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Chichilnisky, Graciela and Cole, Sam

UNITAR, Project for the Future

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progress report

TECHNOLOGY, DOMESTIC DISTRIBUTION AND NORTH SOUTH RELATIONS

project on the future, 1978

AUGUST 1978

A PROGRESS REPORT ON

TECHNOLOGY, DOMESTIC DISTRIBUTION AND NORTH SOUTH RELATIONS

PREPARED BY: Graciela Chichilnisky and Sam Cole

UNITAR PROJECT ON THE FUTURE, 1978

Foreword

by

Philippe de Seynes

The present study is being developed as a self-contained research within UNITAR's Special Project on the Future. But it is also a contribution to the collective and unprecedented effort of the U.N. system on long-term objectives. As the Organization is getting ready for the coming of a Third Decade of Development, the distinctive features of the present context must be acknowledged. It has been customary to ascribe previous shortcomings of co-operation efforts to a lack of political will. The judgement is plainly tautological unless the defficiency can be analytically related to the interplay of social, political and ideological forces. Derogations to a "higher law" which would be clear in its direction and assured of its effects, cannot alone account for the malaise, even the helplessness, which today seems to grip the international community. A conceptual embarrassment is noticeable everywhere.

In the poor countries of the South, as governments are concerned with the increasingly precarious conditions of the impoverished masses, there is no firm consensus regarding the nature of and direction of the actions which could make early inroads into the worst features of poverty. In its recently published report on World Development, the IBRD foresees the persistence of "absolute poverty" for 400,000,000 people beyond the end of this century. Since this gloomy prediction is not based on the assumption of physical scarcities, it clearly invites an investigation into the types of policies and forms of social organization which alone could be held responsible for its fulfillment.

The embarrassment is no less conspicuous in the advanced industrial world where Governments are now too deeply absorbed in the intricacies of short-term economic management to conceive of long range and far-reaching reforms, while their oppositions fail to produce plausible or convincing alternatives. Yet reforms are urgently needed, for, with all the success of their economic miracles, industrial countries must still reckon with a hard core of stubborn and severe poverty, larger than they often care to acknowledge: old age and unemployed young people, ethnic groups and migrant labourers, all categories with no ready access to the political class. This "hidden face" of even the most exemplary societies suggests that a phenomenon of "pauperisation" may still be inherent in the present institutions of industrial economies.

Recent years have been rich in discontinuities. Much attention has been directed to the change in price relationships and the pattern of external imbalances, which followed the launching of the OPEC strategy. However, this is by no means the most intractable difficulty in a changed situation. In fact the world economy shows surprising resiliency in adjusting to its consequences. The prospect of an "energy crunch" is receding, even in the prediction of the pessimists, and as the vulnerability of the international financial system is more widely recognized, there is more confidence that its collapse will be avoided.

Much more significant and durable is the new and pervasive ferment of social protest, expressed in waves of discontent and unrest, frequently erupting in violence and upheavals. The cumulative effect of this process has by now produced a different environment, where traditional adjustment mechanisms do not operate and where problems - including those of international co-operation and geopolitical equilibrium- cannot be seen in quite the same light as before. The intellectual activity which inevitably accompanies such a mutation has renewed our perceptions and expanded our cognitive powers while deepening our doubts and perplexities. In such circumstances, a UN Grand Design could hardly rest on the deceptive certainties of previous exercises.

In fact, its analytical content may be more important than the resulting prescriptions with their aura of finality. The approach should be broadened to include the dimension of social change which had been previously evaded. Otherwise the new strategy will not gain credibility as a "scenario of transformation". Rather it will appear as another "scenario of reproduction" (with adjustments and refinements).

