ECONOMIC THEORY AND THE CRISIS OF ECOLOGY

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DECLRATIONS

Certified that the dissertation entitled "Economic Theory and The Crisis of Ecology" submitted by Sanjay Kumar Dora is for the award of the Master of Philosophy of this University. This dissertation has not been previously submitted for any other degree of this University or any other university and is his own work.

We recommend that this dissertation may be placed before the examiners for evaluation.

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CONTENTS

		PAGES
ACKNOWLEDGEMENTS		
CHAPTER I	INTRODUCTION: DIFFERENT APPROACHES TO THE CRISES OF ECOLOGY	01 to 21
CHAPTER II	THE OLD PARADIGM.	22 to 49
CHAPTER III	THE DIMESIONS OF THE CRISIS	50 to 76
CHAPTER IV	TOWARDS AN ALTERNATIVE PARADIGM	77 to 92
	CONCLUSION	93 to 95
	BIBLIOGRAPHY	96 to 100

CHAPTER - I

INTRODUCTION : DIFFERENT APPROACHES TO THE CRISIS OF ECOLOGY

Life and physical environment go together, for the environment supplies both the nutrients and the conditions necessary for the existence of life. This combination of living things and the environment in which life exists is the biosphere. Like every other life form, we are a part of the terrestrial biosphere. But the characterstic which distinguishes our species from all other life forms that the earth has ever supported, is our ability to modify the environment with our interventions. Again, we need also to take note of a power which we, as a species, alone have and which no other species ever had: the power of self-destruction.(1) This is kind of power which might manifest itself through a "more or less sudden inceneration of our species in the nuclear fires of our own making or thourgh a lingering paralysis caused by a mindless attrition of our habitat".(2)

To focus attention on this mindless attrition of our own habitat, one could do well to point out that,at the present time 100,000 million tons of various kinds of ores are being extracted every year from the bowels of our planet earth. The figure may rise to 600,000 million tons by the end of this

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1 Narindar Singh, "The Environment: what the Powers That Be care two hoots about, in Bernherd Glaeser: Learning from china? Development and Environment in Third World countries. , London: Allen and Unwin, 1987., p.249.

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2 Ibid: ., p. 249.

century, at the present rate and at the present method of mining and using ores. This is nothing but reckless depletion of the terrestrial resources which are essentially finite.

Again it is important to emphasise that the modern hyper-industrialised civilization is now using the atmosphere as a veritable sewer. Every year we are throwing up into the atmosphere about 20 billion tons of carbon dioxide, 130 million tons of hydrocarbons, 53 million tons of nitrogen oxide and over 3 million tons of arsenic, cadmium, lead, mercury nickel and other toxic metals.(3) This and many other forms of mindless attrition of our habitat are at the root of the pollution of our environment. These twin Problems of rapid depletion of terrestrial resources and the pollution of our environment constitutes what is known as the 'crisis of ecology'.

It seems best to recognise the human interventions with the otherwise self-sustaining eco-system as a part of general process which anthropology calls culture. As an anthroplogical category, culture signifies our power and propensity to produce artefacts and to create institutions which together form a distinct sphere of human activity within the biosphere. Since most of what we need is not found in raw nature, we as a

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3 Boyle and Boyle, cited in Narinder Singh, op cit, p. 249.

species have no option but continue to do culture. But once we take a close look at these artefacts and institutions, what seems to have happened is ineffect the degeneration of what anthropology calls culture into what can be best described as 'counter-culture'.(4) Counter-culture signifies our ability to create such artefacts and build such institutions as are not compatible with the terrestrial eco-system. It is essentially self-destructive. And the crisis of ecology is due largely if not entirely to the incompatibility with the ecosystem of some of artefacts and institutions we have of late created. And to see this we need no more than to focus on the products of nuclear physics and petro-chemistry, which more than anything else, menace our existence today.

The unprecedented intensification of the crisis of ecology is a relatively recent phenomenon. This intensification of the crisis of ecology is a result of the induction of such artefacts as sophisticated weapons of mass destruction, nuclear reactors, and products of petro-chemistry into the biosphere. The products of the nuclear and petrochemical industries deplete without relent such resources as are in any case exhaustible and destroy the self-renewing capacity of the rest. The never-ending proliferation of nuclear weapons, nuclear reactors and petrochemical products have infact brought about a greater

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4 Ibid. , p. 251.

accumulations and concentration of destructive power than could have been the case in the past and thus threaten to paralyse the global environment.

A group of intellectuals and activists can be credited for focusing world attention on the intensification of the crisis of ecology. One of the first persons to draw public attention to this was Rachel Carson.Her book 'Silent Spring'[5] alerted the world to the dangers inherent in the careless use of pesticides. Barry Commoners 'The Closing Circle'[6] was also a pioneering work that drew world attention to the gravity of the crisis of ecology. The rapid depletion of our terrestrial resources however gained most attention through the publication of the book 'The Limits to Growth'[7] by Meadows and others in 1972. All these studies and many others provide scientific evidence to the effect that the world, literally, the whole world is in the throes of a major multidimensional ecological crisis.

For the first time in human history, a crisis that threatens the survival of human beings as a race has come into being. The

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5. Rachel Carson; Silent Spring : Harmondsworth : Penguine Books, 1972

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6. Barry Commoners; the closing circle , New york Knoj 1971

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7. Meadows, Donella H. & Others; The Limits To Growth , New York, Universe Books, 1972

twin problems of 'resource exhaustion' and'pollution of the environemnt' have assumed alaraming proportions and are crying out more than anything else for strong and effective remedial actions. But economists seem to be indifferent to it. For as the situtation is becoming more and more serious, professional economists continue to toy with the symptoms ignoring the cause. For the main concern of the present economists are inflation, unemployment, energy shortages etc. But as we shall see later these problems are nothing but the symptoms of the 'crisis of ecology'. Let us study the man-environement relationship to understand the crisis properly. But at the outset it will be useful to state the two meanings of ecology.

If we refer a standard dictionary we will find that the word'ecology' has two meanings. One, it implies the 'eco-system', that is the unit consisting of the organisms and their environment, and two, it means the study of that 'eco-system'.

Environment performs three basic functions in relation to man.(8) First it provides us with natural resources like land, minerals and forestry which are used in human consumption

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8 D.W. Pearce, cited in, Biplab Dasgupta, 'The Environmental Debate: Some Issues and Trends', Economic and Political Weekly, vol., 13 nos., 6-7, Annual No.,1978.,p. 385.

directly or indirectly. Secondly environment acts as a 'sink' for assimilating wastes produced by the human civilization. These range from carcases to 'garbage and from carbon dioxide to the radioactive wastes of the nuclear industry. Thirdly, the environment with its wide varieties of amenities, which include from colourful landscapes to numerous varieties of living beings of every colour and shape makes life so qualitatively rich and enjoyable.

The actions of human beings, generate four types of stresses on the enviornment.(9) First, 'eutrophic' - the stress imposed on the environment in performing the task of decomposing organic bodies and wastes produced by the production and consumption activites of the economic system.

Second, 'exploitative'-which includes such acts as cropping of plants, extraction of minerals and hunting of animals. Here, it is important that the rate of exploitation should always be below nature's capacity to reproduce.

Third, 'disruptive'-which are the physical changes brought about by such diverse activites as urban sprawling, construction of highways and forest clearance.

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9. ibid . p. 385.

Fourth, 'chemical and industrial stresses-which are mainly the results of technological development, examples being the heavy concentration of lead, mercury or radioactaive substances.

The present study is confined to two main types of environmental degradation, pollution of various types and exhaustion of scarce resources. The latter corresponds to exploitative stress and the former to other three types of stresses.

DIFFERENT APPROACHES TO THE ENVIRONMENT PROBLEM

In standard economics, the environment plays a very limited role. There are basically three approaches to the problem of environmental crisis.

NEO-CLASSICAL APPROACHES

The problem of environmental degradation was treated in two ways by the neo-classical economists. First, some of the neo-classical economists treated the environmental problem as a case of negative externalities and further considered these externalities as innocuous. This is reflected in the writings of Professor A.C.Pigou. Moreover, they are no more disconcerting than the additional expenses on the laundry, induced by the emission of smoke by a industry in the neighbourhood, the damage done to one farmer's property by rabbits multiplying as a result

of game preserving activities of the neighbour and the wearing out of road surface by the ever proliferating motor cars.(10) Again the neo-classical economists viewed the problem as arising due to a misallocation of resources in a perfectly competitive set up. The total cost of production includes environmental losses borne by the society, but are not taken into account by individual firms. For example, a chemical plant emits noxious gases which increase the incidence of different diseases among, the people of the areas adjacent to that chemical plant. This represents a social cost which does not show up in the cost account of that firm. Thus there emerges a divergence between private cost and social cost. This becomes all the more clear if we take an entropic view of the economic process. The 'Entropy Law' is the 'Second Law' of Thermodynamics. From the first law of thermodynamics we know that all matter and energy in the universe is constant, for enegy can neither be created nor destroyed. The second law, the 'Law of Entropy' states that the entropy of a closed system continuously increases or that the order of such a system steadily turns into disorders.(11) Thus entropy is an idex of the disorder. The essence of the entropy law is that, "whenever a semblance of order is created

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10 Narindar Singh, 'Economics and the Crisis of Ecology, Delhi, Oxford University press; 1978; p. 27.

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11 Nicholas Georgescue-Roegen, 'The Entropy law and the Economic Problem', in Herman E. Daly., ed.. Towards a Steady State Economy ,San Francisco: W.H. Freeman and Company, 1973. p. 40 This has been dealt with in detail in 'chapter iv' of the present study namely'Towards an Alternatiave Paradigm".

anywhere on the earth, it is done at the expense of causing an even greater disorder in the surrounding environment."[12] Thus in entropic terms the cost of any economic activity is always greater than the product, for any such activity necessarily results in a deficit. Thus the social cost of any economic activity is always greater than the private cost. But since the firm does not pay the full cost of production of the commodity, the production of that commodity in the economy is excessive that is greater than the social optimum. This then results in a misallocation of resources in a perfectly competitive system.[13] The prescription for this malady is the 'internalisation'[14] of the external cost of the environmental damage inflicted upon others by the operation of the firm, namely to make the polluting firm pay. But the dimensions of these externality generating activities in modern economy is so large, the people affected by these activities are so many that those social costs are intangible. For example, the three corporations Goodyear, Volkswagen and Nestle are engaged in remorseless destruction of the Brazilian rain forests. But these corporations do not realise that in destroying the Brazilian forests they are infact penalising the

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12 Jeremy Rifkin, Entropy: A New World View (New York: The Viking Press, 1982), p. 6.

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13 A Kurtosynosis, Modern Microeconomics (ELBS, 1986), edn. 2, p. 543.

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14 Herman E. Daly, op.cit., p. 164.

entirety of mankind. For these forests are a part of the tropical rain forests which produce the largest amount of terrestrial oxygen. The social cost generated by such activites is simply incalculable. So some economists like Oates and Baumal recommended predetermined and necessarily arbitrary and even sub-optimal norms of environmental quality,(15) which then have to be enforced through suitable pollution taxes.

The second approach of neoclassical economists was to treat the environment as a commodity,(16) for which,like any other commodity the consumer has to pay a price. This approach was justified by applying the theory of 'opportunity costs' to environment. Both these approaches are based on certain crucial assupmtions,(17) namely:

(1) Absolute faith in efficacy of the market mechanism in solving all economic problems, including the environmental ones.

(2) The capacity of the environment to withstand the streesses generated by human activities was considered unlimited.

(3) Pollution was considered as a marginal and non-cumulative phenomenon.

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15 William I. Baumal and Wallace F Oates, 'The Use of Standards and Prices for the Protection of the Environment', in Peter Bohm and Allen V.Kause, eds, _The Economics of Environment_ (London: Macmillan, 1971), pp.54-55.

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16 Biplab Dasgupta, _op. cit_ ., p. 386.

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17 _Ibid_ .,p. 386

(4) Such elements of the environment as air, water and landscapes were considered as free goods.

The neo-classical framework for the analysis of environmental pollution has been criticised on several grounds. Some economists have criticised the assumption of the neo-classical economists while others have pointed out that it is administratively and economically difficult if not altogether impossible,to either estimate the extent of environmental damage or to specify the source of pollution or degradation with precision.

Both these approaches grossly underestimate the scale and complexity of the environmental problems.(18)

As for the first approach of making the polluting firm pay for the environmental damage,it is laden with defects and will not work due to the following reasons:

(1) The impact of pollution and wasteful resource use over time is diffused in nature. The impact of pollution is felt over a long period of time, involving hundreds of years and hence the neo-classical economist's time frame is inadequate to measure the impact of pollution.(19)

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18 I.M.D. Little, cited in Biplab Dasgupta, op. cit ., p. 386

(2) The diffused nature of the impact over space.[20]

(3) Again environmental damage in a particular place/object are the coglomeration of a number of pollutants.

