100 $\mu\text{g}/\text{m}^3$ Annual mean	80 $\mu\text{g}/\text{m}^3$ Annual Arith. Geom. mean.

The above standards have been arrived at under certain assumptions and conditions, which it would not be possible to elaborate. In Bombay Category I is a very rare phenomenon but II, III and IV have been observed to occur quite often.

It has been observed that inhalation of carbon monoxide, the result is to reduce the capacity of blood to transport

oxygen. A saturation of 4% and above has been considered dangerous (except in smokers who have a higher initial Co level in their blood. Therefore, WHO suggests, by and large protection against levels above 4%.

Generally sensitive vegetation is damaged at levels below those known to cause even eye-irritation. The obvious conclusion one can draw is that a massive tree-plantation programme could considerably reduce the pollution effects, as coniferation is a natural absorber of pollutants. Similarly the chemical industries could be gradually dispensed to locations away from Bombay.

A typical hypothetical case for dismantling the Trombay Power Plant is offered below. The plant has 4 units. (Two fired by coal and two by furnace oil). If only one new unit is installed (say near Panvel), and when it is commissioned one old unit is closed down, dismantled and transferred. By the time the old unit could be dismantled and transferred, and so on till all the four are shifted. This would mean that there would then be one extra unit. Suppose this entire operation costs Rs. 40 crores, the benefits flowing therefrom could be worked out as follows. 1) Benefits from the additional unit (i.e. 4+1) in terms of extra power generating capacity. 2) Creation of new employment. 3) Benefits from the reduction in pollution (the old site could be converted into a park) 4) Long-run effects on the growth of Panvel industrial area etc. 5) Reduction in a) pressure on Bombay's civic amenities, b) expenditure on medical aid, c) loss of

working days etc. 6) Reduction in the cost of power-generation due to the adoption of newer techniques and so on. If all these advantages work out to anywhere close to Rs. 40 crores (if not more) then the transfer would ^{be} ~~be~~ worth the trouble. We have tried to show that even with all the limitation of the technique of calculation of social cost, an approximate cost-benefit analysis could be of much value in many cases. The survey has, thus given ample information on the sources, and the quantities of pollutants, which could be helpful in making Bombay a more tolerable city. The report has made many recommendations as regards standards, most of which have been accepted by the government and incorporated in the forthcoming act.

~~xxx~~

Water Pollution

3.17 Accumulation of physical, chemical or biological substances in oceans, rivers, lakes, streams, that are directly harmful to life, or has dangerous long-term secondary effects e.g. sewage, industrial waste (liquid), garbage and refuse etc. can be called pollution. These lead to effects which are much more severe ~~and~~ than air pollution. The endemic nature of epidemics like cholera, typhoid, and gastro-intestinal ailments demonstrate the importance of clean water in Bombay city. The problem is not restricted to water-treatment, but extends to timely disposal of waste, leaking sewers and drains, unhygienic habits and processes in public eating houses etc.

It is known that all human wastes (organic) are biodegradable if enough ~~org~~oxygen is provided. In case of the non-degradable material like salts and other chemicals, ^{the substo} often increase the acidity or alkalinity to an extent at which living organisms cannot survive. Sediments besides being themselves harmful can produce bacterial or alga growth. Industries often dump materials and metals like lead and Mercury which are very poisonous.

Mahim Water Pollution Board

37

A water pollution report of the Mahim Creek revealed some very useful and disturbing facts. It revealed that Mahim Creek, which 20 years ago was a fish-landing and oyster-producing area, has turned into a smelly swamp incapable of supporting even representative species of fish. The complete bio-mass of marine life has disappeared and the creek constitutes a major health hazard to the adjoining areas. This has come as a sequel to an unplanned industrialization and population growth in the Bombay-Mahim Creek area.

Briefly we may mention the causes as follows:

(1) The organic matter from sewage consumes oxygen from water and renders it toxic, i.e. the bio-chemical demand for oxygen is very high - (B.O.D.) it is 400 ppm as against the norm of 25 ppm.

(2) Therefore, the dissolved level of oxygen supply in water is very low, reducing the marine life. The oxygen level is Nil - to 1.1 - against the norm of 4.

(3) This encourages the growth of unaerobic parasites viz. guinea worms^m, hook worms^m, which enter and harm the human body.