The tools of the analysis must be carefully appraised. The use of mathematics is nowadays generally seen as essential to the understanding of complex systems. Computerized models serve as control mechanisms for an extensive qualitative analysis; and in the process they also uncover areas where further exploration is useful. Their shortcomings are usually well understood, and often acknowledged, by the professionals*, although

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* See: Sam Cole - Global Models and the N.I.E.O.
1977 - Pergamon Press

Michel Godet - Crisis in Forecasting and the Emergence of Prospective Methods.

not necessarily by politicians always in quest of immediate certitudes, or the media, too readily mesmerized by the scientific appearance of a language with which they are not familiar. There are pitfalls in these techniques. One of them is the temptation, which at times seems almost irresistable, to organize the very structure and mode of operation of the model, according to the availability of quantitative data. This often goes hand in hand with the belief that a model's predictive capacity is a function of the number of variables included in it. A dangerous bias is thereby imparted to an exercise generally undertaken for normative purposes particularly when some of the most crucial factors in the shaping of desirable policies are not easily measurable, or have not as yet been measured. Another pitfall is the illusion - or the pretense - that the design of a mathematical model is a purely technical act, politically neutral and value free. There are many ways in which "ideologies" or "world views", or "images of the future", become determined in the construction of a model and consequently in the policy options which are derived from its use. The participants in the present study make no attempt to conceal that, although their respective positions on the ideological map do not always coincide, their research is inspired by the high priority they attach, above other objectives of society, to the early solution of the worst problems of poverty and dependence, and that it is so designed as to gain insights into the processes likely to advance these aims. They also recognize that matters of social stratification

and power structures are relevant to these processes.

By contrast, the ideology which underpinned the United Nations strategy over two decades may be seen as proceeding from an optimistic philosophy of enlightenment, grounded in neo-classical theories largely relying on market mechanisms for equilibrium and growth, with, however, an early recognition of structural asymmetries adversely affecting less developed economies. These were to be dealt with through a modicum of international regulation and other corrective measures devised to cause no more than minor disturbances to the existing order. As a "paradigm" it was never more than vaguely formulated and it made room from the beginning for a number of deviations which should have invited scepticism as to the strength of its theoretical foundations, yet it rightly highlighted deficiencies in savings and foreign exchange and viewed them as inherent features of Third World economies, in a frame of reference which came to be known as the "two gaps" theory. This was the major conceptual influence in the formulation of international policies of North/South co-operation.

Other world views, particularly those related to the notions of "unequal exchange" and "dependencia" had for sometime been recognized by vocal and vital sections of the world intelligentsia as more relevant to the conditions confronting developing countries, and the behaviour of important aspects of the world economy. With a growing concern over

environment, the ecological school also made timid inroads as it sought to offer not just recipes for improving the quality of life, but yet another competing paradigm within which economies of scarcity were often seen as an inducement to perhaps a condition of social progress. It is only slowly and not very explicitely that these alternative approaches permeated United Nations policy making.

Current world views as described and classified in the present study cannot be seen as integrative theories in the sense that they could identify and articulate the chains of causations and feed-backs which would explain in a satisfactory way the behaviour of a large area of the world economic and social system. Rather they consist of insights, fragments of diagnosis and normative principles only loosely related to each other. In fact the derogatory label "La Vulgate" irreverently pinned by the Paris "New Philosophers" on current, popular versions of Marxism could, at least with equal justification, be applied to all other world views. However this should not be an excuse for sarcasms, but rather a reason for deep concern. For the fragmentary and shaky theoretical foundations on which must rest the construction of a new order, is part of our predicament, and it is likely to remain with us until wider knowledge from a number of social disciplines can be absorbed and articulated in a coherent framework.