As for the second approach, its assumption that people are aware of the full environmental implications of a particular industrial activity is unrealistic. Moreover the industrialists publish information which is false and withhold what is relevant.[21] And thus they successfully attentuate the importance of such externalities. Apart from this the access to information is costly and its interpretation requires specialized knowldge, which acts as obstacle in truly assessing the implications of a particular industrial activity.

II. STRUCTURALIST APPROACH

The structuralist approach to the environmental problems was an outcome of the dissatisfaction with the GNP approach to development of the neo-classical economists. Till then almost

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(19) The desertifiction of Sahara of Rajasthan for example.

(20) For example pollutants like DDT has been transmitted across the continent through the internationally traded goods.

(21) A.C.Pigou, The Economics of Welfare ; 1960, London: Macmillan,1960,p.185.

all economists held the view that economic health is a function of economic growth. They thus considered the maximization of the GNP as a panacea for alleconomic ills.(22) The opposition to the GNP ;approach was both on qualitative and quantitative grounds. The economists adopting the structuralist framework for the analysis of environmental problem raised some questions of fundamental importance. They pointed out that the neo-classical economist's assumption of close relationship between social welfare and such indexes of economic growth as GNP is essentially fallacious.

They argued that an increase in GNP does not necesarily imply an increase in economic welfare because it is possible that the rich may be getting richer while the poor may be getting poorer. It may also well happen that the increased output may be composed of capital goods, or,may be at the cost of a reduced output of consumer goods. Again, they emphasized not only to consider what is produced but also how it is produced. The expansion of real national output might have raised the social cost (real pains and sacrifices) in the economy. For instance, the increased output might have resulted from long hours and in the deteriorations of labour force.

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22. E.J.Mishan , The Cost Of Economic Growth Harmondsworth: Penguine Books; 1969, p. 12.

Quantitatively they also pointed out that calculation of the GNP involves computational difficulties in those countries where barter system is still prevalent and where rural household is the unit of consumption

Although the concept of the environment used by the structuralists included both the 'physical and social environment', the emphasis was more on latter and the former came to the picture only when interacting with the latter. The major environemntal problems considered by this school were, conditions of housing, sickness, malnutrion, problem of drinking water and accumulation of garbage.

III THE ECOLOGICAL APPROACH

The approach of this school was similiar to that of the structuralist and differed only on the point that whereas the structuralist were primarily concerned with the social environment the ecologist's prime interest was on physical environemnt.(23) The ecologists pointed out that the capacity of our planet earth to absorb waste is limited and hence the imperative for the survival of mankind is to see that accumulation of wastes does not exceed nature's ability to

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23 Biplab Dasgupta.op. cit., p. 384

purify. The primary concern of this group was with two major types of environmental degradations. First pollution caused by the industrial activities and by the energy-intensive life style of the hyper-industrialised society. The second concern was the rapid exhaustion of natural resources particularly of the non-renewable ones like oil. The second concern was dramatised by the report of the study sponsored by the "Club of Rome". The 'Club of Rome' raised the fundamental question of 'The Limits to Growth'. For instance, this study affirmed that a number of exponentially growing variables namely population and production in particular would hit their respective ceiling and then collapse, sometimes during the next century.(24) Professor Kenneth E. Boulding also raised the question of limits to growth in his essays:"The Economics of the coming spaceship Earth".(25) He points out that our earth is just like a spaceship which has no chance of returning,to its base and hence is without unlimited reservoirs of anything either for extraction or pollution.This then implies that there are upper limits to the supply of food and energy that the spaceship earth can provide and limits also to the amount of pollution that can be absorbed by its environment. Thus it seems obvious that the matterial growth that brings us towards these limits can not

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24. Dosell H. Meadows. op. cit .,p. 126

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25 Kenneth E.Boulding, 'Economics of the Space Ship Earth' ,in Herman E Daily, Ed, Towards a Steady-state Economy ', San Fransisco: W.H.Freeman and co. 1973,p.121

continue indefinitely and the growth must stop. He goes on to argue that success therefore lies not in maximising the throughput i.e. the GNP but in minimising it.

Thus as against the structuralist who mainly saw the environment as an objective of development the ecologist viewed environment as a constraint on development. They thus sharply criticised the GNP-oriented life-style in the rich countries which according to them was the prime cause of environmental degradation and rapid exhaustion of terrestrial resources and raised the slogan of 'Abandon Affiuence".(26)

The solution some of the pragonist of this approach suggested was to switch over to zero economic growth (ZEG) and zero population Growth (ZPG).(27) It was however not made clear how the arrangements of a switchover to ZEG and ZPG is to be brought about and and also as to how this arrangement would ensure survival. For given the essential counter-ecological nature of modern industry, even a non-growing economy would fail to be viable.(28)

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26 F.E.Trainer, Abandon Affluence ' London: Zed Books, 1985 p.18.

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27 Herman E.Daly, op. cit , p. 158-62

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28 Narindar Singh, op. cit ., p. 34-35.

The neo-classical economists criticised the ecological approach on two grounds.Economists like W. Beckerman criticised it on the ground that it underestimated the ability of a country with a high level of output and welfare and continuing growth of income to pursue a vigorous policy of environmental control.(29) But the flaw in Backerman's position becomes clear, once we realise that whatever might conceivably be done to curb the side effects would fail to tackle the problem at its source. For the basic question is the deliberate release into the environment of even such final products as are known to be utterly toxic and bio-nondegradable. Moreover "perfectly legitimate is Paul Baran's caustic suggestion that the welfare contribution of homicide cannot be judged by the code of behaviour established by a cannibalistic society itself. For the best which can be said in judgement of such behaviour is that it is consistent with rules and regulations the members of this society have themselves evolved".(30)

Another criticism was that the "Club of Rome" approach overstated the case regarding exhaustion of the earth's mineral resource potential of earth's crust by not recognising the technological possibilities of both discovering further reserves and recovering more from existing resource and of findings

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29 W.Beckerman, cited in Biplab Dasgupta, op. cit ., p. 391.

30 Narindar Singh, op. cit .,p. 29.

substitutes.(31)

However, what the neoclassical economists forgot is that the exact timing of hitting the ceiling by the exponentially growing variables of population is not important. But what is important for the survival of mankind is not to underestimate:

(i) The enormous costs and delays involved in finding new reserves or in changing over to a new substitute;

(ii) The unforseen environmental problems such alternatives may create.

(iii) The limitation of technological innovation to compensate for irrational and wasteful uses.

(iv) The fact that the terrestrial resouraces however large are essentially finite.

(v) The fact that the capacity of the biosphere to serve as a sink is essentially limited.

The present work brings together the two major strands that have been described above as the 'ecological approach' and the

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31 H.Coal and others cited in Biplab Dasgupta, op. cit , p. 391

'structuralist approach' to the crisis of ecology. The main flaw in the neoclassical approach is that, it is esentially reductionist in its approach. That is, it believes that effective understanding of a complex system can be achieved by examining its isolated parts. But the fact is that our economy is merely one aspect of the whole ecological and social fabric. And there is constant and two-way interaction between the economic- system and the eco-system. Hence the neo-classical approach of treating the economic system as separate and independent is contrary to the empirical facts of interdependence of the economy with the environment. This implies that the ecological factors can not be relegated to externality in any economic analysis but need to be incorporated into it. But the neo- classical analysis fails to do the same. This is the reason why the traditional economic theories which are mainly the outcome of neo-classical school of thoughts have not been successful in solving the crisis of ecology. The neo-classical economic theories in the words of K. William Kapp have become" antiquated ill-adapted and irrelevant" (32) for the treatment of the present problems. To quote Kapp; :"habits of thought and theoretical framework have a tendency to spread and perpetuate themselves far beyond the point at which they tend to be ill-adapted and infact irrelevant for the treatment

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32 William Kapp, Environmental disruption and Social Costs: A challenge to Economics", Political Economy of Enviornment: Problems of Methods: Papers presented at the symposium held at the Maison des Sciences del' Honne, Paris, 5.8 May;1971 p.91

of new problems. Again theoretical systems can defend themselves by putting forth new assumptions and refinements, which redefine the scope of the analysis and tend to narrow the addmissible evidence with a view to reinforcing the conclusions and to make empirical evidence to the contrary appears to be outside the analysis... I believe something of this sort has happened to economic theory during the last decade". (33)

The failure on the part of the economists to deal successfully with the crisis of ecology inturn leads directly to "A crisis of Economics" or to limits to economics. Thus what is required is a new and more appropriate framework for the analysis of environmental problem.

As against the narrow reductionist approach of the neo-classical economists, the structuralist and ecological approaches recognise the interdependence between the eco-system and the economic system and adopt a 'holistic anaylsis' for treating the problems of environmental disruption and thus appear more appropriate and suitable than the neo-classical approach.

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33 Ibid , P. 91

CHAPTER - II

THE OLD PARADIGM

Changes and, as their result, progress occur in science, in two fundamentally different ways.(1) changes occur when a hypothesis is contradicted by the facts through the process of empirical testing. This then leads to the replacement of that hypothesis by a new and more realistic one. The other type of change occurs when the entire pattern of thought of the scientific community changes. Such"changes refer to the whole underlying structure of scientific process, the kind of questions considered to be relevant for a science, the qualifications to its answers, the body of methods and techniques for testing of theories, the commonly consented degree of rigour required when accepting or rejecting theories,the institutional setting in which the researcher operate, in short, the whole set of factors which Kuhn combines in the notion paradigm".(2)

Paradigms,however, do not always exist at the conscious level. Moreover, they are not easily abandoned. To quote Herman E.Daily, "Just as we are unconscious of the lenses in our own eye glasses until we have trouble seeing clearly, so we are unconscious of paradigms until the clarity of scientific thought becomes blurred by anomalies. Even under the stress of facts

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1. Kurt Dofer,"Introduction: Towards a New Paradigm" in Kurt Dofer,Ed, Economics in the Future , London Macmillion.,1976 P.4.

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2. Ibid ,P.4 1976

that do not seem to fit,paradigms are not easily abandoned."[3]

Paradigm Shift, however occurs when new problems arise with which the existing paradigm cannot deal adequately. These problems are what Kuhn calls "anomalies"[4]

Kuhn's analysis of scientific change involves three ever repeating stages of scientific activity.[5] A scientific discipline is in paradigm stage when it is characterised by the practice of normal science, which means that all research activities are carried on within the boundaries of a paradigm. However, in an absolute sense, no paradigm is ever complete. If one were, normal science would simply not exist, as all previous problems would have been solved. Thus during the paradigm stage the practice of normal science results in continually increasing/ sophistication of the, prevailing paradigm' while also simultaneously creating the basis of its own destruction.[6] For the increasing sophistication of the existing paradigm results not only in the enhancement of its capacity to solve

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3. Herman E.Daily, in Dofer et.al., of.cit .,p.4

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4. Kuhn The Structure of Scientific Revolution , second edition Chicago, 1970, p.18

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5. L.E.Johnson,"Economic Paradigms: A Missing Dimmensions", Journal of Economic Issues ,vol. 15, no.4,December 1983,p.1098.

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6. A.W.Coats' "Is there a structure of scientific revolutions in Economics?" Kyklos 22 Falls year 1969 p.241

those problems that it was designed to solve, but also makes increasingly clear those problems or anomalies that it is incapable of solving. Gradually these anomalies become so clear and are considered so important that the professionals just cannot afford to ignore them. Then, there occurs a search for a new paradigm,which can adequately deal at least with the most crucial anomaly. This is characterised as the "crisis stage". These searches for a new paradigm lead to the emergence of competitive groups of thoughts, which characterise the third or pre-paradigmatic stage of scientific activity. Eventually, however, that paradigm among the available competing groups of paradigms is accepted, which promises the greatest degree of success in solving the anomalies. And the general acceptance of this alternative, based ultimately, on an act of faith in its potential results in a new paradigm.

THE ARISTOTLEAN SCHOLASTIC TRADITION

A study of the history of scientific thought brings several " paradigm shifts" to one's mind. Such paradigm shifts have in turn affected all disciplines of natural and social sciences and have shaped the thoughts, actions of the professionals and the dominant world view and value system.

