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# WORLD SYSTEM PROCESSES AND THIRD WORLD ENVIRONMENT

BY

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## PREFACE

The Third World is frequently presented as an environmental and ecological disaster area. Numerous studies have documented the scale of environmental degradation in the developing world and the impovrishment and human misery and suffering to which it is giving rise. Many of these studies, however, confine themselves to descriptions of the symptoms of environmental disruption and decay and, in as far as they treat the causes of the problems described, seem to suggest that a rapidly worsening situation can be ameliorated by recourse to 'appropriate techniques' and 'environmentally sound' development strategies.

This view is not shared in this paper. It will be argued that the environmental and ecological problems that beset the Third World have their roots, not in 'inappropriate policies', but in the extreme inequalities that characterize the relations between rich and poor countries and rich and poor people. The starting point is the thesis that the growth of international economic relations has had a profound effect on the natural environment in the Third World and that the forces that marginalize the world's poor also marginalize nature, the basis of human existence. The forces and processes that have shaped the world economic system and the international division of labour, it will be argued, have given rise to a complex set of environmental and ecological problems in the Third World that are in significant respects different to those that prevail in the industrialized world.

World system processes and their environmental and ecological implications for the Third World is thus the main subject of this paper. Accordingly, it is divided into two main parts. Part 1 focuses on world system processes. The origins and growth of the capitalist world economy are first described

and the inequalities in international economic relations are discussed. The efforts made to redress these inequalities, first through institutionalized international development strategies then through the New International Economic Order, are reviewed. The environmental impacts and implications of world system processes and the international division of labour are the subject of part 2. A general review of impacts and implications preceeds more detailed treatment of problems in the area of technology and industrial development and agricultural development.

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## 1.1 Capitalist Economic Expansion

The origins of the world economic system can be traced to the sixteenth century and the specific conjunction of factors that led to the emergence of modern capitalism in Europe.[1] The Reformation gave the Christian, especially Protestant, faith a new militancy and proselytizing zeal through which the pursuit of wealth was transformed from an economic means to a spiritual end, beliefs that stood in sharp contrast to the other worldliness of Buddhism and Hinduism and constituted the equipoise of Confucianism. Max Weber (1965) has shown how Calvinism taught the bourgeoisie and parvenus that the pursuit of wealth was not merely desirable, but a duty.[2] The pursuit of riches, once feared an enemy of religion, became its natural ally as capitalism found a counterpart in theology.

The emergence of this new aggressive faith coincided with the New learning - the 'New Instauration' - based upon mathematics, mechanics and inductive method with its aim of finding out about 'things', and the acceptance of a philosophy based upon the idea that through science, as Descartes observed, "Man could become the masters and possessors of nature." The New Learning gave the European the tools to conquer nature and the new philosophy and faith the inclination to do so. Scientific discovery, social philosophy and religious belief became intrinsically linked to processes of capital accumulation, to the readiness to seek domination over nature and over others, and to impose cultural values with missionary zeal.

There was then no single reason for the emergence of modern capitalism in Europe. It was rather "an organic whole, a packet of change." (Needham, 1963, p.141) The conjunction of factors gave Europe, to use Wallerstein's terms, a "slight edge" that resulted in a "surge forward". (Wallerstein 1974, p.53) It provided sanctity to the European's exploitative view of man and nature. Under such a view, the legitimate instrument for expansion, conquest and control was the State, rather than the mind, as it traditionally was in India and China. It was a small step from this self-centered view to the belief than some men were more civilized than others and to the division of the human species into advanced and backward peoples, into masters and slaves, into the chosen and subject race. The emergence of modern capitalism gave rise to "lords of humankind" (Kiernan, 1969) who saw it as an ethical and moral duty "to obey our blood and occupy new markets and if necessary new lands" because "in the Almighty's infinite plan...debased and decaying races" must disappear "before the higher civilization of the nobler and more virile types of men."[3]

And new markets and lands were occupied. European powers fought to gain possession of foreign territories, first in Latin America and the Caribbean, then in Asia and Africa. The arms of capitalism gradually took hold of the world; continents were enchained and peoples subjugated, often ruthlessly. In the early period of growth and consolidation, slavery, murder and plunder became instruments of the State and the new mercantile classes. The processes of colonization legitimized the forces which underpinned them.By 1884 it was possible for the European powers to formally meet in Berlin to carve up Africa and to bring some semblance of order to their mad scramble for possessions. In doing so, they reduced territories to geometrical abstractions and, through the application of compass

and ruler, succeeded in drawing lines through more than 130 African tribal lands.

The historical process of capitalist expansion created a world assimilated to capitalism and the needs of the colonizing powers. Economic and trading relationships were established which, based upon extreme inequality, bestowed upon the colonial territories the role of reservoirs of cheap raw materials required to accelerate the growth of the colonizing powers. The process of capitalist expansion, however, was much more than an invasion of economic structures. It was pre-eminently an exercise in racial humiliation. The ethnic superiority intrinsic to the Western tradition made it possible for the colonizing powers to use and justify the most brutal and brutalizing treatment. Third World writers like Franz Fanon (1966, 1968) and Albert Memmi (1967, 1968) have shown the terrible psychological impact that this treatment has had upon the poor countries: the poor were told they were inferior and, through the forced assimilation of an ideology of discrimination, came to believe they were. Colonialism was much more than an economic system: it was also a cultural invasion that conquered both souls and bodies.

The indiscriminate intrusion of capitalist structures into the corners of the Third World became a decisive force in the disruption of indigenous social systems and cultural values and the erosion of the traditional technological base. It has meant that some poor countries are today less able to meet the basic material needs of their people than they were before the colonial period. The most obvious example is the case of food supplies. The appropriation of agricultural surpluses certainly predates modern colonialism: the Romans, for example, used and eventually exhausted the North African granary. The colonial empires

of modern times, however, ushered in a new phase by using colonial territories to furnish the cash crops required to fuel their own industrial development. The insistence upon cash crop production effectively destroyed indigenous food systems. As a consequence, many societies that were formerly food abundant have been transformed into food deficit societies.[4]

Behar (1970) has shown, for example, that the Mayans, prior to the Spanish conquest, had no serious nutritional problems. They adopted agricultural practices that preserved ecological balance and conserved soil fertility while ensuring a varied diet of corn, beans, fruit, vegetables and game. With the conquest came malnutrition. The Spaniards took over the crops which they then sold back to the Indians for gold and forced them to clear land for cotton, sugar and gold. The British, French and Spanish turned the Caribbean over to 'King Sugar' and, often with the help of bucaneers and pirates, built mercantile empires on the basis of the sugar trade. In the sixteenth and seventeenth centuries, European interests in their Caribbean possessions - possessions that frequently changed hands - was greater than in their North American territories. (Millet, 1979)

Travellers to Africa, Asia and the Pacific in the eighteenth and nineteenth centuries were impressed by the abundance of food and at the level of technological skills.
Travellers in the Pacific, for example, were surprised to discover complex irrigation systems in many Malanesian islands. A visitor to the Solomon Islands in 1853 felt compelled to observe that "although the country is not generally fertile a degree of pains seems to have been taken that I never expected to see among savages." (Spriggs, 1980, p.1) In Africa, countries like Upper Volta, today a so-called 'basket case',

were producing the surpluses required to tide them through periods of drought until as late as the first part of this century. (Ball, 1976)

The problems of hunger and malnutrition took on the form we know today with the introduction of enforced cash crop production linked to the emerging international division of labour. The Spanish colonizers pushed the American Indians from the fertile valleys onto the barren and ecologically unstable hillsides where their descendents still live. The British forced peasants to become agricultural labourers by driving them from their subsistence plots, making them dependent upon the food imported from the home country by the companies of Empire. In the Congo, the Belgians expropriated collective landholdings on a massive scale. Villages were burnt and peasants, deprived of their livelihood, were forced to gather plantation crops, sometimes at gunpoint. (Kabala Kabunda, 1975) The French in Africa employed a subtle system of taxation to coerce peasants into producing cash crops for French companies.

Colonialism affected subsistence agriculture in four main ways: it resulted in a decline in the range of crop species grown; in the number of varieties grown; in the range of techniques employed; and in the intensity of cultivation systems. (Ward, 1980; Ward and Proctor, 1980) The combined effect of all this was an overall impoverishment of subsistence agriculture and, eventually, the destruction of local food systems.

The penetration of capitalist structures not only led to the collapse of indigenous food systems and the loss of control by local communities over their surroundings, it also devalued traditional technological skills and distorted processes of industrial development. German travellers to Tanzania in the nineteenth century, for example, described

a level of technological skills comparable to that which existed in preindustrial Germany. Many of these skills were lost as the country was flooded by the mass produced goods manufactured in British industrial centres. (Kjekshus, 1974) The industrial development that was to take place in many colonies was inevitably oriented towards meeting the development needs of the colonizing country. The colonial period gave rise to a structural imbalance between capital goods and consumption industries. This imbalance has been maintained and reproduced within the general framework of dependence that followed decolonization. As a result of these processes, national economies did not develop as internally coherent systems, but as open and vulnerable economic spaces within a worldwide economic system. (Amin, 1977a)

It follows from the above that the causes of underdevelopment have their roots in the dialectical process of the internationalization of the world system and in the forces and processes which have underpinned the emergence, formation, expansion and consolidation of modern capitalism. The international system, as it has evolved, is not exclusively 'economic'. Rather, it comprises a structure of institutions, classes and power relations. The structure is a hierarchical one characterized by a complex set of exploitative relations which lead to the marginalization and fragmentation of the poor countries.As Baran and Sweezey (1969, p.179) have observed: "Those at the top exploit in varying degrees all the lower layers, and similarly those at any given level exploit those below until we reach the very lowest layer which has no one to exploit." The lowest layer is the poor in the poorest countries who have nothing to exploit but the environment. The chains of peripheralization usually end up somewhere in the countryside at the very edge of the world system where an old woman, prematurely aged by the unremitting struggle to stay alive, scratches with a hoe on the barren ground of a denuded hillside in

what economists euphemistically refer to as 'the primary sector of the economy.'