Since the New International Economic Order is the present point of reference for United Nations development efforts, its ambiguities should be considered. A superficial reading of its legislation may find a language very similar to that of previous designs, such as the International Development Strategy for the 1970's, or the final acts of successive UNCTAD conferences. However the historic context suggests a very different perspective, a world view not unrelated to the notions of "unequal exchange" and "dependencia". In the wake of significant changes in the global power balance brought about by the OPEC strategy, further changes in that direction were not only seen by Third World countries as a possibility, but as the very condition of future progress. This feature is apparent in the provisions related to the advocacy of producers associations, to the assertion of effective control over natural resources, to the mistrust of present arrangements with trans-national corporations, and to the claim for a greater participation in the decision making process of International Organizations. In fact, for the first time, the redress of a fundamental global imbalance appears to loom larger than the demand for immediate or proximate economic gains. There is here probably a dividing line, a departure from the optimistic philosophy of enlightenment within which only incremental advances could be accomodated. It should not be the purpose of a new International Strategy to elucidate the implications of this remarkable advance in the collective thinking of the organisation. The global aspiration must be analytically related to the variety of other objectives among which individual governments determine their own hierarchial arrangements. The question must be

squarely faced whether the pursuance and reconciliation of such global and individual goals can be achieved without fully introducing in the process of conceptualization the dimension of social change.

A case in point may be found in the goal of accelerated industrialization which probably would enlist the most emphatic consensus in the assemblies of the U.N. It is quite unlikely that the target established at UNIDO could be achieved, or approached, through the combined operation of unguided technological development, natural propensities to save and mutations in world demand, even if enhanced by more vigorous trade liberalization policies and adequate provision of international capital. It is more probable that considerably more stress should now be placed in the expansion of domestic markets to overcome the limitations encountered by import substituting industries. Such expansion requires raising the incomes of the poorest layers of the population, and this cannot be achieved through transfers alone, but must involve changes in the patterns of investment and technology as well as of spatial distribution. In non-oil producing countries adequate investment can only be visualized with a measure of forced savings through taxation or inflation with their inevitable impact on the social and political fabric of a society. Shifts in world demand would inter alia imply that Northern countries give greater attention to the core of their impoverished people, recognizing them not just as workers but as deprived consumers who could benefit from the cheaper Third World manufactured goods which the productive apparatus of their own countries does not offer.

Policy choices can no more be viewed as simple or obvious since the faith in "trickle down" effects (automatically derived from overall growth) has been severely punctured. Progress must be made towards a better understanding of the interactions, trade-offs and consistency problems inherent in the pursuance of multiple objectives. More particularly, concern for more equality, or the rapid eradication of mass poverty (which do not necessarily coincide), requires that modelling and scenario analysis look beyond the behavious of national economies, viewed as homogenous entities responding rationally to the enlightened designs of governments. The enquiry must address itself to the social stratification and explore the effects of various policies on different groups or strata: income or professional groups, consumer groups, perhaps also in a more refined analysis ideological or political groups.

It will be said that one cannot "go wrong" in advocating and promoting traditional trade and aid policies. The bottlenecks identified by the "two gaps theory" are real enough, and it should be the purpose of collective efforts to assist in breaking them. This, however, is ignoring the possible perverse effects of markets, both international and domestic, that may undermine the attainment of desired goals. These may occur when international transactions between countries with very different resources endowments and labour supply elasticities play a significant role in the development path followed. The first phase of UNITAR's study has underlined the problematique involved in such relations. Admittedly the game of unequal exchange can yield gains for both parties, notably if compensatory mechanisms are at hand to apportion the surplus.

The resulting relationship may not, however, be very stable, and the persistent deterioration of the terms of trade may after a while induce further inequality. One can indeed go wrong with trade and finance, particularly when high priority is attached to the objective of improved distribution, and when local resources are mobilized through channels which defeat that objective. The equalizing or dis-equalizing effects of trade and finance, (as well as the macro-economic consequences of other given policies) must be considered carefully in the light of specific circumstances and the hierarchy of governmental objectives.

The illusion must be dispelled that a given path once defined can be valid for a very lengthy period of time. This is due in part to the behaviour of investment. An initial increase in investment may lead to lower consumption in the short-term, but higher growth and consumption in the medium term, with the effect of reducing the rate of profit and discouraging further investment. Moreover, long-term development paths proceed through a series of short-term market equilibria. Indeed with all its inadequacies, one redeeming feature of the neo-classical paradigm is that more than other current world views, it focuses its attention to the behaviour of markets, the neglect of which has dashed many hopes of the reformists or radicals.