(4) The suspended solid matter is high. This leads to choking gills and respiratory difficulties for fish. The level of solids is 1600 as against the norm of 100.

(5) Experiments have shown that all fish die in this water within 3 to 6 hours indicating a very high toxicity. A dilution of 1:3 is required before the sample water can support aquatic life.

(6) The creek receives, 328 million litres of domestic effluent and 21.15 million litres of industrial effluent each day. This effluent is untreated with a BOD of 400 ppm. The BOD values are around 100 during high tide and would have to be reduced to 25 mg/l for fish to survive.

(7) The abatement of pollution is essential so that marine life can exist in sufficient quantities and assist in keeping the water unpolluted by feeding on the bacteria.

(8) Pollution affects bird-life by -

- a) reducing the marine life on which birds feed, and
- b) by direct absorption of harmful substances.

The presence of water-birds is essential because they feed on the organic matters which can cause bacteria and disease.

(9) The high solid contents gets trapped in the marsh and putrefies. The topography of the area suggests that even if the water flow is improved the marsh may not allow complete drainage of effluents into the sea through the creek.

On the basis of these conclusion the following recommendations were made.

(1) Effluents are diverted straight into the sea, a sufficient distance away after due treatment. (Note : This proposal is presently under consideration of the Bombay Municipal Corporation, help has been sought from the World Bank to construct a tunnel to the proposed Bandra Sewage treatment unit with a capacity of 1764 (MLO). It is then expected that treated effluent will not return to the shore and will have a Coliform (i.e. Bacteria) below 1000 number.

(2) Till such a system materializes, partial treatment of industrial and domestic effluents be introduced to minimise the harmful effects.

Source of the Effluents

It was observed that there are 100 large and small industrial unit upstream. The majority being a) Dyeing and printing, ⁽²⁵⁾ b) Tanneries (in ~~20~~ Dharavi (30)), the rest are oil-mills pharmaceuticals, chemical industries, textiles, and engineering units. Due to these industrial units the sulphate content has gone up so high 2000 mgs/litre, that it is capable of attacking even concrete structures (e.g. Thana creek fly-over).

After going through the report and its recommendation the following facts emerge.

(1) The damage done to the Mahim Creek could easily have been avoided if legislative action had been taken at the outset of the industrial development (say 20 years ago.).

(2) The entire damage to the area in the form of a) loss of fishing employment through the reduction ^{of} opportunities
 b) the physical loss of the much needed fish for consumption
 c) the losses due to unhygeinic condition and endemic gastro-intestinal afflictions. d) the increased cost of effluent diverging tunnels (which would have been lower had it been constructed earlier), expenditure on public health and hygiene. All these can be called the 'social costs' the society has had to bear because the industrial firms could 'shift them' and reap the benefits.

Land Pollution

3.18 Having dealt with air and water pollution let us try to identify the land pollution in the ^{area} Greater Bombay. As no survey or study is available, we can only make cursory comments. The main source of land pollution is civic garbage and industrial solid waste. This is actually 'damped' either on public or private land. ^{As regards} ~~In case of~~ waste dumping on public land by enterprises, ~~is concerned~~ it is a clear case of 'cost-shifting', which the society has to bear. ^{Similarly} In case of dumping on the firm's premises also it is a social cost; because although the waste is confined to the private premises the effects such as mal-odours, noxious gasses and visual discomforts are not confined to the premises or its occupants. Hence this is also a 'shifted' social cost. The problem becomes more complex in case of civic-waste (i.e. domestic garbage). Here the problem is not one of 'shifting' by ^{one} party to another, but that of society not recognising the cost as such.

Civic awareness could be the only answer to this problem.

Sound Pollution

3.19 Although no data is presently available, technique of estimating the average sound levels in terms of decibels are available which ~~x~~ could be used to estimate the pollution damage in terms of impairment of hearing, tension due to increased stress etc. This form of social cost is again rather difficult to locate or quantify, but can, definitely be recognised as such.

Other non-paid
 Social Costs
Non-paid

3.20 Social costs due to the deterioration of aesthetic values, cultural norms, sensitivity to natural beauty, ^{Rise} in crime due to the prevalence of, and inevitable acceptance of ^{values such as} 'competition' 'success by any means' and deceit as ^{the} prime values ^{are lost} replacing 'cooperation' 'sharing' and 'mutual confidence' ^{non-paid} as ~~the values lost~~. These 'social costs' are controversial, normative and difficult to locate, and yet cannot be ignored.