The old woman is, however, 'in' the world economic system and not outside it. The structures which underlie the system and the mechanisms which govern its functioning have effectively penetrated the most isolated sectors of the poor countries. Scores of studies have conclusively shown that even the most backward peasant regions can be bound by fine threads to the dynamic sector of the national economy and through it to the world market place.[5] Even in Papua New Guinea, regarded by many in the West as the last frontier of the primitive world, virtually all of the remote hinterlands and peoples have now been pulled peripherally into the national economy and through it to the world economy. (Keesing 1980; Kuitenbrouwer 1981)

As Western capitalism developed, first through Europe, later through the U.S. and Japan, into the dominant economic structure, so the Western model of development became accepted as being universally applicable. Today it is regarded, in most of the South as well as the North, as natural and normal, legitimized by a cognitive structure that has developed over several centuries and by the attitudes engendered by colonial rule and cultural indoctrination. The Western view of the world has become the dominant socio-cultural as well as economic cosmology. (Galtung, 1978) Because this view is regarded as natural and normal, challenges to it, for example by the periphery, are regarded as unnatural and deviant, something which is contrary to the laws of nature, as witnessed by Western reactions to transformations in poor countries which involve a violent rejection of the Western cosmology.[6] The readiness of the poor countries to embrace this cosmology has further facili-

tated the intrusion of capitalism as a disruptive force and is the root cause of many of the problems subsumed under the general heading of 'mimetic development.'

## 1.2 The Internationalization of Development

From its origins in the sixteenth century, the world economic system has grown into a juggernaut which has effectively incorporated the far corners of the world. Like a juggernaut, it obeys its own code and laws of behaviour and conforms to its own logic. The capitalist mode has become the dominant mode which, in turn, has become the normal structure.

Although the normal structure, however, those in positions of power as well as the defenders of the status quo acknowledge that it is far from perfect. The life of the poor on the edges of the system is acknowledged to be miserable and the misery is seen as a potential threat to the future stability of the system. As a wave of political liberation swept across the Third World in the post-war period and newly independent nations embarked upon ambitious programmes of development, so the system responded with two decades of development efforts solemnly institutionalized in international development strategies.

The internationalization of these efforts stood on three legs. (Baros and Dolman, 1981) Firstly, international aid and with it the export of hardware (capital equipment) and software (management skills), technology for investment in infrastructure and basic industries. Steel and cement plants, industrial estates, dams, harbour works, highways, power stations, irrigation and flood control works typically headed the list of projects for which aid was sought. University and post-graduate training in North America and

Western Europe supplemented the hardware with managerial capacity, the fellowship programmes emphasizing the acquisition of skills in such fields as public administration, business administration, and national and regional economic, social and physical planning.

The second leg was direct investment of private capital from the North, first in the various resource sectors which colonialism had left in foreign hands, later in local manufacturing branches within the protective walls of import substitution policies and, more recently, in the manufacturing export sector, taking advantage of cheap and 'disciplined' labour which the newly independent country were persuaded to view as a resource endowment. The stock of foreign investment in the newly independent countries quickly grew to some $50 billion and, today, Japan, West Germany, the U.K. and U.S. channel respectively 51%, 60%, 48% and 39% of their overseas private investment to the Third World in the manufacturing sector. (Benachenhou, 1980)

Thirdly, the internationalization of development efforts required the promotion and active support of industrial/managerial/administrative elites and dependent class structures who, where necessary with the assistance of the military, could ensure social and political domestic stability should the benefits of development fail to reach the poor. Governments responded by liberalizing laws regulating the conditions of foreign investment and profit repatriation, by dismantling import barriers, by devaluating local currencies, and by frustrating the efforts made to organize labour.

The most favoured development model was one which respected the universality of the Western cosmology and Western experience. Developing countries were viewed as developed countries at an earlier stage of development. All countries were

seen to start from more or less the same point and, as in a cross country race, were confronted by more or less the same obstacles. (van Bentham van den Bergh et al, 1972) Some countries, logic dictated, would simply run faster than others.[7] In this race, the direction to be followed was mapped out by the Western academic community which was quick to devise theories of development which had pedigrees in, to use Duley Seers' term (1979, p.708), "colonial economics out of political expediency." The speed at which the obstacles could be negotiated would be determined by the carrots and sticks to be found in the hands of expanding TNCs, bilateral and multilateral aid agencies, and a strengthened national entrepreneurial class linked to Western centres of finance and technology.

The theory upon which these efforts were based became known as the 'labour surplus growth process.' (Lewis, 1954) It argued that by assiduously exploiting comparative advantage and by concentrating upon the development of the 'modern sector' of the economy there would be an assault on the 'traditional sector' from which the surplus labour would be drawn. Professor Rostow (1960) gave us the robust image of an airplane on the tarmac to describe the processes involved: first the gathering of strength (initial capital accumulation), then the take-off (growth of the manufacturing sector and the development of infrastructure) and, finally, the cruising flight, the mature state of the economy with services, welfare system and consumerism. The engine of growth was supposed to be the resource sector (mining, forestry, cash crops for export) the products of which would be offered for sale on the international market for processing in the industrialized countries, combined with import substituting industries, manufacturing cheap products for mass consumption (textiles, footwear, beverages) in the

local market, sheltered from foreign competition. The distribution of the benefits of development (in the form of a more equitable income distribution and improved access to social services) would be taken care of by 'trickle down' processes. These processes would ensure that the poor masses would, over time, be moulded into factory workers, secretaries, professionals and government administrators.

By the mid 1960s the first 'success stories' began to emerge: Taiwan, South Korea, Brazil, Hong Kong and Singapore, with a second line of aspirants, like Mexico, Venezuela, Argentina, Iran, Malaysia and Nigeria, on the verge of a breakthrough. Certainly, the 'success' of some of these countries was conditioned by special circumstances as much as by the faithful application of the dominant development theory. Taiwan, South Korea and Iran had received massive injections of foreign aid under the imperatives of cold war politics. Venezuela and Iran had benefitted from the export of oil. Brazil's prosperity was concentrated in a handful of cities, and Hong Kong and Singapore are city states and economic abberations. Whatever the reasons for their success, however, their progress had two embarassing aspects. Firstly, the very success of a *few* developing countries only served to highlight the lack of success of the others. Secondly, the poorest groups *within* the countries that had performed well had benefitted little if at all from the growth that had taken place and the progress made within the modern urban sector, the 'engine' of growth.

There was, as it turned out, very little 'trickle down'. According to the World Bank, the material conditions of the vast majority of people in the Third World have barely changed. Nearly half of all the people alive today live in

absolute or relative poverty.[8] The standard of living of about half the population in the Third World actually declined in the period 1965-1975, a decline which is continuing. (ILO, 1980) Even industrial workers, the privileged few in many developing countries, saw their real wages fall. As the situation worsens, the poor countries have been forced to borrow from Western institutions, some of them very heavily. Total Third World debt in 1980 stood at $456 billion, one half of which is supposedly due for repayment in 1982. Some countries have now reached the impossible stage where they must spend 90% of all that they earn abroad just to pay their creditors and to meet their modest fuel needs.

After nearly three decades of development efforts, the situation in many developing countries is today more critical than ever before. In the words of Amir Jamal, Tanzania's highly respected Finance Minister, "the issue in many cases is one of survival...they could go over the precipice if they are not careful." A further deterioration can only mean, in Jamal's words, "political chaos. It means violence, it means turbulence, upsetting of the order."[9]

Even the success stories in the Third World - now officially labelled the newly industrializing countries (NICs) - are finding it increasingly difficult to disguise acute economic and social problems. Their industrialization has been indebted industrialization and much of the debt is owed to Western banks. The figures are now so large that major defaults could throw the Western banking system into chaos. (Engellau and Nygren, 1979) The City Bank, for example, has reportedly lent Brazil an amount equivalent to its own capital. The consequence is that banks have to lend money under the threat of default and the NICs are forced

to borrow money just to service their ballooning debts. This is a process with inherent limits.

The style of their industrialization - offering Western transnationals a cheap and well-disciplined labour force and a high rate of return on investments of capital and technology - is also giving rise to growing internal inequalities, increased social tensions and political unrest. Whether the NICs will first crack under the weight of their growing debts or under the pressure of internal dissent is a question which remains to be answered. In an 'economic miracle' even optimism can seem grim in the early 1980s.

The experience gained in the past three decades of development efforts point inescapably to the conclusion that processes of national development are as much determined by the *terms of participation* in the capitalist world economy as by the logic of accumulation within national boundaries. It also shows that the very forces and process which lock national economies into the world economic system are able to block the economic emancipation of the poorest groups within the poor countries.

These terms of participation have, we have argued, their origins in a different historical period. The economic relations that exist today are essentially those that were created under colonialism. Economists of different political persuasions have examined these relationships and the effects of the mechanisms moulded into the international economic system which effectively channel the benefits of increased productivity from the periphery to the centre. Liberal economists, like Myrdal, Lewis and Singer, have shown that once a pattern of inequality has been established, the simple operation of market forces will not only maintain but also accentuate it.[10] Radical economists, using a Marxist interpretation of price formations, have reached

the same conclusion.[11] The experience of the post-war period has clearly shown that the workings of an ostensibly 'fair' system of free trade can, when applied to an unequal situation, be just as damaging to the poor countries as processes of imperial extraction from tributary territories were in the past.

The same experience has also pointed to the spurious relevance of the theories in which developing countries have placed so much faith. The imperatives of industrialization in the second part of the twentieth century, which is now projected by large enterprises on a world scale, are very different from those of the first part of the century. High growth rates of output, for example, no longer correspond with high rates of labour absorption. They have also given a new meaning to the concept of comparative advantage, the traditional cornerstone of theories of international trade. It is no longer nation states or world regions that make the difference, but rather pollution regulations, taxation policies, export zones, communications infrastructure, labour skills and disciplines, all highly localized in manipulable production environments.