Prior to 1500 A.D. the dominant world view in Europe and most other civilisations was organic.(7) The scientific framework of

this organic world view was based on two authorities Aristotle and the Church. In the classical Aristotelian tradition, write Dieter Groh and Rolf-Peter,"Nature was conceived of within the parameters of a natural-moral world system of a cosmology that defined the qualitative uniform space."(8)

"Economic,"which at that time, was known as 'Poliitical economy' had adopted the 'organic' metaphor and was interwoven with a qualitative concept of nature. In the theory of social relation, material production (poiesis and techne)(9) played only a subordinate part. It belonged to the domain of the household rather than to the domain of public life, since it essentially and primarily satisfied the needs of the households. Thus up to the sixteenth century material production came under the exclusive jurisdiction of the family. Moreover, this function was delegated mostly to the slaves and the otherwise unfree. Those whose lives were fully engaged in material production did not even qualify as citizens. Needs defined in terms of independently constituted life goals determined the level of material production. Increasing the wealth and production were not the concerns of freeman. "The

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7. Fritjof Capra, op. cit p.37.

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8. Dieter Groh and Rolf-Peter Sieferle, "Experience of Nature in Bourgeois Society and Economic Theory: Outline of an Interdisiplinary Research Project". Journal of Social Research, vol. 47, nos. 1-3 (1980), p.557

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9. Groh and Sieferle, op. cit ., p.557

system-imperative was constituted by an ideal of the good and proper life and economic growth as an end in itself was impossible. Thus the producing and consuming individual was located within a qaulitative cycle of nature."[10] Thus there existed a harmonious relationship between man and nature and economic activities were subordinated to the authority of a definite way of life in this ideal typically outlined social theory up to the fifteenth century.

THE CARTESIAN PARADIGM AND ECONOMICS

The medieval outlook changed radically in the sixteenth and seventeenth centuries. "The notion of an organic living and spiritual world was replaced by that of the world as a machine and the world machine became the dominant metaphor of the modern era."[11] This replacement of the organic world view by a mechanistic world view, was brought about by the scientific revolution initiated by Nicolas Copernicus. Copernicus, in telling the "sun to stop and the earth to go round", began a process which culminated later in a major paradigm shift. But the important point here is that, while the replacement of the

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10. _ibid_ p.558

11. Fritjof Capra, op. cit. p. 38.

geo-centric by the heliocentric astronomy has received all attention, the concomitant replacement of the organic and holistic world-view by the mechanistic and reductionist one has suffered a major neglect.(12) it was only later that men like Galilo, Descartes and Newton finally destroyed the organic world view and replaced it by one which treated the whole universe as but a machine, which subsequently became the dominant mataphor of modern era. Far from being challenged, an established scientism began to flourish in the form of a reductionism based on a new mathod of inquiry, advocated forcefully by Francis Bacon and a new mathod of analytical reasoning conceived by the genius of Descartes. Thus 'holism' gave way to 'reductionsim' and compartmentalisation.. For a machine -any machine- could be reduced to its constituent parts while an organic whole could not be.

It was Francis Bacon who laid the ground work for the machine paradigm. Becon saw the world with different eyes. He had a different vision of nature. For he did not want to sit around contemplating nature. He wanted to find a methodology for controlling it. Nature in his view,had to be'hounded in her wanderings','bound into service'and made a 'slave'.(13) The 'Baconian spirit'changed both the nature and the goal of

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12. Narindar Singh "Education and Peace". Mimeograph .

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13 Capra, op. cit ., p 40

science. For science was no more persued' 'for the glory of God'but was used to exploit nature for personal interests.

Mechanistic reductionism was however carried out to its extreme limits by Rene Descartes with whom man himself became a machine. As far as he was concerned "there is nothing included in the concept of body that belongs to mind,and nothing in the mind that belongs to the body".(14) Thus Descartes considered that mind and matter are fundamentally separate and different. This implies that to him even the human body was a material structure and in no way different from a machine. This kind of division between mind and matter is known as the 'Cartesian Partition'.

The basis of all Cartesian philosophy is the belief that "All science is certain, evident knowledge". Cartesian certainty in turn is mathematical in its essential nature. Descarte compared the universe with a mathematical structure and equated science with mathematics. For he said, the key to understanding the world, to deciphering its hidden secrets to controlling it for human purposes was to be found in one word: mathematics.(15) He then built a complete and exact natural science and developed a new method of reasoning 'Descartes' method was analytical. It consisted of the following four principles(16) for arriving at

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14 Ibid ., p 44.

15 Jermy Rifkin, op. cit , p. 20.

knowledge of things:

(i) To accept nothing as true which was not clearly recognbizable as such; and to avoid prejudice in judgement;

(ii) To divide up each of these difficulties into as many parts as possibles;

(iii) To carry on the reflections, commencing with objects that were the most simple and easy to understand in order to rise little by little, by degrees, to knowledge of the most complex;

(iv) in all cases to make the enumerations so complete and reviews so general as to be certain of not having omitted anything.

This analytical method of reasoning which has become an essential characteristic of modern scientific thought is at the root of all feats that appear to be scientific and technological progress.

But to quote Capra: "overemphasis on the Cartesian method has led to the fragmentation that is characteristic of both our general thinking and academic disciplines, and to the widespread

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16 Sailendranath Ghosh,'Modern Science vs Society', seminar , June 1987, p. 15.

attitude of reductionism in science- the belief that all aspects of complex phenomena can be understood by reducing them to their constituent part".(17)

The point of it all is that the kind of paradigm shift which Copernicus began and which, building on the work of Galileo, Descartes and others, Isaac Newton completed was revolutionary no doubt, but was also counter-revolutionary from at least one point of view.(18) It was counter-revolutionary because it brought about the replacement of life-preserving organic and holistic world-view by a life-disrupting, anti-ecological, mechanistic and reductionist dogma. This mechanistic world view then became the basis of the paradigm that has dominated our culture and civilization for the past three hundred years and this in turn has provided a scientific sanction for the manipulation and exploitation of nature and of man.

This mechanistic outlook was built into economics by its founders, who were mesmerised by the grandiose achievements of natural science, particularly Physics, operating within the domain of the Cartesian paradigm. And it is a great pity that embedded with a mechanistic outlook, the economic process can

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17. Capra, op. cit. p. 44

18. Narindar Singh,"Education and Peace ", Mimeograph p.22

neither account for the existence of qualitative changes of the environment in to which it is anchored, for mechanics knows only

locomotion and locomotion is both reversible and qualityless.(19) This attitude in the science of economics resulted in progressive marginalisation of nature from economics. Although economists do speak occasionally of natural resources, but the fact is that in none of the numerous economic models that have been developed to date we can find a variable standing for nature's perennial contribution. Even Karl Marx's diagrams do not include this colourless coordinate.

To quote Georgescu-Roegen, "if we may use a topical slogan for a trenchant description of the situtation, both main streams of economic thought view the economic process as a 'no deposit, no return' affair in relation to nature".(20) The tools of fragmentation and reductionism, the twin off-springs of the Cartesian method have been applied to economics to such an extent that economics has become blind to the fact that the economy is merely one aspect of the whole ecological and social fabric, a living system composed of human beings in continual interaction with one another and with their natural resources

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19 Nicholaas Georgescu-Rogen, The Entropy Law and the Economic Process ,Harvard University Press, London, 1981, p. 1.

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20 Ibid ., p. 2.

most of which are in turn living organisms.[21] The evil consequences of what Bary Commoner would have called taking a 'tubular view',[22] are the gradual detachment of economics from moral philosophy and value consideration. Moreover, this has led to excessive emphasis on quantification which in turn gives economics the appearance of an exact science. However, this excessive preoccupation with quantification severely restricts the scope of economic analysis by excluding qualitative distinctions that are essential for the understanding of the ecological, social and psychological dimensions of economic activity.[23]

A brief study of the history of economics thought and the development of the scinece of economics will help in pinpointing the limits to ecodnomics in the light of the environmental crisis.

In the 'mercantilist paradigm' of the period of Renaissance, wealth was synonymous with precious metals. Digging mines and favourable balance of international trade were the only source of wealth. The implication of this paradigm writes Herman

21 Capra, op.cit , p. 195.

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22 For we can have only partial view of anything, if we see it through a tube.

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23 For example energy is measured only in kilowatts, regardless of its origin and no distinction is made between renewable and non-renewable sources of energy.

E.Daly "was that the way to richness was to devote a nations manpower to digging up metal that had no other use than as coinage".[24] The merchantalists who laid the foundation of modern economics were strongly influenced by Decrates and Newton,[25] built a paradigm that was diametrically opposite to the organic world view, the dominant metaphor of that time. The mercantilist paradigm marked a distinct shift from the earlier Aristotelian scholastic tradition and can be described as the first paradigmatic shift in the scinece of economics.

The physiocrats of the mid-eighteenth century France tried to explain economics in accordance with natural law and saw agriculture and mother earth as the source of all net value. They claimed that only agriculture and land are truly productive of real wealth. Thus by promoting an early ecological view, they tried to shift the paradigm back to the organic world view.

Adam Smith in 1776, by writing "An Enquiry into the Nature and Causes of the Wealth of Nations" inaugurated the period of classical political economy. With the beginning of the Industrial Revolution, the classical economists saw labour as the source of wealth and 'divsion of labour' and improvement in

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24 Herman E. Daly., _op. cit_ ., p. 3.

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25 Capra writes that the merchantalist ideas were undoubtedly influenced by the concept of equilibrium in Newtonian mechanics. Capra, _op. cit_ , p. 204.

the 'state of arts'as the source of productivity. Moreover, Adam Smith advocated the theme of laissez faire and immortalised it in the metaphor of the "Invisible Hand". Smith believed that an "Invisible hand", competition would control the economy and guide the individual self-interest of all entrepreneurs, producers and consumers for the harmonious betterment of all, equating 'betterment' with the production of material wealth. However, the Smithian metaphor of 'invisible hand' was nothing else then the application of the tool of reductionism to economics. Moreover, the Smithian analysis gave a conceptual framework to economics which is ill-suited to account for the social and environmental costs generated by all economic activity. The 'inivisible hand' guided the people to maximize their respective self-interst (i.e. profit), increasingly at public cost and in the deterioration of the environement and of the general quality of life.

Smith also propounded his famour theory of the 'division of labour' as the basic means of increasing production. And for international trade, he developed the famous doctrine of 'absolute advantage', which says that each nation should specialise in the production of only those goods in which it has an absolute advantage vis-a-vis other countries. The consequences of this were an international division of labour and free trade. "This model of international free trade", writes Capra, "still underlines much of today's thinking on the

global economy and is now producing its own set of social and environmental costs".(26)

ADAM SMITH AND NATURE

The word 'value'according to Smith has two meanings. sometimes it expresses the utility of some particular object, and sometimes the power of purchasing other goods which the possession of that object conveys. The first one may be called 'value in use', the other 'value in exchange'.

THE WATER DIAMOND PARADOX

Adam Smith's 'Water-Damond' paradox is a classical example of the fallacy of the exchange value calculations.(27) "The things that have greatest value in use have frequently little or no value in exchange. On the contrary, those which have the greatest value in exchange have frequently no value in use". This is expressed as the "Water-Diamond" paradox(28)

A diamond has very little use value as compared to water but it commands an astronomical value while water has very

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26 Ibid. p. 209.

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27 Hans Immter, "How Adam Smith Valued Nature" Development:Seeds of change ,1986, 3, p. 45-49

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28 smith cited in John R. Commas, Institutional Economics-Its place in Political Economy ,Wisconsin Press, Wisconsin.,P.173.

insignificant value or no value at all in a market. The fact that these elements of nature like air and water have very little value or no value at all, although they are so dramatically important is not to be seen as a paradox concerning the proportion between use-value and exchange value but as a paradox concerning a very different thing. This is explained as follows.

According to the rationality of the exchange economy, only that portion of nature which can be converted into commodities possesses value. But several extremely important elements and phenomena of nature, which because of their peculiar characteristics cannot be converted into goods and hence command no value. Since they do not posses the power of purchasing other goods and thus are not exchangeable. The atmosphere, for example, is hardly likely to become private property, or the rays of sun cannot be owned or exchanged. These parts of nature are essentially boundless and thus elude division or measurement. Thus the seemingly paradoxical result of the 'Water-Diamond' paradox is not due to the insufficient value of such goods as air and water. But it is due to the fact that it is almost impossible for such goods as water and air to assume a form to which value could be assigned. It if were possible to assign value to water and air, that is, if it were possible to convert them to goods, they would have been probably more expensive than gold or diamond. This falacy in the theory of

value has the following implications.(29)

According to the rationality of exchange value, that part of nature which cannot be turned into 'goods' has no value and hence her value can notbe destroyed. For how can one destroy the value of a thing which is devoid of any value? But although that part of nature which cannot be converted into goods, does not command any social value, they represent a physical production force and thus acquire economic relevance. On the other hand, it has no owner, no value, so it does not cost anything, it is always available and boundless or, no one seems to be interested in its consumption and its destruction remains socially unnoticed. Thus the real paradox is that that part of nature which cannot be converted into commodities is valueless yet exploitable.(30)

Thus, this calculation and criteria of exchange value determination, determine a behaviour towards nature which due to complete lack of awareness of prospective dangers has started a process of destruction of physical wealth of nature. It is an irony that such a method has been eulogized as technological progress. Thus, it is no wonder when Hans Immter says: "that part of nature which is not convertible into commodities, seems to have no chance of survival".(31) But this means a threat to

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29. Hans, Immter, op.cit p.15

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30 Hans Immter, op. cit., p. 49

our own existence also.