Conclusion

3.21 ~~In this chapter~~ ^{Here go for} We have ^{non-paid} tried to show through an analysis of certain types of social costs arising in the Greater Bombay area, that the environmentalist approach can add a new dimension to concept of economic growth. Evidence suggests that such problems of social costs will be existing in all the large city agglomerations in India, and a similar analysis could be used in these cities as well. In terms of

policy implications, the discussion suggests that prima facie there is a strong case for state legislation and intervention in case of industrial pollution. We can thus proceed to the next ^{part} ~~chapter~~ which tries to analyse the existing legislation in ^{Maharashtra &} India in this respect and its impact on the industries concerned.

Chapter III

GOVERNMENT LEGISLATION AND ITS IMPACT on industrial firm. with special reference to Dr. Beck & Co. (India) Ltd. Pimp

4.1 At the outset we must mention that legislation against pollution is a manifestation of social reaction against burdens imposed on it by industrial concerns. We say this because individuals find it impossible to take action in any other way. But unless the society is 'aware' of the problem, legislation does not occur automatically. Further, there is always a tendency on the part of firms to fight against legislation (say by asking for lower environmental standards) because ~~gain~~^{losses} through such legislation would mean a direct ~~loss~~^{loss} (apparently) of the firm's profits. (It will be later shown that this need not necessarily be so.)

Legislation in other countries

4.2 A word about legislation in other countries is necessary. The geographic condition, the nature of plant, animal and bird life, the stage of economic and social development, are some factors due to which standards in one country (say on water quality air quality on methods of treatment and disposal), cannot be strictly applied to another country. But even then they serve as guides. On the other hand the recommendations made by W.H.O. with special reference to conditions in developing countries have been very useful as guides for establishing standards. Standards based on the U.S. Federal Act (Clean Air Act) are given below only as a rough base for comparison. Only selected pollutants are taken.

(1)	Sulphur dioxide and particulates in combination Sulphur dioxide	Lowest concentration found to produce adverse effects 115 $\mu\text{g}/\text{m}^3$ annual arith. mean (Sulphur dioxide)	Primary Standard 80 $\mu\text{g}/\text{m}^3$ annual with mean	Safety margin 30%
(2)	Particulates	160 $\mu\text{g}/\text{m}^3$ (particulates)	365 $\mu\text{g}/\text{m}^3$ max. 24 concentration not to be exceeded more than once a year	0 to 76%
(3)	Carbon monoxide	12 - 17 mg/m^3 (10 - 15 ppm)	10 mg/m^3 maximum 8 hr. concentration not to be exceeded once a year.	17 - 41%
(4)	Nitrogen dioxide	118 - 156 $\mu\text{g}/\text{m}^3$ mean 24 hr. concentration over 6 months period	100 $\mu\text{g}/\text{m}^3$ max. one hr. limit not to exceed once per year	15 - 36%

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter

mg/m^3 = milligram per cubic meter

ppm = parts per million

(Ref. Beard & Wertheim "Behavioural Impairment Associated with small doses of Carbon monoxide")

Legislation in Maharashtra

4.3 The first air-pollution act in India was passed in 1912 and was known as "The Smoke Nuisance Act". This has been amended several times (the last amendment being in 1972).

The evolution of this act has followed the pattern of changes that have taken place in the Greater Bombay area during the last 50 years. The act was initially concerned with the height of the chimney, emitting smoke and the restrictions on the maximum loads a particular emission can carry, and the amount of fine to be imposed in case some firm did not abide by the regulation. The latest formulation (i.e. amendments) of the act is quite comprehensive and provides guidelines regarding the exact permissible levels of smoke, particulates and other substances. [But it has not been adopted because a comprehensive act is being formulated at the national level.] ^{the} The important point is that realization of the problem had come quite early, but somehow the idea was lost for over 50 years before it was amended comprehensively. During the intermittant period, the ^{slogan} "growth at all cost" had become predominant as an objective.] *Omit*

4.4 The first Water Pollution Act was passed in Maharashtra in 1969,³⁹ and a board was established to execute and implement it. It became obligatory for every firm having waste or effluents to take a consent from the Board. It has identified 56 different polluting substances in the Maharashtra region and laid down norms regarding effluent treatment and disposal. The specific details contain the permissible proportions of different substance in the liquid waste. Every firm in Maharashtra, whose activities lead to liquid effluents, has to apply to the 'Board' and take its consent after satisfying the norms laid down by the Board for different types of pollutants. The act is a blessing in disguise, because it is a great source of worry for most

industries causing liquid effluents. ^{And it} ~~is~~ is only a matter of time before all firms come under the purview of this act.