## 1.3 The New International Economic Order

As the structural distortions in the world economic system became increasingly apparent and the theories which underpined several decades of development increasingly transparent, the developing countries have sought, through the United Nations, to establish a New International Economic Order which would "correct inequalities and redress existing injustices and ensure steadily accelerating economic development, peace and justice for present and future generations."

Although presented as a revolutionary set of proposals for reordering the world economy, it has become clear that it is nothing of the kind. (Dolman, 1981, Chapter 3) More interesting than the specific package of proposals presented by the Third World for the reform of the international order, however, is the logic which underpins them. The foundations of the package are firmly anchored in Western theory and value premises. As presented, the package of proposals is essentially an integration package which aims at correcting market distortions and at addressing some of the forces which lead to the marginalization and peripheralization of the developing countries. The package is concerned with improving the terms of participation in a system which the developing countries do not and cannot control.[12]

The logic of the NIEO package can be shown to be impeccably capialist. (Harrington, 1976) If implemented it would enable the Third World - or more precisely some developing countries - to obtain a fairer price for its products through an improvement in terms of trade and an increase in value-added, but it will not and cannot transform the relationships which maintain and reproduce dependence and domination. Although rejected in most Western circles as an extremist challenge, the NIEO package clearly recognizes the primacy of the dominant structure. It attempts to tame but not to transform the juggernaut.

For this reason, the implementation of the NIEO package would result in a world which looks much the same as it does today. There would, however, be two significant differences: there would be more accumulation of capital in the centres within the periphery; and there would be more independent capitalist activity carried out by the centres in today's periphery.[13] The logic underlying the package would ensure the more effective integration of centres of peripheral capitalism in the world economic system and enhance the

capacities for accumulation in such centres. The rise of regional hegemonic powers, intimately linked to the centres of Western capitalism, together with the growth of what Wallerstein (1979) has called "semi-peripheralism", would be inevitable consequences of the New International Economic Order. Unless linked to reforms in national orders, the international reforms would leave the problems of world poverty largely untouched.

Moreover, the implementation of the NIEO package would almost certainly worsen some of the internal problems with which developing countries are wrestling and showing few signs of winning. The international reforms would, for example, stimulate the development of the 'modern' sector and the production of goods for export. This would most likely exacerbate the problems surrounding the growth of enclave economies and of effectively integrating these, through backward and forward linkages, into national economies. There would be a stress on industrialization through imported production techniques, most probably to the neglect of rural areas and the further erosion of the traditional technological and ecological base. These processes would inevitably accelerate urban-rural migration and result in the further growth of squatter settlements in and around large cities where the 'modern' sector is concentrated, with an accompanying intensification of the economic, social and environmental problems caused by migration. Against this background it is not unreasonable to assume that while the implementation of the NIEO reforms would enhance capacities for accumulation in the Third World, and thus increase equality of opportunity at the world level, it could result, without positive measures by developing countries to the contrary, in increased inequalities within many nations in the Third World.

These observations are not to argue against the NIEO nor the need for the reform of an international order which is founded upon relationships which are fundamentally inequitable, but simply to note that NIEO package not only recognizes the primacy of the dominant structure, but also employs the logic of the structure in order to reform it. As such, the reforms emanate from within the structure rather than from outside it. The product of the system they seek to improve, they cannot lead to the transformation of the system itself. Like the three decades of development effort that came before them, the NIEO reforms can only hope to tame the juggernaut. They will not, however, bring about its transformation.

## 2. ENVIRONMENTAL IMPACTS AND IMPLICATIONS OF WORLD SYSTEM PROCESSES

### 2.1 Environment, Development and Underdevelopment

An understanding of the forces and processes of the world economic system is essential for an appreciation of the environmental afflictions that beset large parts of the Third World. Many environmental problems are rooted in the problems of underdevelopment: in the role afforded the poor countries in the international division of labour (a cause of underdevelopment) and in the unremitting struggle for survival of the poor who are marginalized by the system (a consequence of underdevelopment).

Many of the global environmental problems which are now receiving - and rightly so - much attention by both intergovernmental and non-governmental organizations can be traced to the practices adopted and consumption patterns fostered by the Western world and its determination to capture control of renewable and non-renewable resources. The list of such problems is long and alarming. It includes the disruption of the oxygen and carbon dioxide cycles and the

changes they can induce in the world's weather; the depletion of the ozone layer and the threats this may carry for animal and plant life; the dangers caused by the disposal of radioactive wastes at sea by a handful of nuclear powers; the depletion of the world's fish stocks by the distant water fishing fleets of the powerful maritime states; the depletion of renewable and non-renewable resources at unprecedented rates; the pollution of the land, seas and atmosphere by the indiscriminate release of some half million chemical compounds, some of which are highly toxic; the spread of acid rains over distances of up to 100 km from their source, and their destructive impact on animal and plant life.[14]

Such problems, even though their origins may be local, can be legitimately termed global problems since many of them have consequences which could affect, if not the world's total population, very large numbers of people. We will argue, however, that many of the environmental problems of the Third World must be viewed in a light which is different to the one accorded global problems and, more importantly, these problems are fundamentally different from those which characterize industrialized countries. The causes of many environmental and ecological problems, we will argue, are directly related to the terms of participation of the poor countries in the capitalist world economy and to the place afforded them in the international division of labour as it has developed over several centuries.

We will do so by first making some general observations and then by looking in more detail at two areas: technology and industrial development; and agricultural development and food systems.

The international division of labour bestowed upon the poor countries the role of reservoir of cheap resources required to feed the growth of the industrial centres. Mineral resources have been mined, quarried or otherwise extracted often with little or no concern for environmental impacts. The extraction of the phosphate rich central plateaus of the islands of Nauru and Banaba by British, Australian and New Zealand interests, for example, have resulted in the transformation of the plateaus into soil-less, craggy landscapes which will make it impossible for the islanders to return to agriculture once the supplies of phosphate are exhausted. The extraction of minerals in the Third World has traditionally been accompanied by denudation, large scale soil erosion with the concomitant problems of sedimentation, the disruption of ecological cycles, and flooding.

The environmental destruction associated with mining also took less obvious forms. Mining in developing countries transformed social as well as economic structures in ways which have had profound effects on the natural environment. In Zambia, for example, the promise of minerals, particularly zinc and silver and later copper, brought British interests into the area from the south in the form of the British South Africa Company. Faced with the problem of recruiting and feeding the labour required to work the mines, the company first encouraged African peasant farmers to change from subsistence farming to the production of the food crops required to feed the miners. When white settlers arrived from South Africa to establish commercial farms near the mines and along railways, the company discriminated against the African producers. African cultivators were displaced to make way for the Europeans. This gave rise to much higher densities of African cultivators who were forced to resort to unsound agricultural practices.

Overcropping and the cultivation of steep slopes resulted in soil degradation, erosion and a rapid reduction in soil fertility. (Robinson, 1978; Blaikie 1982)

In Northern India, the transformation of subsistence farming to cash crop production had similar very negative environmental consequences. The British built networks of railways and canals to promote the development of export spring crops at the expense of the autumn crops of millets and pulses upon which much of the population depended for food and fodder. Designed with little concern for proper drainage, the networks resulted in the loss of more than one million hectares of agricultural land to salinity by 1891. (Whitcombe, 1972) The railroads that came later accelerated the losses. Drainage was further impeded by the building of new embankments and barriers, and soil erosion and flooding was speeded up by the demand for timber both for railway sleepers and fuel. The deforestation that followed deprived poor families of a source of fuel, compelling them to use cow dung for cooking rather than as a natural fertilizer for their crops. This large scale destruction of the natural environment was accompanied by severe social and economic distortions which together resulted in the impoverishment of a large part of the peasant population.

Industrial centres continue to be nourished by the world's tropical moist forests, the richest land environments known to man. Tropical moist forests, including rainforest, cloudforest, and swampforest, cover 900 million ha. of the planet's surface. Brazil alone has 33% of the world's total, while Zaire and Indonesia each have 10%. Estimates of annual tropical moist forest losses vary considerably but according to an authorative study conducted for the U.S. National Academy of Sciences (Myers, 1980) it could be

as high as 21 million ha a year, an area the size of the United Kingdom.

The demand for tropical hardwoods and pulp in the Western world, cattle ranching for meat exports, and mining are among the main causes of this massive deforestation. The environmental and ecological effects have been dramatic. Soil erosion, flooding and landslides are common, causing siltation of rivers and reservoirs and the disruption of water and electricity supplies. In Sri Lanka, for example, deforestation in the Central Province has turned the catchment areas of the country's two large hydro-reservoirs, which together produce 98% of the nation's electrical power, into a wasteland. Soil erosion has silted up the reservoirs to the extent that Sri Lanka's electricity supply is threatened and plans to electrify 1200 rural villages have had to be shelved. (Peramunetilleke, 1982) The deforestation is also believed to have resulted in a reduction of local rainfall, in the important season between the monsoons, thereby threatening water supplies. Decreases in local rainfall as a result of deforestation have also been observed in Haiti and Senegal.

At present rates of exploitation,lowland rainforests in West Africa, Malaysia, Indonesia and the Philippines will all but have disappeared by the end of the century. The speed and carelessness at which the rainforests are being cleared have forced some environmentalists to conclude that areas where the world's oldest forests once stood could become deserts in the space of a single lifetime.[15]

As the forests go, so do their traditional peoples, either as a result of the diseases introduced - sometimes intentionally - by the new settlers or, in cases where they have been

regarded as little more than 'jungle vermin', as a result of deliberate policies aimed at their extinction, as has occured in parts of South America. In this context, the determination of developing countries to exploit their resource endowments - in this case tropical forests - in ways which enable them to carve out a place for themselves in a competitive international division of labour is directly linked to the deliberate destruction of indigenous peoples.