THE RATIONAL ECONOMIC MAN (REM)

The creation of the rational economic man was yet another step in the pursuit of economics to adopt the mechanistic outlook. Through this creation economics detached itself from any value consideration. Then onwards "whenever the question of values was brought in, economists rejected the challenge and phased out values as belonging to some other field of analysis".(32) The phrase 'other things remaining constant' was used as a cover up to eliminate all values from the economic man. Whenever the economic man gave preference to non-economic considerations and thus violated all economic laws, it was explained by the non-operation of the clause "all other things remaining constant". The economists made the rational economic man the veritable kingpin of modern economics. Although the REM never existed in real flesh and blood and is only an abstract, yet it was at the root of all economic works.

The rational economic man was always assumed to behave rationaly. And the economists laid down the following axioms of

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31 Ibid. p.49

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32 Mark Lutz, " Towards Humanistic Development of Economics," Development: Seeds of Change , 1986, 3, p. 79.

rationality.

(1) His preference are transitive or mutually consistent. That is, if he prefers A to B and B To C, he must prefer A to C.

(2) The rational economic man is assumed to possess infinite ability to compare his preferences for different goods and services and would certainly choose the one which yield him the maximum utility.

(3) His tastes and preferences do not change over time.

The implication of these axioms is that the REM has a utility function. To this the classical economists added their philosophy that all economic phenomenon are grounded in the 'desire for wealth' and are governed by two general laws. The first is that " a greater gain is preferred to a smaller" and the second is the porpensity to "obtain the greatest quanity of wealth with least labour and self-denial".(33) From this they logically deduced that the REM will always act to maximize his utility function. In other words, economists assume a world of individual utility maximizers. This was a great attempt on the part of the economists to free economics from value consideration which are so important for the study of ecological

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33 John Stuart Mill, A System of Logic , New York, 1874, ed. 8, p. 623..

and psychological dimensions of an economic activity and hence was nothing short of equating man with machine, which is totally devoid of values. But man has not only tastes and preferences but also values which he holds dearly. Such values may include the realization of truth, justice and beauty. But economists do not care about these values. More than hundred years ago, the French economist Leon Warls observed: "From other points of view whether a drug is required by a doctor to cure a patient, or by a murderer to kill his family is a very serious matter, but from our point of view (economists), it is totally irrelevant so far as we are concerned. The drug is useful in both the cases and may be even more so in the latter case than in the former."(34)

GROWTH: THE HOLY GRAIL

Our adherence to an economic system that has so many serious faults owes much to the dominance of 'neo-classical' economic theory. One of the issues most relevant to our discussion is the neo-classical theorist's incorrect assumption that the GNP(35) is an acceptable measure of national welfare. But as

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34 Cited in Mark Lutz', op. cit ., p. 80.

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35 Here the term 'GNP'is used interchangeably with 'national income' or 'national dividend'.

Chrisian Leipevt a German economist writes: "The contemporary practice of national income accounting, which focuses on the measurement of GNP, merely obscures the fact that current business practices are ecologically counter-productive.(36)

The concept of economic growth generally used in business and politics was developed between 1930 and 1950 and is based on the 'GNP'. The neo-classical economists operating within the Cartesian framework failed to visualise the inter-depedence between economics and ecology and assumed the impact of economic activities on the environment as marginal and insignificant. Thus, they went on to equate an increase in GNP with an increase in economic welfare. But the 'eco-crisis' has shown the inadequacy and meaningless of the quantitative macro-economic measures or indexes like GNP. And it is good to see that as the 'eco-crisis' looms periliously nearer, increasing number of economists have questioned the meaningfulness and usefulness of such quantitataive economic indexes.(37)

The belief that 'GNP' is correct index of economic welfare is based on certain assumptions, namely

(1) External effects of economic activites either positive or

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36 Christian Leipert, 'What GNP Does not account for", Development Seeds of Change , 1986, 3, p. 58.

negative, are insignificant.

(2) The condition of consumer's sovereignty obtains, and

(3) The failure of reward system for whatever reason is insignificant.

But the fact that these assumptions are unrealistic. Even in the hay days of competitive capitalism these assumption could not be justified.

As far as the first assumption is concerned, all the economists are now convinced that the external effects of production processes can assume alarming proportions. The Bhopal Tragedy and the Chernobyl accidents are examples in the recent past which shows how significamt the external effects or what the economists call the external diseconomies can be.

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37 A number of economists have raised their doubts about the inadequacy of this macro-economic measure as representing welfare. For example see,

(1) E.J. Mishan, op. cit .

(2) Shigeto Tsuru, "In Place of GNP", Political Economy of Environment: Problems of method papers presented at the Maison des Science de L'Homme, Paris, 5-8 July 1971, p.(71)

(3) Kenneth Boulding, "The Economy of The Comming Spaceship Earth" Heeman E.Daly,ed, Towards a Steady State Economy W.H. Free man and Company, Sanfrancisco, p. 421.

Moreover, the doctrine of consumer sovereignty, too, was only a complacent rationalisation by economists. In an address to manufacturers, John Ruskin perorated more than one hundred years ago: "You must remember always that your business, as manufacturers, is to form the market as much as to supply it... But whatever happens to you, this at least is certain that the whole of your life will have been spent in corrupting public tastes and encouraging public extravagance. Every preference you have won by gaudiness must have been used on the purchaser's vanity, every demand you have ceated by novelty has fostered in the consumer a habit of discontent, and when you retire into inactive life, you may , as a subject of consolation from your declining years, reflect that precisely according to the extent of your past operations, your life has been successful in retarding the arts, furnishing the virtues, and confusing the manner of your country." (38)

Arguing on a similar line Mishan has dubbed the notion of consumer sovereignty as a myth. (39) His argument runs on the following lines. Of the most common of the basic assumptions, one frequently invoked to vindicate economic growth is that any extension of the effective range of opportunities

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38 J. Ruskin, cited in Shiegeto Tsuru, op. cit ., p. 23.

39 E. J. Mishan., op.,cit. p. 147.

facing a person leads to an increase in his welfare. But this is not true in a free market economy.[40] In such an economy the consumer is not able to select the range of alternative opportunites that will face him in the market. He is forced to choose only from what the market offers him. With the advent of new kinds of goods the old ones usually disapper from the market. New wants are created by the industrialists and then through a systematic disinformation campaign (advertising), the consumers are allured to buy the newly created goods which Cater the so-called new wants. Thus, unless the wants of the consumer exists indepedently of the products created by industrial concerns, it is not correct to speak of the market so acting, as to adapt the given resources of the economy to meet the material requirements of the society. So the producers determine the range of market goods and the consumers have no alternative but to make their choice from these ranges of market goods which the producers offer. Thus, it is no wonder when Mishan writes: "To continue to regard the market as "To continue to regard the market in an affluent and growing economy, as primarily a 'want-satisfying' mechanism is to close one's eyes to the more important fact that it has become a 'want-creating' mechanism."[41]

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40. "Free market economy" is used to mean a market economy where government's intervention is minimum.

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41 E.J. Mishan, op. cit ., p.147

For instance, the numerous electrical and electronic gadgets that have been introduced into the market in the recent years cater to these so-called new wants. These include electric toothbrushes, electric carving knives, coffee making alarm clocks, pocket calculators the colour television and a large number of novelties trinklers and adorements. The fact however is that this artificial want creation can and has become a recipe for ecological disaster. This becomes clear, if we take the case of 'glossy magazines' that are more or less source of trival entertainments. A glossy magazine requires 2.6 KWH of energy for its production, equivalent to about one-quarter of a litre of oil. Almost two million women's magazines are sold each week in Australia accounting for 5.2 million Kwh of the energy equivalent of 2,995 barrels of oil each week.(42)

As for the third assumption, it may be enough to make reference to the discrminating bias, due to inheritance, which acts also as a spring-board to a select group of man, enabling them to capture a share of the national pie indepedent of their own effect.

Thus the assumptions on which the notion, 'growth in GNP leads to an increase in economic welfare' is based are wrong and fallacious.(43) Moreover, as pointed out by Christian Leipert,

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42 F.E.Trainer, op. cit., p. 31

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43 Christian Leipert, op. cit p. 58

the concept of economic growth and of the GNP which is used to measure growth are inadequate in at least three aspects.

First, economic growth is measured in terms of goods (GNP) or income (GNI) and does not take into account the effects of both on the environment. The economic , balance-sheet shows neither the depletion of the stocks of natural resources nor the destructive effects of pollutant and oates. Thus in the crisis of ecology, it is imperative that the mainstream macro-economic theory and business and national income accounting practice should take into account these negative externalities.

Second, economic growth is defined as a measure of "flow of resources" i.e. the flow GNP, instead of as a measure of stock of resources. Per capita consumption of energy and of raw-materials are used as an indicator of economic deverlopment and social welfare or of modernization in international comparisons. This clearly points out how actors in commercial and economic development are oblivious of the effects of exponential growth of flows-such as consumptions, production and industrial waste, on stocks such as nature and people. According to Leipert, "they overlooked the fact that the flows themselves ultimately depend on the continued maintenance of these resources."(44)

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44 Christian Leipert, op. cit p. 58

Third, the conventional concept of economic growth is indiscriminating. For it does not discrminiate between costs and benefits. It includes as benefits those expenditures which are incurred solely to protect ourselves from the unwanted side effects of production. This according to Herman E. Daly is nothing but hypergrowthmania. To quote him:

"There is no statistical tool that attempts at measure the cost of GNP. This is growthmania, literally not including the costs. But the situation is even worse. We take the real costs of increasing GNP measured by the defensive expenditure incurred to protect ourselves from the unwanted side affects of production, and add these expenditures to GNP rather than substract them. We count real costs as benefits. This is hypergrowthmania". (45)

Any work on economics will be incomplete with out a reference to Marx. Marx, it is important to point out here, had acknowledge the important role of nature in the economic processes.

However, he had not strongly emphasized the ecological concern. This was because in his time. resources were abundant and pollution as a problem had not assumed alarming proportions. The central problem at that time was the exploitation of labourer by the capitalists. However this is not to say that he

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45 Herman E. Daly, cited in Chirstian Leipert, op. cit ., p.65

was not aware of the ecological implications of capitalist economies, as can be seen in many of his statements. To quote one example, "All progress in capitalist agriculture is progaress in the art, not only of robbing the labourer but of robbiong the soil".(46) Thus Marx view of the role of nature in the process of production was part of his organic perception of reality, which stemmed from his awareness of society and nature as a organic whole.

But it is also important to point out that it is nothing but industrialization per see that Marxism, entirely like liberalism has identified progaress with.(47) But just like liberalism again, it has never been concerned with the precise content of industrilization, which as is becoming even more clear now, could well be extremely toxic and as unquestionable. Besides one of the axiom of Marxism is that, in due course the whole world would get industrialised in the fullest sense of the term. Indeed a major claim that is made on behalf of what Marxism conceives to be socialism is that it would expedite the process of worldwide industrialization and thus undo the unequal development that has been brought about by capitalism.(48) Thus, Marxism, in the ultimate analysis had its root in the

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46 Karl Marx, cited in Capra, op. cit ., p. 217.

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47 Narinder singh, "Paradigm Lost" Seminar ,March 1984, no.295, p.5.

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48. ibid

Cartesian mechanistic view of world.

The Great Depression of the 1930's showed the weakness of the earlier economic theories to deal with a major economic problem of global dimesion. John Maynard Keynes observing the problems of 1930's prescribed pump-priming as the instrument for fighting the evils of depression. But Keynes primary concern was the short-run rather than the long-run for he wrote: "In the long-run we are all dead". Again he was less concerned that resources be optimally allocated in some refined sense than they should not lie unused. Hence he advocated, "dig holes and fill them up to fight the evils of depression. However, Keynes, as one is temped to argue, ignored the real cause of the disease and choosed to focus on mere symptoms-the defficiency of aggregate demand. But the expedient of additional public spending literally on anything that seemed to be so natural to suggest itself to him, could only cause far more problems in the long run by depleting resources on its own.(49) The Kenesian philosophy thus becomes clear i.e. consumers must not only keep increasing their spending, but also do so predictably for the system to work. This teaching of Keynes had scant regard for the organic nature.