4.5 We will now describe and analyse the impact of legislation in Maharashtra. The effects can be observed from two angles. 1) From the stand point of the firms. 2) From the society's point of view. We will start with the first. Any legislation on the standards of waste or effluent disposal will generally increase the cost of disposal and consequently increase the per unit cost of production. This increase ~~is~~ ⁱⁿ average cost may be either a) shifted to the consumers by raising the selling price of the commodities concerned, in which case there may be a fall in demand and hence a fall in profits, or b) the increase in cost may be internalised by increase in ~~raw~~ efficiency, recovery of useful commodities from waste, or recycling of waste. If the demand for the concerned commodity is price elastic the entrepreneur will not follow the first method. If the demand is inelastic it will be convenient to raise prices. If we assume for the sake of analysis that demand in case of most goods is price elastic then the firms would adopt the option of internalizing the disposal cost. If this option is adopted there would be a general social advantage in the form of higher economic efficiency better utilization of material resources (also energy resources) and reduction of pollution burdens, although from the firms point of view there may or may not be any change in profitability. In case the firms, while trying to internalize the cost, adopt innovations or processes which

lead to profits from the materials recovered from the erst-while waste, then in the new situation the firm might stand to gain. But if it is unable to internalize the cost-rise through efficiency, it will be forced to cut down its profits.

From the social point of view legislation will mean a) either an advantage in terms of better environmental condition (at the same level of prices of goods if the firms internalize the costs) or b) a better environmental conditions but by paying ~~higher~~ ^{more} for the good (if the firms are able to 'shift' the cost burden.

Now keeping the above analysis in mind let us try to understand the impact of legislation in Maharashtra. The conclusions which we make are based on a) informal interviews with the authorities of the Maharashtra Water Pollution Board, managers of private firms b) on a case study of a resin processing firm near Poona.

The firms were observed to be taking different approaches. e.g. 1) ~~By~~ ^{some} ~~declaring~~ ^{ed} that there were no wastes or effluent resulting from their production process; so that they could postpone incurring of disposal cost until such time that the board authorities served a notice. This was the most common reaction. 2) Firms accepted the standard, declared the waste quantities correctly, but asked for time for adjustment. 3) The most uncommon reaction was to act positively by initiating studies for exploring means of rationalizing processes and reducing costs, recycling, or

extracting useful products from wastes.

Though uncommon, the firm which we studied happened to fall in the third category. Dr. Beck and Co. (India) Ltd. located at Pimpri near Pune was one of the first companies to instal a ^{Bi} Biological Pollution Treatment Plant in 1977. It took them eight years to reach this stage after having initiated the steps in 1969 (the year the water pollution act was passed). They were able to recover 13 different types of materials in their recovery cell. Interestingly, (and admirably) the revenue from the recovered materials was far higher than the cost of installation of the recovery plant plus the cost of disposal of the remaining waste (i.e. after recovery.)

The important analytical implication that can be derived from the above facts is that legislation led to 1) recovery of useful materials from waste which was erst-while dumped in the riverstream. 2) Increased the profits of the firm through adoption of innovative techniques which resulted in a more efficient use of materials. From the point of our economy this is a very significant implication. It is possible that what occurred in this firm could very well occur in several other firms, which would improve the general economic performance.

We will now try to present a hypothetical model which indicates the extent to which legislation can be profitable to individual firms.

To begin let us suppose that there is no legislation, and the firm is only interested in maximising its profit. Suppose, further, that the cost of waste disposal is zero (i.e. the firm simply dumps its waste anywhere it can. In such a case the firm may convert its waste (partly) into economic products as long as the cost of recovery is less than the revenue from the recovered product.