Also being destroyed by the same process is the world's stock of genetic material. Of the 5-10 million species known to man, about three quarters are to be found in the tropics. So far, scientists have explored the utilitarian value of only 1% of all species but further research and the application of techniques of bioengineering is expected to disclose myriad products for everyday use in such fields as agriculture, medicine and industry. (Myers, 1979)
This treasure house of living tissue is being depleted at unprecedented rates. At present, one species disappears each day. By the end of the 1980s, the figure could be as high as one per hour. By the year 2000, one million species could be extinct, and the rate of depletion could continue to grow. (Myers, 1981) The extinction of animal and plant species is an irreversible process and it is one that is clearly linked to world system processes and the role afforded the developing countries in the international division of labour.

The growth of monocultures and plantation economies in the Third World, where cash crops are grown for export rather than food for local consumption, has also had a range of negative environmental impacts. In monocultures there are basically two types of ownership, both of which are historically determined. First, there are the large plantations which may be locally or foreign owned. When foreign owned, they are

branches vertically integrated into a large multinational firm. The firm makes all the important decisions affecting production, financing, marketing and distribution. Locally owned plantations, while not vertically integrated into a firm, are equally integrated into the world economy, and the owners, be they individuals or the state, are dependent upon others for both the supply of basic agricultural raw materials, such as fertilizers and pesticides, and marketing and distribution channels. The second type of ownership is small family farms and holdings producing the same crop. The need to sell what is produced links them to the international market place and makes them similarly dependent on external factors over which they have no control.

Both types of ownership have given rise to environmental problems. On the large plantations the relative abundance of land has encouraged waste and poor environmental practices. Soil erosion is typically a serious problem and ever larger volumes of imported fertilizers are required to maintain soil fertility. The execessive dependence on fertilizers and pesticides gives rise to a chain of environmental problems, as will be discussed in the last section. On the smaller family landholdings, population pressures combined with limited financial and technical resources have led to the overcultivation of land and, consequently, soil erosion, the loss of fertility, and, in general, environmental degradation. Monocultures reduce ecological diversity and increase ecological vulnerability. It increases susceptibility to plant disease and pests and reduces genetic diversity. For these and allied reasons, it may be wrong to assume that land that has long been used for the production of a single cash crop can be easily turned over to food production.

The environmental effects of monocultures have been particularly severe on islands. The advent of mechanization, following on the import of first slave and then indentured labour in such sugar islands as Mauritius, Fiji and Barbados, for example, led to large populations that became trapped on the islands due to poverty and lack of education. In these circumstanes, ecological and environmental pressures can become particularly intense and destructive, adding to the extreme vulnerabilities of island ecologies. (Gouron, 1963)

The plantation economy is thus much more than an economic system. It has also had profound political and social effects. It gave rise to a pronounced misallocation of resources, carried high social costs, and created vested interests, all of which distorted the processes of development. (Beckford, 1972) These distortions have had profound environmental impacts.

Processes of industrialization and urbanization have similarly been distorted by prevailing international exchange relations. Much of the development that has taken place in the Third World has been mimetic in character and confined to sectoral and geographical enclaves. This has been a significant factor in the massive migration of people from rural to urban areas. Driven from the countryside by a long tradition of political and economic neglect and ever declining standards of living and opportunity, and attracted to the towns and cities by the prospect - often illusory - of jobs and a better future, people have uprooted themselves in unprecedented numbers. The dramatic growth of Third World cities - cities with features, quantitative and qualitative, which refuse to recognize the relevance of Western urbanization theory and experience (Payne, 1977) - is placing enormous stress on the natural environment. And since the

growth of Third World cities is expected to continue - some 60% of the world's population will be living in the crowded cities of the Third World by the end of the 1980s if present trends go unchecked - the environmental pressures can be expected to further intensify.

Already many Third World cities cannot cope. Mexico City, for example, a city whose population is expected to double by the end of the century, already has to pump water over a distance of 200 km to meet the needs of its inhabitants, using one third of all the power it generates in the process. Urbanization in the Third World is a major cause of environmental degradation and economic impoverishment and many of the forces which have fuelled the massive movement of people have their origins in the processes of the world economic system.

Many of the poor that remain behind in the rural areas are also agents of ecological destruction. Their search for firewood, for example, has denuded hillsides causing erosion, sedimentation and flooding. They cultivate slopes which could best be left under tree cover and allow their sheep and goats to overgraze pastures. In this they have no choice. Last in a long chain of exploitative relationships, they have nothing to exploit but nature.

The landless peasants - in Brazil 70% and in Java 85% of the population is entirely landless - are pushed by the forces that underpin the world economy onto marginal lands and into the more intensive cultivation of the 'commons'. (Blaikie, 1982) In East Kenya, for example, the weaker sections of the peasantry, unable to compete with the richer peasants, have been pushed into more arid lands, where population pressures and unsound agricultural practices have given rise to ecological destruction and the acceleration of processes of desertification. (O'Keefe et al, 1977) In Nepal and Sri Lanka, landless peasants have

been compelled to illegally clear forests and cultivate steep slopes in the knowledge that the soil will be washed away within a season or two. (Blaikie, 1980; Blaikie et al, 1980) With up to 13 people cultivating each hectare, topsoil losses in Nepal have reached such proportions that it can reasonably be considered the country's "most precious export". (Eckholm, 1976, p.78) The tribal Sora of Orissa, India, have been driven by taxation policies and exploitation out of the valleys that have traditionally been their home onto steep and wooded hillsides. Forced to practice shifting cultivation with 3-4 year fallow periods as opposed to the 10 year period practiced a generation ago, they have, in the space of 30 years, transformed dense jungles into near deserts. (Vitebsky, 1981) In other parts of India - particularly the mountainous states of Himachal Pradesh, Uttar Pradesh, Assam, and Jammu and Kashmir - there are millions of hectares without any topsoil at all, only a rocky sub-stratum devoid of organic matter.

In large parts of South and Central America the situation is similar if not worse. In El Salvador nearly 80% of the country's surface is subject to soil erosion, making it one of Latin America's most environmentally devastated countries.[16] Most fertile and productive land - the middle volcanic slopes, the interior basins and river valleys and much of the coastal plain - is owned by the export-oriented *latifundistas*. Hundreds of thousands of peasants have been driven onto marginal, often hilly, land where, struggling to grow the food required to keep them alive in the face of official repression, they ignore the agricultural practices they were once able to adopt, abandoning exhausted land after a year or two of cultivation. Similarly in Haiti, inequitable land ownership, the maldistribution of economic opportunity and persistent and grinding poverty have reached the point where soil erosion has become, in the view of the United Nations, the "country's principal problem." (UNDP, 1972) North American sugar corporations own the

most productive land, crowding the peasants onto the slopes where cultivation is a futile and at best a temporary proposition. (Riding, 1975)

In an economy of inequality and poverty, there can be little place for environmental conservation and the husbandry of resources. The victims of a system that gives the most productive land to the privileged classes directly linked to the international market place, the poor peasantry will remain agents of ecological disruption until such time as they have access to a plot of land capable of ensuring a decent living on a sustainable basis. (Eckholm, 1979) Viewed in these terms, the forces and processes that marginalize the poor also marginalize nature, the basis of human existence.

In short, 'underdevelopment' is the word that best explains the ecological destruction which is taking place in large parts of the Third World. It helps explain why deserts are expanding at the rate of nearly 60,000 sq. km. a year and why an area twice the size of Canada is on the brink of being turned into a desert, threatening still further the survival chances of more than 600 million people. It is the reason why an island is forming in the Bay of Benegal out of the once fertile soils of Himalayan valleys. It is the reason why the Panama Canal may be little more than an open ditch by the time it is taken over by the Panamanians.[17] It helps explain why perhaps one third of the world's cropland may disappear in the next 20 years.

Underdevelopment, we have argued, has its roots in the processes and forces of the world economic system. It follows that the same forces and processes are the cause of many of the environmental problems which presently confront the Third World.

## 2.2 Technology and Industrial Development

Modern science-based technology has been a decisive force in the growth of the world economy. Immanuel Wallerstein (1974) has elegantly shown how the size of the world economy is a function of the state of technology, and how technology has served to integrate the system's component parts. Technology has become one of the keys to understanding centre-periphery relationships and the growing disparities between the world's rich and poor. The rich world not only produces and trades the commodities which the world apparently wants, it has also developed the capacity for technological change and innovation, a capacity to a large extent vested in the laboratories of TNCs. This has enabled them to become the main beneficiaries of any type of commercial transaction with the Third World, be it in the areas of trade or investment. (Singer and Ansari, 1977)

In its national context technology comprises a system of knowledge, experience, skills and organization required to produce, utilize and control tools and services that we can call techniques. It is pivotal to development: whether the need is more food, better education, improved health care, increased industrial output, more efficient transport and communication, ensured energy supplies, and the capability to control natural disasters, technology plays a decisive role.

The poor countries have become acutely aware of the importance of technology to the process of development. They understand that without a capacity for change and innovation they are forever condemned to penury and stagnation. In search of technology, they have turned to the

industrialized world, especially Western TNCs, that presently supply between 80-90% of all the technology acquired by the Third World.

Much of the technology, however, has been acquired indiscriminately and has been subjected to little in the way of rigorous evaluation. There are many reasons why it should be. Technology is not merely a means of production and therefore neutral. As a system of knowledge, experience, skills and organization, technology incorporates and reflects value systems. It embodies deeply rooted assumptions about the organization of knowledge, space and time, of human relations and relations with nature. (Galtung, 1978; Dahlberg, 1973)

Every technology carries its own code - economic,social, cultural and environmental. Western technology embodies the code of Western cosmology. (Galtung, 1978-1979) The economic code requires that technologies be capital-intensive, research-intensive, organization-intensive, and labour-extensive. The social code is one which creates a centre and a periphery and thus perpetuates a structure of inequality. The cultural code presents the Western World as being entrusted with the historic mission of moulding the world according to its own image. The environmental code built into the technology presupposes a relationship between man and nature that is typically vertical; one in which man is given to rule over nature, to be to nature what God is to man.