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49 Narindar Singh, Economics And The Crisis of Economy , Delhi, Oxford University Press, 1978.,p. 3.

In the late 1940's a neo-classical-Keynesian synthesis was proclaimed which was nothing else but some sort of grafting of the Keynesian tools in the neo-classical model. However the neo-classical-Keynesian synthesis retained the neo-classical philosophy of "ever increasing growth of GNP as the panacea for all ills". Thus the neo-classical-Keynesian sysnthesis established the growth paradigm upon which stand the models and policies of our current political economy. And henceforward, GNP-Gross National Product-became the summum bonum to be maximised. However, it is needless to point out that this growth paradigm is menifestly anti-ecological and is behind the twin problem of rapid decline of terrestrial resources and environmental degradation.

Thus all the models, theories that have come up in economics due to these above paradigm shifts in econmics have their roots in the Cartesian Paradigm. And it is no wonder that they have failed to deal with the environmental crisis. These theories, tools and equipments, in fact the 'Old Paradigm' itself was misleading from the beging. The sooner the professionals realise the uselessness of the old Paradigm and make a search for an 'alternative paradigm' which will be able to deal successfully with the most important of the present anomalies namely: the crisis of ecology, the better it will be for the mankind. .....

CHAPTER - III

THE DIMENSIONS OF THE CRISIS

CHAPTER III

THE DIMENSIONS OF THE CRISIS

The world has undergone rapid metamorphosis during the last few decades under the impact of the scientific and technological revolution. The spectacular achievements of mankind have illuminated all the corners of the world.But in this bright light mankind has for the first time seen a string of strange spectres-shortages of energy and materials, food and pollution of different kinds. Two major reports of the past namely ' The Global 2000 report ' and The Report of the United Nations Environment Programme (UNEP) have warned the world against the worsening condition of the environment. To quote from the Global 2000 report If the present trend continues, the world in 2000 will be more crowded, more polluted, less stable ecologically and more vulnerable to disruption than the world we live in now. Serious stresses involving population, resources and environment are clearly visible ahead" (1)

Thus the chaotic and short-sighted exploitation of nature has produced a set of conflict situations in the utilization of nature. In fact, it is the chaotic and short-sighted exploitation of nature that has led to the intensification of the crisis of ecology. People are becoming increasingly aware that our planet earth cannot for long withstand all the strains of a remorseless destruction of exhaustible resources and an unnecessay interference with the self-sustaining eco-cycles. Thus, the twin problems of 'The limits to Growth ' and 'The Environmental Crises' have become frightfully real and are of top most concern for the present civilization. It is however important to point out that the twin problems of 'The Limits of Growth' and ' The Environmental Crises' are not separate both stemming from the same cause namely the pursuit of abundance or the obsession with growth. Let us first study 'The Limits to Growth'problem.

'The Limits to Growth'

Not long ago, a group of researchers at the Massachusetts Institute of Technology (2) warned the whole world that approximately another hundred years of exponential growth at the

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1. Council on Environmental Quality and US Department of State , The Global 2000 Report to the President: Entering the Twentyfirst Century , vol. 1, Summary Report (Washington, D.C.: US Government Printing Office, 1980) , p.1.

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2 Donnela H Meadows, and others, The Limits of Growth New York; Universe Books (1972) p. 192.

present rates of production, pollution and population will probably result in a limit to economic growth and then a sudden invisible decline. Let us see what are the reasons to believe that a real case for 'The Limits to Growth exists. In the first place comes the shortages of the basic resources which mankind needs to support its normal life and activities. And the basic question becomes: for how many more years can mankind continue its traditional practice of using irreplaceable resources at exponentially growing rates? On the basis of their calculations scientists have established that mankind is assured of the basic resources for instance, for the following periods: aluminium for 354 years, copper for 62 years, iron for 290 years, lead for 41 years, tin for 43 years, and nickel for 69 years.[3] These statistics point out to the fact that mankind will have exhausted the stock of almost all metals by the year 2500 A.D. Again coming to coal and oil the two most important sources of energy , scientists have pointed out that they have a time of only 143 and 32 years respectively.[4] These estimates are based on the assumption that the present use rates of all these resources remain constant. But if we take account of the fact that the use rates of these resources are not constant but are growing exponentially than the 'Limits to Growth' problem becomes all the more imminent. Some technical fix optimists

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3 F.E. Trainer, _op. cit_ ., pp. 56-57.

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4. _ibid_., p. 57

however point out that, there is no reason to worry because advancement in science and techonology will permit the solution of these problems without great inconvenience. But the basic thing that these technical optimists forget is that "technological hybris and over-reaching are but two sides of the same coin and both have long been associated with self-destruction".(5) The Greek legend of Icarus, for instance was intended to make precisely this point. Daedalus, Icarus's father and a highly skilled craftsman, made wings for them both so that they could escape from the labyrinth of Cretes. But the wings were attached to their bodies by wax; and without paying any heed to his father"s advice to the contrary, Icarus flew higher and higher and got too close to the Sun. "The 'wax' in the legend suggests that technology particularly if it happens to be very daring, must have some crucial weakness or other. Evidently, the destruction of Icarus can be explained in terms of his refusal to recognize the inherent limits of technology.(6)

Moreover, in recent years, evidence has begun to accumulate indicating that technical progress in some areas, particularly in agriculture is faltering badly. For example, the absolute yields of some major US and world crops have reached a plateau and have not risen significantly since 1970. And there has

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5 Narindar Singh, 'Education and Peace', mimeograph.p.5

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6. p.,5 Ibid ., p. 5-6

been a fall in world grain yield in 1970s.[7] Moreover, the increase in agricultural output achieved in the past, has often been produced by even bigger increase in inputs. For example an eleven per cent increase in agriculture production in the United States between 1949 and 1968 was achieved with a six hundred and forty-eight per cent increase in the use of nitrogen fertilizer. Likewise Britain's thirty-five per cent increase in agricultural production was achieved with a eight hundred per cent increase in nitrogen fertiliser consumption.[8] Limits to technology becomes all the more clear from the fact that percentage of crops lost to pests in the period 1947-1974 doubled despite a ten-fold increase in pesticide application.

Another reason for the belief that a real case for limits to growth exists can be found in the close relationship between growth and pollution. Let us study the relationship between economic growth and pollution of the environment.

RELATIONSHIP BETWEEN GROWTH AND POLLUTION; A MODIFIED ROSTOW'S MODEL

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7 Brown cited JF.E. Trainer, op. cit., p. 210

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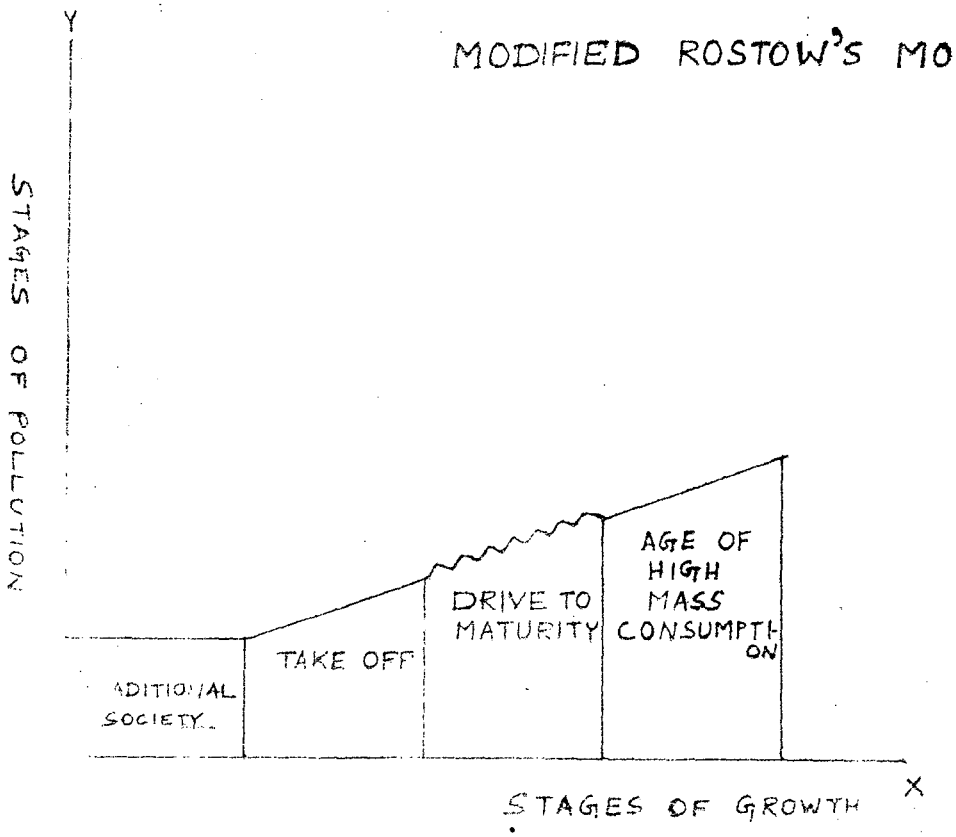
8 Ibid p. 210

One way of approaching the relationship between growth and pollution involves the use of a modified Rostow's model such as the one depicted in the figure given below.



9 Savage and others, Economics of Environmental Improvement, Boston : Houghton Mifflins Company; 1974, p.211.s

The model suggests a simple, direct and close relationship between growth and pollution. Thus the growth of an economy from 'traditional' to 'take off' and so on has been accompanied by higher stages of pollution.

Prior to the industrial revolution, agriculture was the main source of livehood for most of the people. Agriculture practice was the main economic activity. Moreover, the peasant engaged in traditional agriculture production was relatively speaking a non-polluter. Most of the inputs, such as seed, organic manure as well as the outputs were naturally biodegradable and were recycled.

As against this in the present hyper-industrialised society, mankind is engaged in such economic activities as are not only consuming large quantities of all limited resources but are also creating pollution of various types.

Thus the simple, direct and close relationship suggested by the above given Modified Rostow's Model in fact points out to the fact that there exists limits to Growth. Thus we cannot simply go on the persuit of an ever increasing GNP, for the simple reason that the consequential envoirnmental stresses generated

by an ever increasing GNP will become intolerable and will certainly spell doom for all, Thus 'pollution' will act as a check on our pursuit of an ever increasing GNP, even if we do not run short of basic resourses.

THE PRICE OF POLLUTION

According to American biologists P.R. Ehrlich and A.H.Ehrlich most mothers milk in the United States contains so much DDT that it would be declared illegal in interstate commerce if it were sold as cows milk.(10) This single sentence points to the fact that the problem of pollution has assumed alarming dimensions. A brief study of different types of pollutions and their consequences will help us to realise the seriousness of the problem of pollution.

I

AIR POLLUTION

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10 K.William Kapp, 'Environmental Disruption and Social Costs: A Challenge to Economics", in, Political Economy of Environment: Problems of Method, Papers presented at the symposium held at Maison des Science de L'Home. Paris, 5, 8 July 1971, p.94.

Perhaps the most urgent worries centre on the problem of air pollution. An estimate of the extent of the pollution of air can be had, if we cast a glance at some of the statistics. According to one estimate, each year we are throwing up into the atmosphere over 200 million tons of carbon mono-oxide, over 50 million tons of various carbons, about 146 million tons of sulpher dioxide, 53 million tons of nitric oxides and so forth.(11) And coming to the US alone it is estimaed that each person produces more than 500 Pounds of air pollutants per year and that industry produces 172 million tonnes of smoke and fumes which accounts for almost 50 per cent of world's industrial pollution.(12)

CLIMATIC EFFECTS

It is alarming to discover that the concentration of carbon dioxide in the atmosphere has risen by 10-12 per cent during the last fifty years.(13) Although there is a controversy regarding the precise nature in which this will effect the biosphere, most of the scientists converge on the opinion that

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11 I.Laptev, "The World of Man in the world of Nature, Moscow, Progress Publishers, 1979 p. 17

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12 Colliers's Encyclopaedia, New York: Macmillan Educational Company, P.F. Colliers, Inc. New York, vol.9, p. 258

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13 I. Laptev, op. cit., p. 17.

this will have pernicious effects on the bio-sphere. Carbon dioxide in the upper atmosphere is relatively transparent to incoming sunlight but not to heat radiated outward from earth. The consequence is that there is a tendency for heat to be trapped in the earth's atmosphere.This is the sinister spectre of the hot-house effects.[14] which scientists fairly often refer to. There is scientific evidence to the effect that our planet earth experienced something of this sort during the period 1880 to 1940. In this period the annual mean temperature of earth rose by around 0.7° C which caused the glacier to retreat and the North Polar ice cap to thin. As a result, the whole arctic tree limits and moose population shifted northward .[15] It is important to point out here that an increase in annual mean temperature of earth by 4 to 5°C would be enough to melt the polar ice caps and raise ocean levels by 300 feet, so that entire continents could be submerged under water. However in the 1940's the cooling trend set in. Scientists have pointed out that this is the effect of accumulation of solid suspended particles, smoke particles, nitrates etc. in the atmosphere. These suspended particles have created a screen for solar

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14 Also known as the Green House Effect,because carbon dioxide in the atmosphere functions like a glass in a green house. While letting solar radiation through, it does not let the infra-red radiation go back into space.