Similarly even if the cost of disposal is positive, it would be profitable to convert waste into useful products so long as the revenue from the recovered material is greater than the conversion cost plus the cost of disposing the remaining waste. Thus the firm will have no incentive to convert waste if the cost is greater than the revenue from the recovered product.

With the introduction ^{and ~~the~~ enforcement} of legislation (i.e. accepting the fact that the disposal of waste unsatisfactorily causes burdens to the society) the position of entrepreneurs would be altered. The firm would either have to increase the price of its primary product (which may not be possible), or incur the cost of disposal, but internalize it through recovery from waste. Sometimes neither increasing the price nor internalizing it may be possible. In such a case, the society would stand to gain, but the firm may suffer a loss. But so long as the gain for the society is greater than the loss to the individual firm, the legislation will be justified. And even if in some cases, the loss to the firms is greater than the

benefit to the society, the legislation will be justified so long as ~~and~~ the ^{total} gains accruing to the society are greater than ~~and~~ the ^{total} losses suffered by the firms concerned.

There can be a strong case against legislation only when the changes due to legislation, in the production and consumption are such that the total gains are less than the total losses.

The Dr. Beck Experiment

4.6 We will now take an illustrative example. (Dr. Beck and Co. (India) Ltd., Pimpri)⁴⁰. This firm producing chemicals by processing resins was incurring enormous waste. They started taking steps to reduce this waste in 1969 (incidentally this was the year when the "Maharashtra Prevention of Water Pollution Act" was passed). They decided to process these waste and recover various solvents from distillate. Their rate of recovery increased gradually and by 1971 they reached a recovery rate of 90%! They recovered 14 different types of chemicals, the important ones being Methanol, Naphtha, White Spirit, Acetic Acid. The total quantity recovered chemicals during this short span of time was 3461271 Kgs. of different chemicals. A net national saving of scarce materials valued at Rs. 2.25 crores, over a period of 9 years, i.e. Rs. 25 lakhs per annum. All these chemical would otherwise have gone down the Mula river. Now if we can suppose that out of 7,000 odd large and medium sized firms in Bombay and Pune, 50% can recover some materials or the other from its waste, ~~we should~~,

and
 If we know the output of effluents and the rate of recovery, and the prices of these products, then ^{there will be a} net gain from the legislation on prevention of water pollution. Besides, if all this material had not been recovered (and as a matter of fact it was not to a great extent) it would have caused severe pollution in the water streams. The cost-benefit of material recovery from waste for the above mentioned firm works out as follows :

	Rs.
Annual Cost of Recovery from Waste	10,00,000
Revenue from Recovered Products	25,00,000

Profit	15,00,000 annually

The following formula⁴¹ will give the extent to which waste conversion would be profitable for a firm.

Suppose, that the cost of disposal ^(i.e. D_w) is zero, then waste conversion will be profitable till

$$1) \quad W \cdot C_w < P_w \cdot W_r$$

where W = Waste Product

C_w = Cost per unit of converting waste products into goods

P_w = Per unit selling price of converted waste products.

and W_r = Converted waste product

Similarly when D_w is positive, it would be still profitable to convert waste so long as

$$(W \cdot C_w - P_w \cdot W_r) < D_w \cdot$$

Both these situations represent firms in the light of profit maximization. When we add the social cost of pollution - E_w ~~then~~ the above relationship modifies such that from the social view point treatment of waste product would be profitable when

$$(D \cdot C_w - P_w \cdot W_t) < D_w + E_w .$$

If we take the figures of Dr. Beck and Co., the answer would be an obvious affirmative. But suppose the costs of Dr. Beck & Co. rise to Rs. 25,00,000. ^{in this case} Even ~~then~~ recovery would be profitable because there would be less pollution to that extent and a saving of national resources. Now if we suppose that the social cost of pollution is Rs. 5,00,000 then from the social angle it would be profitable to convert till the cost of recovery goes up to Rs. 30,00,000, although this would mean a loss of Rs. 5,00,000. *to the firm concerned.*

Similar calculations could be done for many firms in Pune and Bombay to get an estimate of the social cost and benefit ~~and~~ arising from the production process.

Conclusions

(Start on a fresh page)

4.7 (1) Our review of literature (2.1 onwards) show that although the problem of ^{non-paid} social costs was recognized and dealt with, in great detail, it was classified as welfare economics.