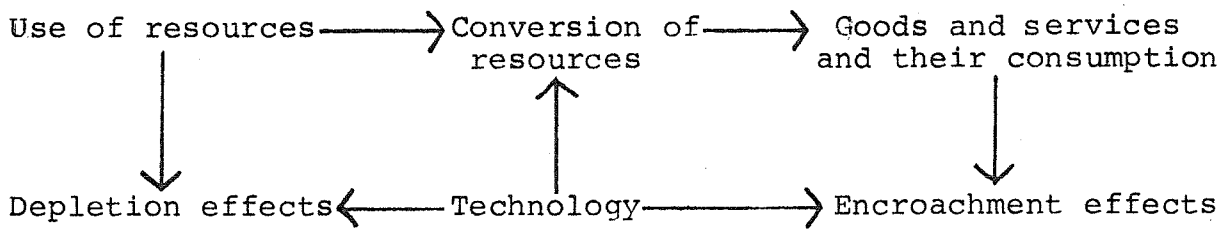
The environmental code has meant that much Western technology has had a highly destructive impact on the environment. The guiding principle for the development of technology in the capitalist West has been the need to externalize costs and to internalize profits, a principle which, applied under free market conditions, has resulted in mounting

social costs and environmental damage. It has induced trends towards bigness and a dominating scale of operations and has resulted in the development of technology which is characterized by the substitution of labour and other imputs by ever greater quantities of non-renewable energy, a lack of integration with natural processes, and a narrow concept of efficiency. (Ophuls, 1977)

Economic activity is linked to the environment both in terms of input and output. At its simplest, the relationship can be expressed as follows:

input → production → output

This can be rewritten in terms of the above as follows:




In a narrow sense, environmental problems can be expressed in terms of: (i) depletion effects; (ii) conversion processes; and (iii) encroachment effects, reflected in pollution and waste. The growth of output in the Western world and the technology which has made this possible have been generally insensitive to resource demands and depletion effects, inefficient and wasteful in conversion processes, and insensitive to pollution effects and the capacity of the environment to assimilate and recycle the residuals resulting from processes of production and consumption. (James, 1978)

Under free market conditions a producer has little interest in nor incentive to develop products which reduce demands on available supplies of renewable and non-renewable resources and which reduce demands on the assimilative and regenerative capacities of ecosystems. There is no interest, for example, in encouraging product durability. In the context of product differentiation under oligopolistic competition, the development and marketing of products with a long service life is counterproductive from the viewpoint of the individual oligopolist. (England and Bluestone, 1971) The producer sees more advantage in building obsolescence into his products as well as generating demands for transitory products, especially when the social costs of production can be externalized.

There is ample evidence to argue that the composition of output in the Western World has changed in the direction of both energy and resource-intensive products and pollution-intensive products. (Commoner, 1971) The production of new commodities has demanded greater supplies of energy and renewable resources, much obtained from the Third World, which continues to play its historical role as a reservoir of raw materials, and involved a greater discharge of waste flows which, like synthetics, are less easily, if at all, assimilable by the environment. The replacement of soap with detergents and returnable bottles with throw away plastic and metal containers are obvious examples of this trend. Even new biodegradable products produce toxicity that can kill fish, even though they die without the foam previously found so objectionable.

Not surprisingly, ecologists have pointed to the destructive and wasteful character of much modern Western technology. Following the lines of such distinguished scholars

as Jacques Ellul, Erich Fromm, Jurgen Habermas, Ivan Illich, Herbert Marcuse, Lewis Mumford, Theodore Roszak and E.F. Schumacher who have argued that much modern technology has succeeded economically because it has been allowed to fail socially, they similarly conclude that the same technology "is an economic success because it is an ecological failure." (Commoner, op.cit., p.151)

There are few grounds for believing that the technologies developed in the U.S.S.R. or Japan are any more successful than those developed in the West. The Soviet Union is confronted with serious environmental problems, although they may be qualitatively different from those of the West. (Goldman, 1972; Ophuls 1977; 'Komarov', 1980) According to 'Komarov', there are hundreds of cities in the Soviet Union where the air is dangerous to health. An area the size of Western Europe has been laid waste through erosion, desertification and the pollution of land and water from farming, mining and industrial operations. The Sea of Azov, once one of the most productive bodies of water in the world, today yields a catch one nineteenth of what it was 30 years ago.

The main reason for the problems appears to be the subordination of the environmental dimension of the objective function of the central planning authorities to the short-term goals of efficiency and the growth of output. The goals of industrialization and agricultural production are afforded greater importance than the need to conserve and protect the environment. This goal structure is manifest at the plant level in the general absence of non-polluting techniques and a conception of cost-minimization not dissimilar to that under private ownership. (James, op.cit.) At the level of the farm, it is manifest in an emphasis on high technology agriculture with its heavy reliance on

mechanization, fertilizers and pesticides and little regard for their impacts on the environment.

For its part, Japan has not only given the world some of its most serious air pollution problems but also such tragedies as itai-itai disease (chronic cadmium poisoning) and Minimata disease (chronic mercury poisoning), both the results of toxic effluents indiscriminately discharged by industrial enterprises.

The code built into both Japanese and Soviet technology is essentially the Western code. Japan has effectively propogated Western values through its technology exports; there is little in its hardware that presupposes and propogates collectivist values or social structures. (Galtung, 1978) Similarly, it is difficult to see how the technology presently emanating from the Soviet Union carries any kind of socialist code.

The key point is that the poor countries in indiscriminately accepting technologies presented as the 'best from the West', are importing technologies which are intrinsically and inherently environmentally destructive. More importantly, they are also importing structure; the structures embedded and reproduced in the technology. The import of technology implies the import of structure. At its worst, imported technologies, unless stripped of their rich world ethnocentricity and stamped with the societal imprint of the importing country, can amount to a structural-cultural invasion which results in the reproduction of rich country structures, modes of behaviour, and value premises. It is a subtle invasion for the combattants are systems that promise progress. But once established, they create societies in their own image, demanding structurally compatible techniques to sustain them. In this situation, weakness re-

inforces dependence and dependence creates more weakness. In the process, Western cosmology takes a still firmer footing and the social and physical environment are subjected to mounting stress.

As the environmental limitations of much Western technology have become increasingly apparent and the often irresponsible attitudes of industrial enterprises have become the cause of public concern, so environmental legislation has been enacted. Steps in this direction have sometimes only followed disasters and tragedies, such as oil spills (Torry Canyon, Amaco Cadiz), industrial 'accidents' (Minimata, Soveso, Billingham, Harrisburg),and plain irresponsibility (Love Canal), and in response to public outrage. This increasingly strict legislation has encouraged Western enterprises to transfer crisis-laden production activities to Third World countries, where the externalization of costs to the social and physical environment still goes largely unchecked.

TNCs, the main architects of the new international division of labour, have been shown to have an inherent bias against the incorporation of environmental and ecological considerations in investment decisions. (Kefalas, 1980) Purveyors of the argument that 'the poor need jobs more than they need clean air', there is every reason for believing that many enterprises have conducted their affairs in the Third World with less regard than they are now obliged to show in their home countries where they are seeking to project a public image of responsible corporate citizens.

There are numerous documented cases of TNCs supplying 'dirty technologies' which have either been banned or limited in their home country. (Farvar, 1976) This has especially been the case with pesticides. In the U.S., for example, companies are able to produce pesticides solely for export

without providing health or safety data. (Weir and Schapiro, 1980) In 1972, a pesticide banned in a number of industrialized countries caused the mass poisoning of Iraquis who had consumed barley and wheat treated with alkyl-mercury fungicides. (WHO, 1976) It has been estimated that today about one person is poisoned every two hours in the Third World by pesticides, most of which are imported from the rich world . (Weir and Schapiro, op. cit.)

There is also a long tradition of TNCs exporting environmentally inappropriate products. A technology may be 'clean' in the home country but become dirty when exported to the Third World where fundamentally different conditions may prevail. Baby formula milk, for example, may be harmless when clean water and sterilized bottles are available, but a killer when they are not. Where there are no requirements concerning product conformity to health regulations, indeed where health regulations exist more on paper than in practice, where there is no control of veracious advertising claims nor countervailing information - conditions characteristic of many developing countries - the inevitable result is that disasters and tragedies can only be discovered *ex post*. And environmental 'mistakes' are far more costly - socially and economically - in a context of absolute poverty.

As Western TNCs seek to transfer crisis-laden production processes to the Third World, so some developing countries have apparently been convinced that their large and empty open spaces constitute a 'comparative advantage' that they can turn to good use. The consequence has been the development of 'pollution havens' in parts of the Third World where environmental controls are minimal. Copper smelters, an environmental scourage, are a case in point. They pollute

the air with sulphur dioxide and other noxious gasses. In the West, where they have a long history of environmental destruction (Warren, 1973), they are being forced to either reduce emissions by the use of expensive equipment or to close down. Developed countries do not want them; developing countries have shown a readiness to accept all the dirt and health risks involved. (Mikesell, 1979, 1980) In effect, Third World countries are using their permissive environmental legislation and the natural environment to subsidize First World industrialization. (Radetzki, 1980)

Barnet and Muller (1974, p. 345) suggest the shape of things to come by reciting an advertisement placed by the State of Mexico in Mexico City's English language paper: "Relax, we've already prepared the ground for you. If you're thinking of fleeing from the capital because the new laws for the prevention and control of environmental pollution affect your plant, you can count on us."

The Third World is not only locked into a system in which they must import technology with inbuilt structures that encourage environmental degradation, it is also increasingly becoming the dumping ground for the dirty production processes that the rich no longer want. These are trends that do not augur well for the future state of the physical environment in the Third World.