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15 Collier's Encyclopaedia, New York: Macmillan Education Conmpany P.F Colliers, ibc. London New York, vol. 9. p. 258.

radiation. It has been pointed out by scientists that if such light reducing pollutants continue to increase at their present rates, then earth's mean temperature would decline by 4 to 5 degree C. by the year 2030,[16] which will produce a cooling down and even an icing up with Catastrophic consequences for all the species on the earth.

ACID RAIN

'Acid Rain' has become increasingly a serious problem. The factories using fossil fuels and the power plants emit pollutant fumes which contain such gases as nitrogen oxide, sulphur dioxide and sulphur trioxide, which react with atmospheric moisture to form nitric acid and sulphuric acid. These then return to earth as acid rain, the effects of which on plant and animal life can be devastating. The US National Academy of Sciences in one report cites specific studies in Sweden and northern New England that correlate reduction in forest growth with acid rains levels.[17] The acid rain also pollutes lakes and streams, resulting in the death of fish and the contamination of drinking water. A 1976 Cornell University survey of 217 lakes in Adirondac Mountains of New York State

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16 Ibid., p. 258.

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17. National Academy of Sciences, Mineral Resources and Environment, Washington, D.C.,1975 in Lester R.Brown, The Twenty Ninth Day (USA, 1978), p. 44.

shOwed 51 per cent of these lakes to be highly acidic. A generation ago virtually all were alive with fish, but the survey showed 90 per cent are now barren.[18] The acid rain is also found to harm crops and reduce the fertility of the soil.

II

POLLUTION OF THE HYDROSPHERE

Enormous quantities of various substances formed as side effects and waste products of human activities are dumped into the hydrosphere. These wastes that enter the hydrosphere contain noxious substances such as lead, cadmium, cynides, mercury and scores of other new substances invented by men and never found in nature. These substances accumulate in seaweed, in plankton and in fish and ultimately return to man like an evil boomerang. The result of the pollution of the hydrosphere are the large scale death of fish and other aquatic life forces. For example in 1955 the lake Erie produced 75 million of fish but by 1968 the fishery was gone poisoned by sewage and nitrates from commercial fertilizers. Instances of human deaths are also not rare. For example, in the late fifties several hundred people living in a small fishing village in Minamta Bay were taken ill, due to methyl mercury poisoning out of which more than one

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18 Lester R. Brown, op. cit., p. 43.

hundred died.[19] The world also witnessed the 'itai-itai' sickness resulting from cadmium-polluted water which killed half of those sticken by it. The gravity of the situation can be realised if we caste a glance at the statistics of mammals and wildlife extinction given in the "The Red Book". It states that 36 species of mammals and 94 species of birds had irretrievably vanished from 1600 to 1970.[20] Another major sources of pollution of the hydrosphere is 'oil'. Approximately a million tons of oil seep into the seas from freighters, tankers, and offshore drilling rigs each year. For instance, shortly before the Christmas of 1976, the oil tanker Argo Merchant ran aground forty-three kilometers of the cost of Nantucket and forty-eight kilometers from Georges Bank, one of the world's richest fishing areas.[21] Since oil floats in the water surface of the sea, it interferes with the flow of light and oxygen in the sea. Thus oil can render waters at least temporarily un-inhabitable. The 'oil carpet' extending over thousands of square kilometers inflicts damage on the 'Earth's lungs'. It reduces the capacity of the ocean to absorb carbon dioxide and change the process of evaporation from the ocean surface. It also poisons the Plankton and reduces the productivity of phytoplankton phytosynthesis

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19 I. Laptev, op. cit., p. 25

20. Ibid p.27

21 Lester R. Brown, op., cit., p. 52.

The oceans which over two-thirds of the earth's surface constitute an integral party of humanity's lifesupport system, supplying both oxygen and food. It is also the life-boat of numerous marine creatures. The long oceanic food chain, with microscopic plants at the bottom and choice table grade fish at the top, supplies humanity with vitally needed high quality protein. Thus pollution of hydrosphere jeopardises human nutrition as well as marine life.

III

THE PROBLEM OF WASTES

The millions of industrial plants all over the world each day disgorge staggering amounts of waste. The United States environmental protection agencies in 1980 stated that there were seven lakhs and fifty-thousand industrial plants in United States, producing about 57 million tonnes of dangerous waste earth year.[22]

The random dumping of these hazardous wastes and inadequate provision for their treatment has created a major environmental problem. For example huge dumping of waste in the Love Canal

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22 Collier's Encyclopaedia, op. cit., p. 254.

area at Nigra Falls, New York has resulted in an increase in the incidence of cancers, miscarriages, birth defects, nerve damages etc.(23) This is only one instance of the hazards of random dumping of waste,but there are many more instances of the hazards of random dumping of toxic industrial byproducts. And there is no doubt that this problem of random dumping of hazardous waste has assumed alarming proportions.

IV HAZARDS OF PETRO-CHEMISTRY

One of the major reason for the intensification of the crisis of ecology is the fantastic expansion of the petrochemical industry, since the second world war this expansion of petro chemical industry. in Professor Barry Commoner's phrase has an extraordinarily intense degragative effect on the environment.(24) Guided by the profit principle these new chemical industries introduced, not entirely in ignorance, products which are both extremely toxic and bio-nondegradable. Detergents, fertilizers and insecticides are the particularly noxious cases. These substances being completely immune to enzymatic attack are inherently bio-nondegradable. In contrast, just no organic substance is produced in nature unless there is provision also(25)

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23 Ibid.,p. 255

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24 Barry Commoner, Ecology and Social Action, University of California Press, Berrkeley, 1973, p. 21.

for enzyme capable of breaking it down. Thus the bio-nondegradable substances gradually accumulate and intrude violently into the otherwise self-sustaining eco-cyclical process. This then is the precise way in which the biosphere is getting converted into a necrosphere a sphere of death by the staggering accumulations of products from the chemical industry. One such product is DDT. DDT of course put an end to the threat of malaria wherever it was used after the second world war and was instrumental in the rapid expansion of agriculture in the post world war period. But later on, it was discovered that DDT generates a wide variety of harmful side effects which more than offset its beneficial effects. DDT is a bio-nondegradable chemical. In a study R.G. Nash and F.A.Woolson have shown that 39 per cent of DDT applied in a field in Maryland was present 17 years later.(26) In addition DDT has the property of great mobility. It can leave the site of application and be transported by air and water over great distances. Such is the mobility of DDT that, it is found in the milk of nursing mothers in America and even in the flesh of Penguines. It has been pointed out by certain researchers that DDT upsets the oxygen balance of the biosphere. Detected in all ocean waters it disables the tiny marine plants known as the green algae. Since these green algae are known to produce as much as seventy

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25 Barry Commner, The Closing Circle,New York:Knoft 1971;p.44

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26 R.G. Nash and F.A. Woolson, quoted in Orie L. Loucks, "The Trial of DDT in Wisconsin", in John Harate and Robert H. Socolow, Patient Earth, , New York,Holt 1974., p.96

per cent of atmospheric oxygen, DDT certainly upsets the oxygen balance of the atmosphere. Moreover DDT when applied affects not only the target insect groups but a wide range of organisms. Thus use of DDT has been, in some instances followed by epidemic outbreaks of an insect pest, through its effects on the natural enemies of that insect pest. The consequence is an upset of the population relationship among species in whole ecosystems.

One of the properties of DDT is its low solubility in water combined with a high solubility in lipids (fats). The solubility of DDT in water is 2.2 parts per billion, where as it is more than million times more soluble in the lipids of plants and animals.(27) Living organisms therefore 'scrub' DDT from their environment and thus DDT accumulates in the fat of these organisms. This then is transported from the preys to the predators. The result is thus a magnification of DDT concentration in the food chain of the eco-systems. Besides DDT, synthetic fertilizers have been found to seriously disrupt prescisely those biotic processes which impart to the soil its basic fertility. This is the precise reason why their productivity in terms of agricultural output decreases after they are used for some times, thus necessitating their use in ever larger quantities. Thus the damage they impart to the fertility of the soil increases relentlessly.

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27. Orie L. Loucks, op cit. p.97

DEFORESTATION

Forest vegetation with its accompanying soild organism, makes up approximately 90 per cent of the Earth's total bomass on land. But it is a pity that man is engaged in a remorseless destruction of this asset thereby causing a threat to the stability of the ecological system. Although deforestation is a universal phenomenon, the destruction of tropical rain forests is of the greatest significance. Indeed many people now believe that the destruction of tropical forests is one of the greatest problems facing mankind in the present time.

Tropical rainforests which in 1982 occupied nearly 12 million (11,610,350) square kilometers of the continuously warm high rainfall areas of the globe that lie between the Tropics of Cancer and Capricorn perform a number of functions for us. The most important function that the tropical forests perform is that they are the largest terrestrial net producers of oxygen. Considered as a solar engine. they absorb more sunshine than any other living land cover. They thus help in moderating surface temperatures and in reducing heat reflection into the atmosphere. This forty metre or more thick three-dimensional

carpet is the living place of several million species of both plants and animals. They further conserve the rainy water and slowly release it to the atmoshphere as water vapour, which later provides rain in other areas. They also protect the land from wind and water erosion and floods. The success of agriculture in the tropics depends to a large extent on the maintenance of natural forests in the adjacent areas.

But instead of conserving these tropical forests which are rendering irreplaceable service, man is engaged in their destruction. Straight line projections give a date only 70 years ahead (2057) for the final demise of this currently still vast, irreplaceable sector of our planet, unless we halt this destruction.(28) And it has been pointed out by scientists that no technology or enginerring could replace the functions that rain forests perform for us free. The total rainforest destruction will have dire environmental effects, which rank with those of nuclear war. The environmental effects of a total destruction of the tropical rain forest include massive erosion and landscape degradation in the wet tropics. This in turn will lead to a major food crisis through a decline of agricultural productivity beginning in Southeast Asia around A.D.2000 and spreading elsewhere later.(29) Tropical rain

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28 Nicholas Guppy, 'Troppical Deforestation- A Global View', Journal of Foreign Affairs, vol. 62, nos. 4-5, 1984 : 929

29 Ibid., p. 931.

forests and their soil contain 20 per cent of world's terrestrical carbon pool of 500 billion metric tonnes, 46 per cent of this in the living forest. When the forests are cleared most of these are released as carbon dioxide. Thus one of the most dangerous consequences of the tropical rainforest destruction is the increase in the level of atmospheric carbon dioxide which has the dangerous green house effects. All these have led Guppy to write: "In the destruction of tropical rain forests a crisis point may be approaching between human activity and life support system".(30)

VI

HAZARDS OF NUCLEAR INDUSTRY

One of the most serious threats to our plannet comes from man;s harnessing of nuclear energy both for peaceful and for military uses. The first use of this power was to wipe out two cities. But it seems mankind has not learnt any lesson from it. The proliferation of nuclear power stations and the stock-pilling of nuclear weapons still continue unabated. Even the Three Mile Iseland 'incident' and the Chernobyl 'incident' of the recent past have failed to dampen the spirit of the nuclear heros, to

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30 Ibid. p. 932.

whom, nuclear power seems to be the key to world's future. The nuclear heros cling to the belief that nuclear power would provide infinite amount of energy indefinately. But what they have failed to realise is that catastrophic consequences of generating this power on earth, which is almost literally the Promethean act of stealing the fire from the gods. Let us discuss briefly some of the hazards generated by the science of nuclear physics.

I have first discussed in what follows the Nuclear Questions by assuming that no nuclear plant accident can or ever will take place in the world. The pooint that II have emphasised is that even if we make the above assumption, the nuclear industry is still a global menace. And a nuclear power station anywhere should be a sufficient cause for concern for people every where.(31)

Even the normally working nuclear power stations are a source of intense thermal pollution, for they cannot but ooze immense amounts of heat into the biosphere . Nuclear energy in a power station is utilised to boil the water to produce steam that drives the generator. A temperature in the range of 1000-2000 degree F is required to perform this task with thermodynamic efficiency. But expressed in terms that are equivalent to the

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31 Narindar Singh, 'The Profound Immorality of Nuclear Power', mimeograph, p. 9.

temperature scale the energy generated by the fission process is in the range of million degrees. This led Professor Barry Commoner to remark that the use of nuclear power for the relataive mild task of boiling water violates the familiar caution against attacking a fly with a cannon. No doubt the fly will be killed, but at the cost of considerable unnecessary damage.[32] The pwer of the atomic energy which has been described by Commoner as a kind of thermodynamic overkill' can be judged from the fact that one nuclear power plant may be able to heat up the water, say, in the Hudson River by as much as 7 degree F. The earth has delicate thermal balance. The radiation of the vast amount of extra heat by the ever-proliferating nuclear power station will sooner or later certainly lead to a disruption of the delicate thermal balance of our global eco-system. This is certainly a problem without any conceivable solution. But it is not the only one.