The price theory did not include this variable. But as welfare has much to do with ^{non-paid} 'social cost', our conclusion is that, so long as it is not included in the pricing process, determination

X:271L.2.N7
L₉
180997

Stop

of prices will have little to do with welfare. / The integration of social costs cannot take place till ways are found to quantify them.

(2) If the ^{conventional} old G.N.P. maximizing model [(2.15)] of growth is followed, it would lead to a great distortion in capital outlays, quantities of goods produced, prices, and the distribution, of income and wealth. This is so because natural resources are assumed to be given and changes in ^{absolute quantity (or relative scarcity) of} the natural resources are not accounted for. (X) Add - see o

(3) The new model (2.15) will go a long way in correcting the distortions in resource allocation, and establish a reciprocal relation between, the 'stock' of natural resources and the 'flow' of production. The new model explicitly recognises the fact that maintenance of capital stock in tact, nay even regeneration of it, can be made an effective part of the economic process.

(4) Legislation on Environmental Pollution is not a recent origin in India, as is often supposed. The administration recognised the problem as early as 1912 and promulgated the Bombay Smoke Nuisance Act. But the next legislation bearing on pollution viz. "Maharashtra Prevention of Water Pollution - 1969, was enacted after more than 50 years. This shows that while in the early stages of industrialization an overall view of the problem was taken, at later stages the emphasis shifted on to 'growth at all costs', and the social costs were neglected. The two World Wars and the subsequent ^{ly} increasing concern of UDC's to catch up with the West were the important ^{cau} causes fo

problem with all its cumulative effects ^{is being} ~~was~~ felt, and is now explicitly recognized, and hence ^{appears to be} ~~looks~~ anew.

(5) As the Dr. Beck & Co. illustration shows, a concern for environmental variables leads to a selection of technology which ~~would~~ lead to a) a greater utilization of scarce resources, specially water. b) higher economic efficiency, and c) a pattern of production that reflects resource endowment. The recent concern with the appropriate technology is also intimately connected with the aspect mentioned above.

(6) Much empirical work needs to be done to weigh the advantages and disadvantages of concentration. It may be mentioned that most of the work in the field of industrial research is pertaining to the benefits that arise due to agglomeration of industries (e.g. location models minimizing costs). But little work has been done on the disadvantages of agglomerations.

(7) [~~In chapter III~~] ^{had} the nature of pollutants and the effects they have ^{the conclusion} on environment in the Bombay region, leads us to ~~produce~~ that, every region has an 'Optimum Pollution Absorption Capacity'. ^{(*) - Add - see over leaf} Till this limit is reached natural forces can absorb and neutralize industrial effluents. Beyond this limit, all pollution becomes cumulative and dangerous. This optimum level varies from region to region. Working out the 'Optimum pollution absorption capacity' in a given region involves the estimation of the pollution levels of individual pollutants and aggregating them. For such aggregation the weights have to be worked out based on the level and composition

of economic activity (and also of the geomorphic and other natural factors) of the region. It is realised that a number of problems of empirical and conceptual nature would arise. But a beginning has to be made with whatever data that are available for understanding this important aspect.

(8) There is a great scope in the field of 'cost-benefits'^{analysis} of resource use, resource recycling and recovery, in the presence of antipollution legislation; due to a high concentration of industries in Maharashtra. (X) See below.

(9) 'Environmentalism' is not a rich man's fad, but a poor man's necessity. Environmental objectives are therefore not opposed to, but are a complement^e to our commitment to growth and development, with justice.

Add (X) Besides industries Cost-Benefit studies in the field of agriculture [~~any~~^{e.g.} construction of dams large and small, which have been functioning very inefficiently as was found through several case studies by this author), like the long run unpaid costs of the use of chemical fertilizers and chemical pesticides. It is not sufficient to presume that most 'unpaid costs' would be neutralised by 'unpaid-benefits'. ~~What~~ is it absolutely necessary to quantify both (even approximately to start with) and add the result to the cost-revenue-^{price} calculus.