## 2.3 Food Systems and Agricultural Development[18]

Food and agricultural systems have profound effects on the environment. The systems in the Third World have undergone a transformation as a result, firstly, of processes of colonization and, secondly, processes of development which have been based upon and moulded by Western cosmology.

In part one we briefly sketched the collapse of indigenous food systems and the loss of control exercised by local communities over their surroundings as a result of the intrusion of capitalist structures. As indigenous food systems progressively collapsed and systems of cash crop production were established, so Western agriculture began to develop along lines which were capital and energy-intensive. The capacity of this system to produce vast quantities of basic foodstuffs has now established it as the dominant model with a universal applicability. It is being exported to the Third World at a time in which the poor countries, stuck with cash crops which no longer command the prices they may once have done, are increasingly unable to feed themselves, and at a time in which the serious limitations - economic, social and environmental - of the dominant model are increasingly being recognized.

The Western model was developed in response to the needs of and the opportunities in Western countries at a time in which the colonized periphery was feeding itself.[19] In the U.S., for example, vast areas of land combined with limited manpower made early mechanization necessary and provided a rationale for measuring agricultural productivity in terms of output per man, rather than output per unit of land. By the 1850s, tens of thousands of machines were already in use in North America. Harvesters enabled the farmer to reap crops on as much land as he could sow - impossible if he relied on hand-cutting. An explosion of labour-saving agricultural technology followed: mechanized ploughs, drill planters, screws for land clearing, grain binders, as well as barbed wire for enclosing ever larger areas. The Civil War, which took so many men away from farming, the emancipation of slaves, and the beginnings of industrial development all gave a further impetus to the trends to mechanize agriculture.

In this first agricultural revolution, animals replaced man as the source of mechanical power. The results of the innovations were impressive indeed. In 1800, for instance, it took 373 manhours to produce 100 bushels of wheat and 344 manhours for the same amount of corn. Some 100 years later the figures were reduced to 108 and 147 respectively.

A second revolution followed after the Second World War based upon scientific and technological innovation and the substitution of automative for animal power. Increased use of complex machinery, genetically improved varieties and much greater use of fertilizers and pesticides, made possible by oil selling at just over $1 a barrel, led to enormous increases in productivity. By 1959, the manhours required to produce a bushel of wheat and corn had been further reduced to just 18 and 22 hours respectively. Today, some 2.5 million U.S. farmers are capable of feeding 220 million U.S. citizens and of producing millions of tons of grain for export.[20]

There is no question that this high technology model had, when measured on its own terms, been successful in providing food. There is also no doubt that it is now generally regarded, in the East as well as most of the South, as the most modern and efficient ever devised. It is becoming increasingly clear, however, that the model, its past performance nothwithstanding, has serious deficiencies, not the least of which are environmental. These deficiencies render it of doubtful relevance to the hungry nations of the Third World. It is not a universally valid model, and it is not generally exportable.

The economic, social and environmental costs of the model are high. It is so expensive to use that only the most

competitive farms are able to stay in business. Farm supplies in the U.S. is a $90 billion annual business and borrowing to purchase them has resulted in the accumulation of an agricultural debt of some $120 billion. Since the 1930s, 4.5 million family farms have disappeared and, today, one third of all food produced is supplied by a mere 2% of U.S. farmers, while the top 20% raise 80% of all crops and animals. The trends towards concentration are continuing: the U.S. Department of Agriculture expects that by 1985 over 60% of all farmers working in 1975 will have been eliminated. Capital intensity has also increased: today it costs $400,000 to create a single job in agriculture, about ten times the cost of a single job in industry. Concentration is also growing among the suppliers of essential inputs and in the post-harvest sector: about three-quarters of all profits realized from the sale of foodstuffs go to some 50 companies.

Ecologists have explained the success of the high technology model in terms of its ecological failure.[21] The ecological damage wrought by the model includes the increased use of increasingly expensive fertilizers and pesticides with rapidly diminishing rates of return, disastrous pest outbreaks created by the destruction of natural predators through pesticide use, and the pollution of land, water and the rest of the food chain by the chemicals used. The non-renewable energy required to keep this system functioning amounts to 1,400 litres of oil per North American per year. If the world's population were to be fed a U.S. diet using U.S. agricultural production technologies fuelled by oil, then all known petroleum reserves would be exhausted within 11 years. Demands for water are also extremely high: underground reserves in the U.S. are being exhausted at such rates that some states may have used up all available supplies by the end of the century. The extraction of water and oil has been linked to increased seismic activity in some areas.

In addition to this catalogue of ecological disasters, the high technology model has resulted in the narrowing of the genetic variety of food crops. In the U.S., a mere 6 varieties of corn account for nearly three-quarters of all production, and 4 Canadian breadwheats for three-quarters of all harvests. An authorative study concluded that North American food crops are genetically uniform and impressively vulnerable. (National Academy of Sciences, 1972)

Despite its impressive performance, the high technology model can be shown to be scientifically crude and linear, relying on industrial techniques to yield an end product (the system's only goal) that will fetch the highest price on national and international markets. The technology clearly incorporates the social, economic and environmental codes discussed earlier. Socially, the technology induces concentration of corporate power and perpetuates a structure of inequality, being based upon the survival of the fittest. Economically, the technology is capital-intensive, research-intensive, organization-intensive, and labour-intensive. Environmentally, the technology carries a code which legitimizes man's over-exploitation of nature. The model is neither environment enhancing nor ecologically sustainable.

In reaching this position, it has enjoyed considerable government support. The Western nations currently spend more than $20 billion - more than they give in aid to the Third World - in protecting and supporting their agriculture. While often considered a miracle of private enterprise, U.S. agriculture is protected from the vicissitudes of the market place by U.S. law. Ever since the Depression, farmers have been protected from drops in grain prices. Washington makes cash payments to farmers when prices fall below government-set 'target prices' and encourages farmers to store on their

own land, partly at taxpayers' expense, any crops which they cannot sell immediately. Until the early 1970s the Department of Agriculture bought grain surpluses and stored them temporarily in huge and expensive granaries. The Department also paid farmers to take their land out of production. Costing about $1 billion, this was at the time the most expensive support programme over initiated by the U.S. government.

The results of this economic logic is that our world is one in which perhaps 50 million people die of hunger each year while the U.S. holds large stocks of grain that are three years old.

The situation in Western Europe is similar. The EEC is essentially an agricultural community. The Common Agricultural Policy - the foundation upon which the Community is built - takes up 75% of the EEC's budget, or some $15 billion. Community protection complements the support received in individual nations. British farmers, for example, whose political and social charisma is, like their U.S. counterparts, eclipsed only by that of motherhood, are featherbedded to the tune of $20,000 each year, a subsidy more than five times that of the British steelworker (Shoad, 1980)

Despite its inherent limitations, the high technology model has become intrinsically linked to notions of the 'best from the West'; it has become part and parcel of the dominant structure and of the universalized Western cosmology. It has been presented to the Third World as a model to be copied by large parts of the academic community, by corporate interests and by international aid agencies that tend to finance the kinds of projects they know best, i.e. those based on or which clearly reflect their own ex-

perience. In the U.S., for example, food aid is legally conditioned by the recipients acceptance of Green Revolution type techniques. Similarly, multilateral organizations like the World Bank have been at the forefront of efforts to encourage cash crop production in the developing world, while the European Development Fund gives over half its agricultural assistance to cash crop not food crop products. (George, 1981) Credit and technical advice are readily available for growing export crops, but not basic food crops. Farmers can get fertilizers and insecticides to treat peanuts in Senegal, cotton in Chad or Tanzania, or tobacco in Zambia, but there are no back-up programmes for food crops in these countries. Encouraged by the World Bank and other donor agencies, these countries pay little attention to the commercialization of food crops and the development of appropriate agricultural techniques and support policies. As a result, the food surplus that are produced are often underused and undervalued. In 1981 in Tanzania, for example, maize rotted while the country's food imports surged.

Most of the countries in the Third World have shown themselves not only ready but also keen to follow the advice tendered. In increasing numbers they are turning to costly, socially disruptive and environmentally degrading techniques, even though small plots worked by peasants can be up to 13 times more productive than large mechanized holdings, indigenous cropping systems can use labour more effectively, and can, with appropriate practices, be environmentally far less damaging. Elite classes and dependent power structures in Third World countries have seen the introduction of the Western model as remunerative to themselves, while equating it with such notions as 'productive' and 'modern.'[22]

Developed in countries that were land-rich and labour-poor, the high technology model is being increasingly used in countries that are land-poor and labour-rich. Countries that choose to adopt the model must expect it to contribute to job displacement rather than job creation and to result in increased migration from rural areas to towns and cities where jobs are already scarce and the environment - social and physical - is under sustained attack. Countries that employ the model must also expect it to magnify the inequalities between the rich land-holding classes and the peasant farmer, fueling the tensions that already exist between them.[23]

Even countries committed to building self-reliance have chosen to follow the high technology path. In Tanzania, for example, cotton and coffee plantations are considered a symbol of progress while the agricultural knowledge and techniques of the country's vast peasant population are neglected or ignored. As a recent study observes: "Until now, there has been nothing available except the strategy of high-yield varities, fertilizers, pesticides and mechanization." (Egger, 1976, p.22)

The introduction of Western agricultural methods and practices has inevitably strengthened links of dependency. Essential inputs, sometimes only available in the form of a 'package', are supplied by international agribusiness, that also exercises firm control over marketing, distribution and even storage. Foreign food processing firms, in alliance with dependent elites, have not been slow to respond to requests for assistance, and have reaped considerable rewards in the process. (George 1979; Ledogar, 1976) Returns on investments average 14-16% in Latin America (probably greater in Africa and Asia), compared to 4-6% on investments in the industrialized world. (U.S. Senate

Committee on Foreign Relations, 1975 Appendix A, Table 7)

The ecological and environmental problems that have accompanied high technology agriculture in the North have also struck with a vengence in the Third World. (Milton and Farvar, 1972) Some large-scale irrigation projects have been particularly damaging. Schistosomiasis, once a minor disease, now affects 75% of the population in the Nile Delta, the result of the construction of the Aswan High Dam. The construction of the Akosombo Dam has created a similar problem in Ghana. The Kariba Dam has contributed to the almost total destruction of surrounding agricultural systems and to epidemics of sleeping sickness. (Farvar, 1976) Soil erosion, the reduction of soil fertility, pollution caused by the careless and indiscriminate use of fertilizers and pesticides are all very common occurrences.