Another problem associated with this industry and which is of equal importance, is the dispersal of the radioactive reactors waste which have halflives ranging from two hours to 24,000 years. Again the radioactive structure of plants which with their life span completed have to be decommissioned but cannot be decontaminated and dismantled for 150-200 years or may be longer period still. These inactive plants will soon outnumber

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32 Barry Commoner, The Poverty of Power, London: Jonathan Cape, 1976, p. 98-99.

the active plants because the life span of a typical nuclear reactor is no more than thirty years. But although the inactive power plants will be dead they will still be immensely radioactive and hence a constant source of radioactaive pollution for the adjacent areas. Thus even if we assume that nuclear power stations are completely accident free, they cannot but pose serious environmental hazards, for no conceivable technology has been developed to tackle the above mentioned problems successfully.

The Chernobyl accident of the recent past has shown how unrealistic the assumption of a accident free nuclear power station is. In a 1984 study on high risk technology, Charles Perrow, Professor Sociology at Yale University wrote :

"if the safety system have worked so far why call this a high risk system ? One answer is that we simply have not given the nuclear power system a reasonable amount of time to disclose its potential..... we are only begining to uncover the potential dangers that make any prediction of risk very uncertain (33)
Only two years after Perrow's book was published , the explosion at Chernobyl Plant confirmed his thesis. Again researches have pointed out that if current rate were to

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33. Charles Perrow, cited in Christopher, Flavin ,"Reassessing Nuclear Power : The Fall out from Chernobyl" World Watch Paper 75, March,1987 p.39.

continue there would be three additional accidents by theyear 2000. And, at that point with 500 reactors in operation, core damaging accidents would occur every four year (34). These facts suggest that we can no longer assume that no nuclear plant accident can or will ever take place anywhere in anywhere in the world and once we discard the assumption of accident free nuclear power stations, the profound immorality of nuclear power becomes all the more clear. Let us take the instance of the Chernobyl 'incident'.

Chernobyl is the world's most serious nuclear power accident so far. The direct costs include 31 death, 1000 immediate injuries, 135 ,000 people evacuated from their homes in the Ukraine and at least three billion dollar in financial losses. But the long-term implications which are far more troubling and uncertain will with all probables over shadow the short-term costs. As the Soviet official put it, it may not be possible simply to remove the consequences of the accidents. The shadow of the accidents will be felt by the people of Ukranine and of entire Europe for decades to come. Estimates of resulting concer deaths by researchers in the field ranage from less than 1,000 to almost 500,000. (35) Thus the costs of an accident in a nuclear power staion is almost incalculable.

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34. ibid ,p40

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35 Ibid., p. 5.

Coming to the other uses of the nuclear power that is, the uses of nuclear power for military purposes, it is important to point out that if the threat of nuclear holocaust from the remorseless stockpiling of nuclear weapons becomes true,. it will be the ultimate manifestation of the crisis of ecology. The risk involved can be realised from the fact that a nuclear holocaust need not to be triggered by an actual war between the nuclear powers but it may well occur due to an accident. has not taken so far; more so because ever more of these missiles continue to be acquired all the time. But the fact, for example, that in the United states alone five thousands man are removed from missile duty every year for drug, alcohol and other psychological problems suggests that the threat of nuclear holocaust is frightfully real.

The recognition of the fact that our biosphere is a single living unit, Led James Lovelock to designate it after the Greek goddess 'as Gaia. "Nuclear reactors, both active and dead are so may tumours, in her body. Here are some 375 of the 'peaceful' variety in existence right now and unknown of the military kind How many of them can Gaia carry before she collapses herself? But if Gaia dies or is paralysed at least, do we continue to live as a species? (36)

Thus in the present situation Albert Einstein's observation that

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36 Narindar Singh,. op., cit., p. 12.

the unleashed power of atom has changed everything save our modes of thinking seems even more profound ..

VII

EVOLUTION OR INVOLUTION

A brief study of the problems of 'limits to growth and the environmental crisis brings an important question to one's mind. In the light of these problem one wonders whether human civilization is in the path of evolution or involution, for bringing the Jerusalem of economic growth to the earth's green and pleasant land has so far conspicuously reduced both the greenness and pleasantness. The irony of the situation is that the more the industrial developement the more danger to the environment. Development has acquired a sinister dimension pollution. The negative aspects of development are so paramount that they outstrip all its benefits and the net result is retrogression. Most of us believe that human civilization is in the path of evolution i.e. moving outward, but the fact is that we in the path of 'involution' which is same as to say that we are engaged in an act of unrolling or unfolding of our civilization. We cannot call evolution to a process which ultimately leads to no where but self- destruction. So instead

of evolution what is taking place is involution for human civilization is not moving outward but is literally being rolled or turned inward. And instead of development what we are experiencing is retrogression. Thus the time has come to seek development alternatives but alternatives to development.

CHAPTER - IV

TOWARDS AN ALTERNATIVE PARADIGM

Karl Marx once said "the tradition of all past generations weighs like an Alp upon the brains of the living".(1) This explains our passive adherence to a useless faith in the charismatic power of the Cartesian-Newtonian mechanical world view to solve all the problems. But the fact is that being unable to solve the most serious anomaly of contemporary civilization namely the "crisis of ecology", the Cartesian-Newtonian paradigm has become diseased.(2) In fact it is dying a slow death and in the process contaminating everything it gave birth to. But it is a pity to find instead of discarding the old, diseased and dying paradigm, the professionals are still clinging to it. They are trying to apply the concepts of an out-dated world view - the mechanistic world view of Cartesian Newtonian Science - to a reality that can no longer be understood in terms of these concepts.

According to Robert Heilbroner, an economist, 'sustained and conclusive change is the inescapable lot of human society'(3) but the danger is that if we mispercept the reality or misread the symptoms of the crisis or if we stand

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1 Karl Marx, cited in Narindar Singh, 'Paradigm Lost', Seminar, March, 1984, p. 1.

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2 Jeremy Rifkin, op. cit., p. 4

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3 Robert R.Heilbroner, in Lester Brown, op. cit., p. 329.

idle by assuming that nothing can be done to get ourselves out of this crisis situation, then change will inevitably be painful and chaotic or may even spell doom for the entire mankind. To cite Heilbroner once again, we need not be "reduced to the impatience of astronomers watching the imperturbable mechanics of celetial objects".(4) Thus we must act and act on the fundamental consideration that man has the capability, the wisdom and above all the obligation to remidiate this situation.

To meet the challenge of environmental degradation what we need is a "new paradigm" a new vision of reality, a fundamental change in our thoughts perception and values".(5) The switch over to a new paradigm is however not an easy task for Daly reminds us that paradigms are not easily abandoned even under the stress of fact that do not seem to fit. But, let there be no mistake about the consequences of clinging to the 'old Paradigm'. It will only result in the intensification of the crisis of ecology. Thus the imperative of survival of mankind calls for a shift to an alternative paradigm - a paradigm that can solve the most serious anomaly confronting our civilization.

A BACKWARD STEP IN HISTORY

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4 Robert L. Heilbroner, cited in Lester Brown, op cit, p 330.

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5. Capra, op. cit., p. xvii.

It took thousands of years before the Aristotlean world view could be replaced by the mechanistic world view. But in that instance there was plenty of time to make the radical change in the world view. But in the present situation, the problem involved is of such paramount importance and the time factor is so crucial that we are being forced to make a transition from the mechanistic world view to an alternative and more competent world view at the shortest possible time.

The mechanistic paradigm is based on 'reductionism'. But for a new vision of reality we require an awareness of the essential interrelatedness and interdependence of all phenomenon which the toll of reductionism of the mechanistic world-view is ill-adapted to provide. This, then, calls for a switch over to an organic paradigm - the Aristotlean organic world view. This however, requires a backward step in history rather I would say a 'big backward leap' in history, taking into consideration the time contraint.

As against the mechanistic paradigm of the Cartesian-Newtonian science which is essentially reductionist the organic paradigm is holistic'.

The term 'holistic' has its roots in the Greek word "hoils' (whole) and refers to an understanding of reality in terms of integrated whole, whose properties cannot be reduced to smaller

units. "Holism" is the basic theoretical approach derived from the environmental observation of reality. "Holism" as a concept is as old as the Indian Upanisada. The Upanisada contains idea of wholeness of systems and unity of all life. Holism as developed by modern scholars like Smuts and latter by Bews states that - as a consequence of the existence of a complex environment, all phenomenon has to be analysed in the contact of the environment.[6] Holism, recognises unlike reductionism that[7]

(i) The whole is a contingent structure which is an reciprocal interaction with its own parts and with the greater whole of which it is a part and

(ii) neither the whole nor the part completely determines each other.

If we want a more durable civilizational pattern than we have to deal successfully with the most fundamental problem of our time. For this, however we need to recognise the problem which is of paramount importance for the survival of human beings as species. But the Descarte's method of arriving at true knowledge of things obscures the issue which is of fundamental

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6 Kurt Dopfer, 'Towards a New Paradigm' Kurt Dopfer, (ed) Economics in the Future, London, Macmillan Press, p. 9.

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7 Sailendra Ghosh, "Modern Science Vs Society' Seminar (New Delhi), June 1981, p. 21.

importance to mankind. The first principle of the Descarte's method of arriving at knowledge of things is "to accept nothing as true which is clearly not recognizable as such". And according to the second principle for a proper understanding of a problem what is required is, 'to divide up the problem into as many parts as possible and so examine each part in isolation'. Thus the second principle distorts the true nature of the 'crisis of ecology' for we know from the Gestalt School of Psychology that 'the sum of the parts is different from the whole'.(8) Thus the separate examination of the problem of 'crisis of ecology' deters us from clearly recognising the crisis. For example the separate examination of the problems of 'environmental degradation', 'inflation', 'rapid resource depletion', 'unemployment' etc. which are essentially the different parts of a single problem-namely the 'crisis of ecology' results in dilution of the seriousness of the problem of 'crisis of ecology. This results in our not being able to clearly recognise the crisis. This then gives rise to what Einstein would have called a 'crisis of perception'. And the first principle deters us in accepting the crisis as true, for it accepts nothing as true which is not clearly recognisable.

On the other hand it is this impasse which 'holism' helps us to avoid. For what 'holism' demands is a concern with a problem

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8. J.P.Chaplin and T.S. Krawiec, Systems and Theories of Psychology, New York, Holt , Rinehart and Winston inc.1979.,p.134-135

which is itself of fundamental and existential importance. Therefore, it also demands an examination of all facts and relations which can be shown to be relevant to it. Holism thus requires one to dismiss as impertinent the traditional boundaries which have been erected to mark off one discipline from the rest. Holism calls for interdisciplinary or multi-disciplinary research, for creativity depends on fullness of concepts, fullness of experience, fullness of heart. To quote Neils Bohr, "Fullness alone leads to clarity and in the abyss does truth dwell".(9)

In Paulo Friere's a formulation, no intellectual exercise can have any educational value unless it is critical and it cannot be critical unless it is holistic. In his own words: "The investigation will be most educational when it most critical, and most critical when it avoids the narrow outlines of 'partial' or 'focalised' views of reality, and sticks to the comprehension of total reality.(10) This then calls from the cultivation of what Paulo Friere calls "Critical Consciousness'(11). Thus cultivation of 'Critical Consciousness' as disintinguished by Paulo Freire from 'Naive Consciousness' which by definition is

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9. Neils Bohr, cited in Sailendra Ghosh, op. cit., p. 20

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10 Paulo Freire, Peadgogy of the Oppressed, Herdmondsworth:Books 1975 , p. 80.

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11 Paulo Freire, Education for Critical Consciousness , New York: The Seabury Press, 1973, p. 34.

uncritical can only enable us to perceive and then to meet the challenges of our time.