ReferencesChapter I

- 1 * William Kapp, Social Costs of Business Enterprise,
Asia Publishing House, 1950.
- 2 Ibid.
- 3 James E. Meade, "External Economies and Diseconomies in
a competitive situation," in Reading in Welfare Economics,
A.E.A. series, 1969.
- 4 Adam Smith, Wealth of Nations, The Modern Library, 1937,
Page 681.
- 5 Karl Marx, The Poverty of Philosophy, International
Publishers, pages 199 onwards.
- 6 Robert Owen, "Report to the County of Lanmark", reprinted
in Introduction to Contemporary Civilization in the West,
Columbia University Press, 1946.
- 7 C. Kingsley, "Cheap Clothes and Nasty" reprinted in
Alton Locks, Macmillan, 1911.
- 8 F. Engels, "The Conditions of Working Class in England"
(New York, 1887) Page 64.
- 9 Charles ^{on}Furrier, Selections From the Work of Furier, London,
1901, Page 109.
- 10 J.A. Hobson, Work and Wealth - A Human Valuation,
Macmillan, 1916.
- 11 Sidney and Beatrice Webb, The Decay of Capitalist Civilization,
George Allen & Unwin, 1923, Chapter 5.

- 12 Oskar Lange, On the Economic Theory of Socialism, University of Minnesota Press, 1938, pages 103, 104.
- 13 A.C. Pigou, (a) Socialism Versus Capitalism, Macmillan, 1947, pages 43-45; (b) The Economics of Welfare, Macmillan, 1932; also (c) Economics in Practice, Macmillan, 1935, Lecture V.
- 14 K. William Kapp, Op.Cit.
- 15 T.R. Malthus, A Essay on Population, 1798.
- 16 R.H. Coase, "The Problem of Social Cost", Journal of Law and Economics, October 1960.
- 17 Donella and Dennis Meadows, Randers and Behrens III, The Limits to Growth, Potomac Associates, 1972.
- 18 E.J. Mishan 1) Welfare Economics, 1969, 2) Costs of Economic Growth, 1967, 3) The Economic Growth Debate, 1977
- 19 Agarwala and Singh Ed., Economics of Underdevelopment, *was reviewed by E.J. Mishan*
- 20 J.K. Galbraith, The Affluent Society.
- 21 Paul Samuelson, Positive Economics. (Correct)
- 22 Robert U. Ayres, Resources Environment and Economics, John Wiley and Sons, 1978.
- 23 Virginia Brodine, Air Pollution, Harcourt Brace ~~Inc.~~ ^{Ltd.}, 1971.
- 24 Peter Bohm, "An approach to the problem of Estimating demand for public goods", article in Economics of Environment, ed. Peter Bohm and Allen Kneese, Macmillan - 1971.
- 25 Mailer, "Estimating Social Benefits from Pollution Control" Paper in the above-mentioned volume, ~~also~~.
- 26 Lave and Seskin, "Health and Air Pollution", as above.
- 27 Allen Kneese, "Background for the Economic Analysis of Environmental Pollution" - Paper contained in his book

- Economics and the Environment, Penguin, 1977.
28. Freeman, Haveman and Kneese, Economics of Environmental Policy, Wiley-Hamilton Pub. - 1973.
 29. C. Stern, Air Pollution, Vol. I, II and III - 1968.
 30. "Canada Water Act" - in Economic Thinking and Pollution Problems, Ed. by D.A.L. Auld, Chapter 5.
 31. United Nations - Volume on the E.C.E., "Symposium on Problems Relating to Environment", Part II, 1971.
 32. Ibid, Other Papers, Page 378 onwards.
 33. Ingo Walters, Studies in International Environmental Economics, ed. by Ingo Walters, esp. articles by Jaleel Ahmed, William J. Banmol and David Pearce.
 34. Bates and Marton, "The Human Environment," (1962) Encyclopedea Britannica.
 35. Rachel Carson, Silent Spring.
 36. Air Pollution Survey of Greater Bombay, sponsored by Bombay Municipal Corporation - Conducted by NEERI, Nagpur, 1975.
 37. M.V. Vaidya, "Water Pollution Report" for the proposed Mahim Nature Park, Bombay, 1979.
 38. The Bombay Smoke Nuisance Act, 1912, (Government of Maharashtra) Modified upto 1972, published in 1977.
 39. Maharashtra Prevention of Water Pollution Act, 1969, Government of Maharashtra Publication, 1970.
 40. M.V. Vaidya, "Recovery from Waste in Synthetic Resin Processing Industry", Paper presented in a Seminar on "Waste and Cost Reduction and Recovery in Industry, OCIM, Bombay, 1978.