There are also the inevitable failures of the planning and predictive capacities. Planning may for a while reduce uncertainties and later increase rigidities and induce a false sense of confidence in the policies pursued. Changes of direction, if not anticipated, may have to be

drastic or abrupt, as seen in the experience of mixed as well as centrally planned economies. The resilience of the socio-political system, its capacity to change gear in times of great pressures, to proceed through "tatonnement" while keeping a long term perspective, are factors which should be recognized in the design and formulation of a U.N. strategy.

The very long period is receiving close attention today by students of the "Kondratief Cycle" seeking to identify the major events which have generated in the past and are likely to generate in the future long waves of growth or stagnation. This seems particularly apposite, although highly speculative today as so many forecasts include a break in the historical trend of the last quarter century. It may be equally interesting to consider approaches of the contemporary historical school, more particularly as it examines the coexistence, over periods of time and on different levels, of social structures inherited from the past, developed in the present, and anticipating the future. This may help in the discovery of the strategic areas, and optimum time, when interventionist policies may operate with the best chances of success.

The present report is about work in progress. This suggests the limits of the expectations which may be placed upon it, as well as of the critics which may be levelled against it. It lists in the appendices the direction in which the investigation will now proceed with a strong participation of Third World individuals and institutions. The difficulties of the chosen course are not under-estimated. The paucity of data on distribution and other social indicators is acknowledged. Yet the insistence on statistical

refinement can be sometimes counterproductive if it paralyzes further thinking and the development of new statistics. Moreover, it can be argued that the statistical problems of current larger and detailed models which use more ready or available statistics are at least as large as the ones encountered in smaller, more aggregated models which require less easily available data.

The first phase of the study reported here was not meant to develop a predictive tool. Rather it has sought in the first instance to gain theoretical insights in regard to problems and processes of major relevance to present circumstances, and which have not sufficiently benefited from previous U.N. exercises, and to provide a basis for further work more adequate to predictive purposes. It has generally elicited considerable interest on the part of academic as well as official circles to which the method and first results have been presented. We are most happy that I.L.O., UNESCO, and ECLA, which have for sometime conducted enquiries in related fields, have now decided to combine their efforts with ours. The innovative nature of the work seems in tune with the specific role and mandate of UNITAR, which should, in its research seek to avoid the trodden paths. We are highly grateful to Dr. Davidson Nicol, the Executive Director, for having so warmly and consistently supported the project. We are also very appreciative of the leadership provided by Mr. Jean Ripert, Under-SecretaryGeneral, Department of International Economic and Social Affairs, during the discussions of the ACC Task Force on Long-term Objectives and its Technical Working Group, as well as for the financial assistance he has afforded to the project from the Secretary-General's Trust Fund. The dedicated and talented professionals whose names are listed in page vi and their two team leaders , Graciela Chichilnisky and Sam Cole deserve our outmost praise and gratitude.

Philippe de Seynes
Director, Project on the Future
UNITAR

Background

This paper and appendices report an ongoing study of the interrelationships between technology, income distribution and other socio-economic issues in a long term global context. The work began in March 1977 as a small exploratory study, 'Technology for Basic Needs', as part of the UNITAR Project on the Future, a joint effort between the Department of Economics at Harvard University and the Science Policy Research Unit at the University of Sussex. Since then the scope has increased to fulfill the objectives described below. In addition, the work now forms part of a wider programme involving other organisations within the United Nations system[1], which is oriented towards the preparation of a set of objectives for the Third Development Decade (1980-1990). The bulk of the work described here has been carried out at the Science Policy Research Unit at the University of Sussex, the Harvard Institute for International Development and the Center for the Social Sciences at Columbia University.