A holistic perspective again presupposes a long run view as against a short-run view, for only a long-run perspective can truly become a holistic perspective. Since a holistic perspective has to take everything that can be shown to be significant into account it has to incorporate a long run view. For example, the Keynesian prescription of "dig the holes and fill them up" to fight depression appears quite sound if we take only a short run view, for in the short-run it stimulates effective demand and helps to fight the evil of depression. But once we take a long run view, the solution appears worse than the malady itself. For it the long period it essentially leads to rapid depletion of terrestrial resources and hence creates a larger problem in the proces of solving a smaller one. Thus, the Keynesian approach of solving the problem of depression does not take into account all the factors that can be shown to be significant, for it takes a short - run view of the problem and hence is not holistic.

'Knowledge is not the product of brain alone, it is also the impouring of the heart', said Tagore. Thus, facts of any signifiance, cannot exist without values and 'is' cannot be severed from the 'ought'. This then, means that in the name of scientific positivism the professionals cannot eschew all

concern with the'ought' for the sake of the invioble 'is'. For a 'is - ought' disjunction will make one oblivious of the fundamental, and will result in the sole preoccupation with the triffles. As against this the 'is' and 'ought' that is the ' Head ' and 'Heart' become one in the face of most fundamental issue. Let us see how, what matters today more than anything else is the fact the human race as a whole faces the threat of extinction. Historically, this is a completely novel situation and we cannot effort not to take note of it. "In fact no positivist worth his salt, if he wants to give us a picture of the world as it can possibly push the novel threat away from the range of his concerns. But the moment he gets persuaded to take it into account, he cannot but open the doors of his peception to sentimentality.. Indeed, if this does not touch his motive cord, nothing ever will". (12a) This then is the way that the Head and the Heart become one at least in a non-trival situation. This is then the profoundest justification for what Roger Sperry calls the emergence of science and values. To quote him:

"Instead of separating science from values, the current interpretation leads to a stand in which science - in its purest sense as a means of revealing and understanding of man

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12. Narindar Singh, op. cit., p. 80.

12a. . Roger Sperry cited in Narindar Singh, "Economics from the Heartless". Mimeograph 298 p.5

and the natural order - becomes the best source, method, and authority for determining the ultimate criteria of moral values and those ultimate ethical axioms and guidelines to live and govern by it".(13)

Thus, in the new paradigm there has to be a emergence of 'is' and 'ought' so that the gap between them becomes as short as possible.

It is good to notice that cracks have already appeared in the super-structure of the 'old paradigm' and a beginning of a search for an alternative paradigm has already been made. The shift to a new paradigm however is not an easy task. This is perhaps the most difficult task any civilization has ever had to undertake. This herculian task requires nothing short of what Kuhn calls 'The Scientific Revolution'. As the decay of last year's leaves provides humus for new growth the following spring, so also, only the ultimate demise of the 'Old Paradigm' will provide the necessary infrastructure for the construction of a new, organic, holistic and more appropriate paradigm.

ECONOMICS UNDER THE NEW PARADIGM

Marcello Cini once suggested that economics could take a good breath of air from ecology and revive itself from the present coma.(14) This then implies that if economists wish to

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13. ibid. p. 5

regenerate their subject, they can do little better perhaps than to make ecology their central concern. Thus if at all economics is to become relevant then, it must cease to be concern with logical consistency alone. This does not however mean that it ought to renege
consistency. But what relevance demands is an adequacy to reality no less than to consistency. But yoked as it is to a mechanistic paradigm, it cannot see reality. So what is required first of all is a detachment of economics from the mechanistic paradigm. And this can only be achieved by adopting an ecological perspective. For an ecological perspective is essentially 'holistic'.

So it is time for new alliances and culture. An interesting starting point for detaching economics from the mechanistic paradigm could be what Schumacher calls 'meta-economics'. Meta-economics deals with two parts:

(1) One deals with man, and

(2) the other deals with the environment.

Its thrust is that it must derive its aim and objectives from a study of man and it must derive at least a large part of

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14 Enzo Tiezzi, "Under the Guidance of Entropy and Biology" Development;Seeds of Change , 1986: 3, p. 76

methodology from a study of nature.

Contemporary economists under the influence of the mechanistic paradigm have become so absorbed in logical mathematical and econometric subtleties that they have almost totally neglected the study of the environmental factors. They have kept the environmental factors outside the economic analysis by categorising them as 'external factors'. What they have failed to realise is that, it is these external factors upon which the meaningfulness of their exercises utterly depends. Thus for the revitalisation of economics, economists must turn their main attention to questions that now seem to lie completely beyond and outside their own reservation to what Schumacher calls 'meta-economics'.(15)

Schumacher makes a powerful plea for the study of 'meta-economics'by writing.

"If economics neglects the study of meta-economics or remains unaware of the limits of application of economic calculus, he is likely to fall into a similar kind of error as that of certain medi@val theologians who tried to settle questions of physics by means of biblical quotations."(16)

Again economics to be relevant must incorporate the entropic

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15. E.F.Schumacher. 'Does Economics Help? : An Exploration of Meta-economics' J.Robinson, ed,After Keynes,Oxford; Basil Blackwell. 1973 p. 33

concept of reality for the essence of this law is the essence of reality itself. Let us see how the 'law of entropy helps us to understand the crisis properly.

The first law of thermodynamics tells us that 'energy can neither be created nor destroyed'. Since energy can neither be created nor destroyed, if there is a demand for more energy than our entire supply of terrestrial resources then we simply cannot do things that we might like to do. In this sense the first law of thermodynamics sets an absolute limit on the total amount of available nergy in the world because our conventional fuel resources i.e. fossil fuels are essentially fixed and limited.(17) Here then, is a strong evidence for 'limits to growth' because the total nergy content of the world is constant and fixed. In this respect, the energy crisis is stark and of the first order.

Coming to the second law of thermodynamics i.e. the law of entropy, which says that the entropy of a closed system continously increases or that the order of such a system steadily turns into disorder. Entropy is the measure of unavailable energy within a closed thermodynamic system. The

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16. E.F.Schumacher, quoted in W.Kern, "Returning to the Aristotlelian Paradigm: Dally and Schumacher", F Journal of The History of Political Economy. Winter 1983, 15(4) , p. 510

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17 A.M. Weinberg, "Energy: Future Alternatives and Risks" Academy Forum, National Acadmy of Science (Cambridge), 1984, p. 12.

energy that is free for man to use is available energy, of law entropy and when energy is unavailable to man, it is of high entropy - that is when it has dissipated throughout a thermodynamic system. The law of thermodynamics has the following two implications:

From the first law it is obvious that we do not produce or consume anything, we merely rearrange it. And from the second law it is clear that our arrangement implies a continuous reduction in potential for further use within the system as a whole.

To understand the above point let us consider the economic process from the point of view of thermodynamics. From the point of view of thermodynamics, matter, i.e. energy enters the economic process in a state of 'low entropy'. For example when a piece of coal is burned, its initial free energy has become so dissipated in the form of heat, smoke and ashes that man can no longer use it. Thus the free energy of a system continuously and irrevocably degrades into bound energy.[18]

Another implication that follows from the second law is that in converting heat into or for that matter any form of energy

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18 Nicholas Georgescus - Roegen, "The Entropy Law and the Economic Problem", Herman E.Daly, Ed., Toward A Steady- State Economy, San Francisco: ;W.H.Freeman and Co., 1973, p. 40

into another form say mechanical energy there is always some waste heat or bound energy that pollutes the environment. In fact that bound energy is what pollution is all about. To quote Rifkin, "Many people think that pollution is a by-product of production. In fact, pollution is the sum total of all the available energy in the world that has been transformed into unavailable energy".(19)

Thus the entropy law, which connects all economic activities to their biophysical foundations(20) helps us to reach the root of the crisis of ecology. Thus economics to become relevant must take a entropic view of all economic activities.

Let us see by taking a concrete problem, how the entropy law is the supreme governing principle behind all economic activities. Inflation has been cited as the number one concern of the American people. Conventional economists who analyse inflation as a phenomena of 'too much money chasing too few goods', have not been able to deal successfully with it. This is due to the failure of the conventional economists to realise that today's inflation is tied directly to the depletion of our non-renewable energy base.(21) The more the energy extracted from the environment, the more

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19 Jeremy Rifkin, op. cit., p. 35

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20 Nicholas Georegescu-Reogen, op. cit., p. 1.

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21 Jeremy Rifkin., op. cit., p. 123

difficult it becomes to extract further energy from the environment. Again it becomes more costly to extract less easily exploitable supplies of available energy from the environment. Thus the cost of extraction of energy continues to rise all along the energy flow line. This, in turn, gives rise to a 'cost-push' inflation. Again the disorder from the past flow-through further accumulates and is an additional economic, social and political cost which further increases the prices for both consumers and producers. "Thus the inflation spirals faster and faster as the energy environment nears depletion".(22)

Barry Commoner has given statistics to provide irrefutable evidence of how the entropy law affects the whole process.(23) In 1960, every dollar invested in energy production yielded 2,250,000 BTUs of energy. This figure was reduced to 2,168,000 BTUs of energy in 1970 and just after three years the figure dropped to only 1,845,000 BTUs for each dollar invested. This implies that in just thirteen years, there has been a decrease of 18 per cent in the productivity of capital in energy production. This shows that the present day phenomenon of inflation has an ecological base and can best be understood with the help of entropy law.

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22 Ibid., p. 124.

22 Ibid., p. 124.

Thus only if economics adopts an ecological perspective and incorporate anentropic view of reality, then it will be able to deal successfully with the 'crisis of ecology' and thus cease to be irrelevant.

CHAPTER - V

C O N C L U S I O N

CONCLUSION

The 'economics-ecology debate' has acquired renewed importance in recent years due to the intensification of the crisis of ecology. It is paradoxical that although it involves nothing less than our survival as a race, the interface between economics and ecology happens to be one of the most englected areas of research. It is however good to find that in recent years there is a growing awarenGess among professionals of the ecological dimensions of development. Development and environemnt have become increasingly interwined.

The present study deals with the twin problems of 'The Limits to Growth' and 'The Pollution of the Environment' which together constitute 'The Crisis of Ecology'. The science of economics as it has been developed so far, has not been able to deal with the crisis of ecology successfully. This in turn has giaven rise to the 'The Limits to Economics'. Based as economics is in a mechanistic epistemology, it is essentially reductionist in its approach. And economics maintains its reductionist approach by relegating the ecological factors to externalities. This neglect is one of the main reasons of 'The Crisis of Ecology'.

To qoute Hans Immter; "From the beginning nature has remained outside the categories of economic thinking, yet production continuously devours nature. This contradiction is at the root

cause of crisis of ecology".(1)

The failure of the economists to recognise the ecological constraints on economic growth is one of the glaring examples of their utter disregard for nature. But the fact is that our planet earth is finite and hence economic growth cannot be continued indefinitely. Economists however have lost sight of this finitude and prescribe economic growth as the panace for all ills. The inevitable consequences of this are however, the rapid depletion of terrestrial resources which are essentially finite and also the pollution of different types. Thus economic growth for growth's sake is both destructive and unsustainable. Again the laws of thermodynamics can no longer be ignored in relation to the survival of mankind. The second law of thermodynamics tells us that the entropy of the physical universe increases constantly because there is a continuous and irrevocable qualitative degradation of order into chaos. If we take a entropic view of all economic process, it becomes clear that all economic actvities in their ultimate analysis degrade natural resources and pollute the environment. The earth is entropically winding down naturally. But the real concern is that the economic activities of the Hyper-industrialised societies are accelerating the process and hence leading the earth at a fantastic pace towards an ecological disaster. So survival dictates that man must learn to ration the meagre resources he has so profligately squandered.

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1 Hans Immter, op. cit., p. 44.

Economics can face squarely the challenge of the crisis of ecology first by emancipating itself from the mechanistic and reductionist epistomologyand secondly by adopting an ecological entropic world view based on a holistic perception of reality.

Ecology is basically a multi-disciplinary subject and discussion only of its economic aspects without adequate reference to the technological, social, political and other aspects would be inadequate for the understanding the multi-dimensional crisis of ecology. Thus to solve the crisis of ecology a multidisciplinary holistic approach is required. This however is not possible unless a transition is made from the mechanistic and reductionist paradigm of Cartesian and Newtonian science to a truely organic and holistic paradigm. Thus the only solution is a new paradigm.

The sooner mankind realises this and subnstitutes the mechanistic and reductionist world-view by a organic and holistic world view the better it will be for the human civilization, otherwise it will be caught by the same thread that has already strangulated so many species of birds and animals of the earth

One may say in the end that, the major global problems of our times such as resource and energy difficulties, environemntal degradations in their ultimate analysis are all inter-connected. They are the inevitable consequences of one basic mistake: our

determination to cling to a mechanistic and reductionist world view. Thus one neat solution to all these problems is to switch over to an organic and holistic World view. The survival of our whole civilization may depend upon whether we can bring about such a change before it is too late. Already time is running out fast..

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