- 41 D.A. and Auld, "An Economic Analysis of Environmental Pollution" in Economic Thinking and Pollution Problems, Ed. Auld, University of Toronto Press, 1972.

BIBLIOGRAPHY

1. Auld D.A.L. (ed.) - "Canada Water Act" - in Economic Thinking and Pollution Problems - Chapter 5.
2. Agarwala and Singh (ed.) - Economics of Underdevelopment.
3. Ayres Robert U. - Resources Environment and Economics - John Wiley and Sons, 1978.
4. Bates and Marston - "The Human Environment" (1962) - Encyclopaedia Britannica.
5. Bohm Peter - "An approach to the problem of estimating demand for public goods" - article in Economics of Environment, Peter Bohan and Allen Kneese (ed.) - Macmillan - 1971.
6. Brodine Virginia - Air Pollution, Harcourt Brace Inc. 1971.
7. Coase R.H. - "The Problem of Social Cost", Journal of Law and Economics, October 1960.
8. Carson Racheal - Silent Spring,
9. Engels F. - The Conditions of Working Class in England, (New York, 1887), Page 64.
10. Fourier Charles - Selections from the work of Fourior, London, 1901, Page 109.
11. Freeman, Haveman and Kneese - Economics of Environmental Policy, Wiley-Hamilton Pub. - 1973.

12. Galbraith J.K. - The Affluent Society.
13. Government of Maharashtra Publication, 1970 - Maharashtra Prevention of Water Pollution Act, 1969.
14. Government of Maharashtra Publication 1977 - The Bombay Smoke Nuisance Act, 1912.
15. Hobson J.A. - Work and Wealth - A Human Valuation, Macmillan, 1916.
16. Kapp William K. - Social Costs of Business Enterprise, Asia Publishing House, 1950.
17. Kneese Allen - "Background for the Economic Analysis of Environmental Pollution", paper on Economics of Environment, Penguin, 1977.
18. Kingsley C. - "Cheap Clothes and Nasty", reprinted in Altol Locks, MacMillan, 1911.
19. Lange Oskar - On the Economic Theory of Socialism, University of Minnesota Press, 1938, Pages 103, 104.
20. Lave and Seskin - "Health and Air Pollution", article in Economics of Environment, ed. by Bohm V. Kneese.
21. Meade James E. - "External Economics and Diseconomies in a Competitive Situation" in Reading in Welfare Economics, AEA Series, 1969.

22. Marx Karl - The Poverty of Philosophy, International Publishers, pages 199 onwards.
23. Malthus T.R. - An Essay on Population, 1798.
24. Meadows Donella and Dennis, Randers and Behrens III - The Limits to Growth, Potomac Associates, 1972.
25. Mishan E.J. - 1) Welfare Economics - 1969. 2) Costs of Economic Growth - 1967. 3) The Economic Growth Debate - 1977.
26. Mailer - "Estimating Social Benefits from Pollution Control", article in Economics of Environment, Bohmir Kneese (ed.)
27. National Environmental Engineering Research Institute, Nagpur - Avi Pollution Survey of Greater Bombay, sponsored by Bombay Municipal Corporation, 1975.
28. Owen Robert - "Report to the County of Lanark" reprinted in Introduction to Contemporary Civilization in the West, Columbia University Press, 1946.
29. Pigon A.C. - a) Socialism versus Capitalism, MacMillan, 1947, Pages 43 to 45. b) The Economics of Welfare, Macmillan, 1932, c) Economics in Practice, Macmillan, 1935, Lecture V.

30. Smith Adam - Wealth of Nations, The Modern Library, 1937, Page 68.
31. Samuelson Paul - Positive Economics.
32. Stern C. - Avi Pollution, Vol. I, II and III - 1968.
33. United Nations - Volume on E.C.E. "Symposium on Problems Relating to Environment", Part II, 1971.
34. Vaidya M.V. - Water Pollution Report - for the proposed Mahim Nature Park, Bombay, 1979.
35. Walters Ingo - Studies in International Environmental Economics - Ingo Walters (ed.), articles by Jaleel Ahmed, W.J. Banmol, D. Pearce.
36. Webb Sidney and Beatrice - The decay of Capitalist Civilization, - George Allen and Union - 1923 - Chapter 5.