The genetic diversity of Third World food crops is also being seriously undermined. Writers on the Green Revolution have pointed to the fact that the very success of high yielding varieties threatens the existence of native species which may jeopardize the maintenance of the new species. (Dasman et.al., 1973) In Iran, for example, new wheat varities have been attacked and destroyed by a disease to which the locally displaced crop was immune. (Farvar, op.cit.) In the African plain of Upper Volta, only 10% of the rice grown is now of local origin. (Dasman et al, op.cit.) In Mexico, many indigenous types of corn have been supplanted by high-yielding varities, hybrid sorghum, strawberry farms that export to the United States, and an eight lane highway across the central plateau. Many strains of wild wheat have all but disappeared in their native areas. In Turkey, wild progenitors of several grains can today only be found in castle ruins and graveyards. (Myers, 1981) At the same time, there is much evidence to suggest

that local varieties can give the same yields as the 'mircale seeds' if they are given the same inputs, thereby reducing genetic risks. (Palmer, 1972)

There can be little doubt that recourse to the high technology model, developed in and for the West, is and is likely to remain, a central issue in the Third World environment problematique.

NOTES AND REFERENCES

1. On the emergence and formation of the world economic system, see Wallerstein (1974, 1979).
2. Max Weber (1965, p. 175) quotes John Wesley, the founder of Methodism: "We ought not to prevent people from being diligent and frugal; we must exhort all Christians to gain all they can, and to save all they can; that is, in effect, to grow rich." For a discussion of the relationship between the rise of protestanism and the emergence of capitalism, see Wallerstein (1974) and Eisenstadt (1968).
3. Albert Beveridge, quoted in Fulbright (1966).
4. See George (1979) upon which the following paragraph is based.
5. See for example the works of Frank (1969a, 1969b) and Laclau (1971).
6. The same can be said of reactions which occur at the international level. The events of 1973 is a good example. In view of the Third World, the events meant that "for the first time since the rise of Western capitalism, a decision affecting the world economy was taken outside the West" (Ismail Sabri Abdullah, quoted in Time, 22 December 1975). Western reaction was one of horror. It was, as Galtung has observed (1978, p.102), "akin to what might have happened if the sun suddenly turned dark in the middle of the day without any eclipse having been predicted in advance." It was contrary to the laws of nature.
7. For a review of early theories of development, see Szentes (1976).
8. World Bank, *Development Report 1980*.
9. Jamal, interviewed in *D & C* (publication of the German Foundation for International Development), No. 1, 1981, pp. 28 and 29.

10. See Myrdal (1954, 1956), Singer (1950, 1964) and Lewis (1950, 1954).
11. See Amin (1976) and Emmanuel (1972).
12. As Gamani Corea who, as Secretary-General of UNCTAD, has played an important role in drawing up the NIEO package, has observed: "I am of the opinion that the underlying desire, indeed demand, of all is that the countries of the Third World be incorporated into the system of world-wide trade. They do not any longer want to remain at the margin or outside of this system. They want to belong to it and participate in the decisions and events that influence its development." Quoted in Frank (1978), p.14.
13. On this, see Galtung (1977), Amin (1977b), Magdoff (1978), Vayvynen (1978) and Dolman (1981).
14. These problems are periodically brought to the attention of the international community in, inter alia, the annual State of the Environment reports published by UNEP.
15. For the case of Java, see Thijsse (n.d.)
16. On El Salvador, see Eckholm (1976), Chapter 10.
17. Examples extracted from Allen (1980).
18. This final section draws heavily upon George (1979).
19. For discussions of the development of the model, see, for example, Olmstead (1975).
20. On the impact of technological change and innovation in U.S. agriculture, see Rasmussen (1962).
21. For a review of the environmental impacts of the high technology model, see, for example, Van den Bosch (1978), Pimentel (1979), Leach (1976) and Ball (1978).
22. For an interesting description of the social and economic impacts of the high technology model in Nigeria, see Wallace (1981).
23. This has very often been the experience with the so-called Green Revolution. See, for example, Griffin (1972), Pearse (1977), and Moore Lappé et al (1979 and 1980).

BIBLIOGRAPHY

Allen, R. (1980), *How to Save the World*, Kogan Page, London.

Amin, S. (1976), *Unequal Development*, Monthly Review Press, New York/London.

Amin, S. (1977a), *Imperialism and Underdevelopment*, Monthly Review Press, New York/London.

Amin, S. (1977b), 'Self-Reliance and the New International Economic Order', *Monthly Review*, Vol. 29, No. 3, pp. 1-21.

Ball, Nicole (1976), 'Understanding the Causes of African Famine,' *Journal of Modern African Studies*, Vol. 14, No. 3.

Ball, Nicole (1978), 'Deserts Bloom and Whither', *Ecologist Quarterly*, Spring.

Baran, P., P.M. Sweezy (1969), *Monopoly Capital*, Monthly Review Press, New York/London.

Baros, P., A.J. Dolman (1981) 'The International Division of Labour and Strategies for Global Reform', *Habitat International*, Vol. 3, No. 6.

Barnet, R.J., R.E. Muller (1974), *Global Reach: The Power of Multinational Corporations*, Simon and Schuster, New York.

Beckford, G.L. (1972), *Persistent Poverty: Underdevelopment in Plantation Economies*, Oxford University Press, Oxford/New York.

Behar, M. (1970), 'Nutrition of Mayan Children Before the Conquest and Now', *Clinical Pediatrics*, Vol. 9.

Benachenhou, A. (1980), 'For Autonomous Development in the Third World', *Monthly Review*, Vol. 32, No. 3, pp. 569-582.

Blaikie, P. (1980), 'Poor Peasants', in J.D. Seddon, P.M. Blaikie, J. Cameron (eds), *Peasants and Workers in Nepal*, Aris and Philips; Warminster, 1980.

Blaikie, P. (1982) 'Class, Land-use and Soil Erosion', *ODI Review*, No. 2, pp. 57-77.

Blaikie, P.M., J. Cameron, J.D. Seddon (1980), *Nepal in Crisis: Growth and Stagnation at the Periphery*, Clarendon Press, Oxford.

Commoner, B. (1971), *The Closing Circle: Nature, Man and Technology*, Alfred A. Knopf, New York.

Dahlberg, K.A. (1973), 'The Technological Ethic and the Spirit of International Relations', *International Studies Quarterly*, Vol. 17, No. 1, March, pp. 55-88.

Dasman, R.F., J.P. Milton, P.H. Freeman (1973), *Ecological Principles of Economic Development*, Wiley, New York.

Dolman, A.J. (ed) (1980), *Global Planning and Resource Management*, Pergamon, New York.

Dolman, A.J. (1981), *Resources, Regimes, World Order*, Pergamon, New York.

Dorfman, R., N.S. Dorfman (eds) (1972), *Economics of the Environment*, W.W. Norton, New York.

Eckholm, E. (1976), *Losing Ground*, W.W. Norton, New York.

Eckholm, E. (1979), *The Dispossessed of the Earth: Land Reform and Sustainable Development*, Worldwatch Paper 30, Worldwatch Institute, Washington, D.C., June.

Egger, K. et al (1976), 'Agro-Technological Alternatives for Agriculture in the Usambara Mountains', Botanisches Institut der Universität Heidelberg, December (mimeo).

Eisenstadt, S.N. (ed) (1968), *The Protestant Ethic and Modernization*, New York.

Emmanuel, A. (1972), *Unequal Exchange: A Study of the Imperialism of Trade*, Monthly Review Press, New York/London.

Engellau, P. Birgitta Nygren (1979), *Lending Without Limits - On International Lending and Developing Countries*, Secretariat for Future Studies, Stockholm.

England, R., B. Bluestone (1971), 'Ecology and Class Conflict', *Review of Radical Political Economics*, Vol. 3, No. 4.

Fanon, F. (1966), *The Wretched of the Earth*, Grove Press, New York.

Fanon, F. (1968), *Black Skin, White Masks*, Grove Press, New York.

Farvar, M.T. (1976), 'The Interaction of Ecological and Social Systems: Local Outer Limits in Development' in W.H. Matthews (ed), *Outer Limits and Human Needs*, Almgvist and Wiksell, Stockholm.

Fosberg, F.R. (ed) (1963), *Man's Place in the Island Ecosystem*, Bishops Museum, Honolulu, pp. 207-223.

Frank, A.G. (1969a), *Latin America: Underdevelopment of Revolution*, Monthly Review Press, New York/London.

Frank, A.G. (1969a), *Capitalism and Underdevelopment in Latin America*, Monthly Review Press, New York/London.

Frank, A.G. (1978), 'Rhetoric and Reality of the NIEO', May (mimeo).

Fulbright, J.W. (1966), *The Arrogance of Power*, Random House, New York.

Galtung, J. (1977), *Poor Countries vs Rich; Poor People vs Rich. Who Will the NIEO Benefit?*, Occasional Paper 77/4, Vienna Institute for Development, Vienna.

Galtung, J. (1978), *Development, Environment and Technology: Towards a Technology for Self-Reliance*, UNCTAD (document TD/B/C.6/23), Geneva, June.

Galtung, J. (1978-79), 'Towards a New International Technological Order', *Alternatives*, Vol. IV, pp. 277-300.