The present paper therefore describes work in progress on a project to be completed in July 1980. The aim here is not to present a fully integrated document leading to operational policy alternatives, but to describe different aspects of the work, which are at various stages of completion, to indicate the relationship of these components to the overall objectives of the project and in particular to discuss the methodology adopted for the work to be completed satisfactorily in the next two years. For this reason the balance of the report is towards technical issues (of, for example, mathematical modelling) which are the necessary underpinnings of any systematic study. The methodology, which is based on previous work on the Bariloche model and at the University of Sussex employs a combination of quantitative and non-quantitative modelling and scenario analyses. Although the purpose of this report is not to present fully worked out policy alternatives, some results and examples of issues raised so far by the work will be reported as an indication of the nature and intention of the study.

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[1] ESA, ECE, CEPAL, UNCTAD, UNIDO, ILO, FAO, UNESCO and the World Bank

CONTENTS

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Figures and Tables

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Participants in the Project

From March 1977 (Pilot Phase):

Graciela Chichilnisky (co-director)	Department of Economics, Columbia University/ Harvard Institute of International Development
Sam Cole (co-director)	Science Policy Research Unit, University of Sussex
John Clark	Science Policy Research Unit

From March 1978 (Preparatory Studies):

Larry Christiano	Center for the Social Sciences and Department of Economics, Columbia University
Jay Gershuny	Science Policy Research Unit
Henry Lucas	Institute for Development Studies, University of Sussex
Dennis Mengen	Center for the Social Sciences and Department of Economics, Columbia University
Ian Miles	Science Policy Research Unit
Lance Taylor	Department of Economics and Nutrition, Massachusetts Institute of Technology

From July 1978:

Liliana Acero	Science Policy Research Unit and Department of Sociology, University of Sussex
Alberto Bonfiglioli	Science Policy Research Unit
Arlene Roberts	Center for the Social Sciences and Department of Economics, Columbia University
Howard Rush	Science Policy Research Unit

From September 1978 - non-inclusive list containing collaborative studies (denoted *)

Frank Ellis	Institute for Development Studies, University of Sussex
Richard Falk*	Center of International Studies, Princeton University
Gilberto Gallopin*	Fundacion Bariloche

Cont.....

Martha Gavensky*	UNESCO
Gordon MacKerron	Science Policy Research Unit
Carlos Mallman*	Fundacion Bariloche
Tony Meagher	Science Policy Research Unit
Jose Serra*	Universidad Campinas

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APPENDICES

The report is based on the following appendices, most of which are available upon request. The content of the appendices is summarised in the report in the pages indicated in brackets . * indicates draft or initial working document only ; ** indicates not yet available for distribution.

1. "A North-South Model" by Graciela Chichilnisky, Working Paper, Harvard University, 1977

   Also: ** "The North-South Model in Relation to Major Branches of Economic Theory", by Graciela Chichilnisky, Working Paper, Science Policy Research Unit, 1978 [pages 42 to 44]

2. "Modelling with Scenarios: Technology in North-South Development", by Sam Cole and Graciela Chichilnisky Futures, August, 1978 [p. 9 to 13 and 81 to 83]

3. "Developing North-South Scenarios: Diagnoses, Prescriptions and Prognoses" by Ian Miles, Working Paper, Science Policy Research Unit, University of Sussex, 1978 [p. 17 to 28]

4. "The Choice and Analysis of Scenarios of World Development", by Ian Miles, Science Policy Research Unit, University of Sussex, 1978 [p. 13 to 14]

5. "Global Models: An Evaluation of Their Relevance to Policy", by S. Cole, Science Policy Research Unit, University of Sussex, 1978. [p.35 to 39]

6. "A Summary Comparison of One Region and Global Models", by Graciela Chichilnisky and Sam Cole, Science Policy Research Unit, University of Sussex, 1978 [p. 35 to 39]