George, Susan (1979a), 'Impact of the Food Systems of Industrialized Countries on Society and the Environment in the Developing Countries', paper prepared for the UNEP/ECE Regional Seminar on Alternative Patterns of Development and Life-Styles, Ljubljana, 3-8 December, 1979, ECE (document Euv/Sem. 11/ R.18), Geneva, October.

George, Susan (1979b), *Feeding the Few: Corporate Control of Food*, Institute of Policy Studies/Transnational Institute, Washington D.C. and Amsterdam.

George, Susan (1976), *How the Other Half Dies*, Penguin, Harmondsworth.

George, Susan (1981), *Les Stratèges de la Faim*, Editions Grounaver, Geneva.

Goldman, M. (1972), 'The Convergence of Environmental Disruption', in R. Dorfman, N.S. Dorfman (eds) (1972).

Gourman, P. (1963), 'Pressure on Island Environment' in F.R. Fosberg (ed) (1963).

Griffin, K. (1972), *The Green Revolution: An Economic Analysis* UNRISD Report No. 72.6, Geneva.

Harrington, M. (1977), *The Vast Majority: A Journey to the World's Poor*, Simon and Schuster, New York.

ILO, (1980), *Yearbook of Labour Statistics, 1979*, Geneva.

James, J. (1978), 'Growth, Technology and Environment in Developing Countries: A Survey', *World Development*, Vol. 6, pp. 937-965.

Kabala Kabunda, M.K.K. (1975), 'Multinational Corporations and the Installation of Externally Oriented Economic Structures in Africa', in C. Widstrand (ed) (1975).

Keesing, R.M. (1980), 'Traditional Enclaves in Melanesia', paper presented to ANU Seminar 'Melanesia: Beyond Diversity', ANU, Canberra, November (mimeo).

Komarov, B. (Psnedonym) (1980), *The Destruction of Nature in the Soviet Union*, Pluto Press, London.

Kefalas, A.G. (1980), 'The Multinational Corporation and the New International Economic Order', in A.J. Dolman (ed) (1980), pp. 146-180.

Kiernan, V.G. (1969), *Lords of Human Kind: European Attitudes to the Outside World in the Imperial Age*, Weidenfeld and Nicolson, London.

Kjekshus, K. (1974), *Precolonial Industries*, University of Dar es Salaam, Dar es Salaam, December.

Kuitenbrouwer, J.B.W. (1981), *The Dialectics of Class and State Formation and of Development Policy in Papua New Guinea*, ISS Occasional Paper No. 86, Institute of Social Studies, The Hague, March.

Laclau, E. (1971), 'Feudalism and Capitalism in Latin America', *New Left Review*, No. 67, May-June.

Leach, G. (1976), *Energy and Food Production*, IPC Science and Technology Press, Guilford, Surrey.

Ledogar, R. (1976), *Hungry for Profits: U.S. Food and Drug Multinationals in Latin America*, IDOC, New York.

Lewis, A., (1950), 'World Production Prices and Trade, 1870-1950', *Manchester School of Economic and Social Studies*, Vol. 20.

Lewis, A. (1954), 'Economic Development with Unlimited Supplies of Labour', *Manchester School of Economic and Social Studies*, Vol. 24, May.

Magdoff, H. (1978), 'The Limits of International Reform', *Monthly Review*, Vol. 30, No. 1, pp. 1-11.

Memmi, A. (1967), *Colonizer and Colonized*, Beacon Press, Boston.

Memmi. A. (1968), *Dominated Man*, Beacon Press, Boston.

Mikesell, R.F. (1979), *The World Copper Industry*, Johns Hopkins, U.P., Baltimore.

Mikesell, R.F. (1980), 'The Structure of the World Cooper Industry', in S. Sideri, S. Johns (eds), *Mining for Development in the Third World*, Pergamon, New York, pp. 61-69.

Millet, R. (1979), 'Imperialism, Intervention and Exploitation: The Historical Context of International Relations in the Caribbean', in R. Millet, M.W. Mill (eds), *The Restless Caribbean: Changing Patterns of International Relations*, Praeger, New York, pp. 3-13.

Milton, J.P., F.T. Farvar (eds) (1972) *The Careless Technology*, Natural History Press, New York.

Moore Lappé, Frances, J. Collins, C. Fowler (1979), *Food First: Beyond the Myth of Scarcity*, Ballantine Books, New York.

Moore Lappè, Frances, J. Collins, D. Kinley, (1980), *Aid as Obstacle*, Institute for Food and Development Policy, San Francisco.

Myers, N. (1980), *Conversion of Tropical Moist Forests*, National Academy of Sciences, Washington, D.C.

Myers, N. (1979), *The Sinking Ark*, Pergamon, Oxford.

Myers, N. (1981), 'The Exhausted Earth', *Foreign Policy*, No. 42, pp. 141-155.

Myrdal, G. (1954), *Economic Theory and Underdeveloped Regions*, Duckworth, London.

Myrdal, G. (1956), *An International Economy*, Harper, New York.

Needham, J. (1963), 'Poverties and Triumphs of Chinese Scientific Tradition', in L. Crombie (ed.), *Scientific Change*, Basic Books, New York.

O'Keefe, P., B. Wisner, A. Baird (1977), 'Kenyan Underdevelopment: A Case Study of Proletarianisation', in P.O'Keefe and B. Wisner (eds.), *Land Use and Development*, International African Institute, London.

Olmstead, A. (1972), 'The Mechanization of Reaping and Mowing in American Agriculture, 1833-1870, *The Journal of Economic History*, Vol. 35, pp. 327-352.

Ophuls, W. (1977), *Ecology and the Politics of Scarcity*, Freeman, San Francisco.

Palmer, Ingrid (1972), *Science and Agricultural Production*, UNRISD Report No. 72.8, Geneva.

Payne, G.K. (1977), *Urban Housing in the Third World*, Leonard Hill, London.

Pearse, A. (1977), 'Technology and Peasant Production: Reflections on a Global Study', *Development and Change*, Vol. 8.

Peramunetilleke, T.B. (1982), 'Trees and High Tension', *Earthscan Bulletin*, July, p.4.

Pimentel, D. Marcia Pimentel (1979), *Food, Energy and Society*, Edward Arnold, London.

Rasmussen, W.D. (1962), 'The Impact of Technological Change on American Agriculture, 1862-1962', *The Journal of Economic History*, Vol. 22, No. 4, pp. 578-591.

Radetzki, M. (1980),'Mineral Processing in LDCs', in S. Sideri and S. Johns (eds.), *Mining for Development in the Third World*, Pergamon, New York, pp. 229-243.

Riding, A. (1975), 'Saving Haiti', *Saturday Review*, 17 May.

Robinson, D. (1978), *Soil Erosion and Soil Conservation in Zambia: A Geographical Appraisal*. Zambia Geographical Association Occasional Study, No. 9, Lusaka.

Rostow, W. (1960), *The States of Economic Growth. A Non-Communist Manifesto*, Cambridge U.P., London.

Spriggs, M. (1980), 'Irrigation in Melanesia: Formative Adaptation and Intensification', paper presented to the ANU Seminar 'Melanesia: Beyond Diversity', ANU, Canberra, 6 November (mimeo).

Szentes, T. (1976), *The Political Economy of Underdevelopment*, Akadémiai Kiadó, Budapest.

Thijsse, J. (n.d.) 'Will Java Become a Desert?, Institute of Social Studies, The Hague, (mimeo).

UNDP (1972), *Country and Intercountry Programming: Haiti*, UNDP, New York, 11 December.

U.S. National Academy of Sciences, (1972), *Genetic Vulnerability of Major Crops*, Washington, D.C.

U.S. Senate Committee on Foreign Relations (1975), *Multinational Corporations in Brazil and Mexico: Structural Sources of Economic and Non-Economic Power*, Report to the Sub-Committee on Multinational Corporations of the United States Senate Committee on Foreign Relations, Washington, D.C.

Van Bentham van den Bergh, J.F. Glastra van Loon, E.V.W. Vercruijsse (1972), 'Science and the Development of Society', paper prepared for 20th Anniversary Conference of NUFFIC 'Science and the World of Tomorrow', The Hague, October (mimeo).

Van der Bosch, R. (1978), *The Pesticide Conspiracy*, Doubleday, New York.

Vayrynen, R. (1978), 'Interdependence vs Self-Reliance in Economic Relations', *Alternatives*, Vol. 3, No. 4, pp. 481-514.

Vitebsky, P. (1981), *Political Relations Among the Sara of India*, School of Oriental and African Studies, Department of Anthropology, University of London, London.

Wallace, T. (1981), 'The Challenge of Food: Nigeria's Approach to Agriculture 1975-1980', *Canadian Journal of African Studies*, Vol. 15, No. 2, pp. 239-258.

Wallerstein, I. (1974), *The Modern World System*, Academic Press, New York.

Wallerstein, I. (1979), *The Capitalist World Economy*, Cambridge U.P., New York.

Ward, R.G. (1980), 'Changes in Subsistence Agriculture', paper presented to the ANU Seminar 'Melanesia: Beyond Diversity', ANU, Canberra, 6 November.

Ward, R.G., A. Proctor (eds.) (1980), *South Pacific Agriculture: Choices and Constraints*, National University Press, Canberra.

Warren, K. (1973), *Mineral Resources*, Penguin Books, Harmondsworth.

Weber, M. (1965), *The Protestant Ethic and the Spirit of Capitalism*, Unwin University Books, London (first published 1904).

Weir, D., M. Schapiro (1981), *Circle of Poison: Pesticides and People in the Hungry World*, Institute of Food and Development Policy, San Francisco.

Whitcombe, Elizabeth (1972), *Agrarian Conditions in Northern India: The United Provinces Under British Rule 1860-1900*, University of California Press, London.

WHO (1976), *Environmental Health Criteria; I. Mercury*, Geneva.

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