7. "A Model of Technology, Domestic Distribution and North-South Relations" by Graciela Chichilnisky and Sam Cole, to appear in Technological Forecasting and Social Change, October, 1978 [p. 42 to 44]

8a. "The Calibration and Solutions of a Macro-Model of Technology in North-South Development", by John Clark, Sam Cole and Henry Lucas, to appear in Applied Mathematical Modelling, 1978. [p. 56 to 63]

8b** "Solutions of a North-South, Two Good, Two Income Group Model with Trade", by John Clark, Science Policy Research Unit, University of Sussex, 1978 [p. 55]

8c** "Dynamic Analysis of a North-South, Two Good, Two Income Group Model with Trade", by Sam Cole, Working Paper, Science Policy Research Unit, University of Sussex, 1978. [p. 55]

26.** "A Model of Innovation and Investment", by Sam Cole, Working Paper Science Policy Research Unit, University of Sussex, 1978. [p. 89 to 90]

27.** "The Fruit Industry in Central America", by Frank Ellis, Institute For Development Studies, University of Sussex, 1979. [p. 84]

28.** "The Environmental Dimension in Technology and Development Strategies", by Gilberto Gallopin, Fundacion Bariloche, Argentina, 1979. [p. 81]

29.* "Basic Needs in the North-South Debate: Imperatives and Distortions", by Graciela Chichilnisky, World Order Models Project Paper, Institute for World Order, 1978.

SECTION 1 AIMS OF THE PROJECT AND SCOPE OF THE PILOT STUDY

Aims of the Project

1.1 The study rests on a desire to contribute to the international debate on long term global development alternatives and especially to the search for mechanisms which will help to bring about equitable economic and social development within the world order. As such the study provides an analytic framework within which selected distributional issues of world interdependence, in particular, those related to aspects of North-South development are explored[1].

1.2 The study rests on a number of assertions: above all, that the major focus on the Third Development Decade should be on certain normative and instrumental concerns. The major normative issues to be confronted are those of eliminating extensive and extreme poverty and maldistribution worldwide whilst recognising other development targets. The instrument concerns are those of reshaping existing national and international distribution of wealth and power in order to achieve these goals. These concerns arise since, despite rapid economic growth worldwide in the post war era and a significant transformation of power structures much of the world population continues to exist at scarcely above subsistence level. For vast numbers of people, even the most basic human needs of material and social life are not met. In many respects the distribution of material and social well-being is worsening rather than improving.

1.3 A second assertion is that given adequate international and national strategies, including appropriate technological change and rapid industrialisation, the foundations of a plentiful and equitable social and economic development can be laid in the next Development Decade although the full realisatic of the goals of such development may not be until the next century. There are many possibilities for the future but the shape which global society takes in the long term will be to a large extent a function of conscious human actions in the short and medium term.

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[1] It should be noted that the term 'North-South' is here a convenient shorthand. It is not intended to disguise important structural differences, but merely to indicate the major focus and orientation of our analysis.

1.4 Barring world war or catastrophe, most people in the world today will be alive in twenty to fifty years time. It is desirable that all people should be aware of possibilities for the future and to engage in the conscious determination of their own life styles and those of future generations. Predominantly, the goals, speculation about and directions set for the future in modelling and futures studies (in the United Nations as elsewhere), even when focusing on the problems of Southern countries, have reflected a Northern perspective. Furthermore, only a narrow range of views within the North and South are accounted for in those studies. The purpose of long term forecasting exercises and futures studies in general should be to promote a more widespread discussion and awareness of a wider range of possibilities for the future and the various trade-offs upon their realisation. The United Nations is a major agent in such discussion.

1.5 In the present debate about long term global development objectives and mechanisms for achieving those objectives there are many different perspectives on development reflecting the views of different nations and interest groups. Quite evident here are the official and unofficial positions of nations and groups of nations in the North-South and East-West dialogues (and transnational groups representing government, environmental, labour and business interests). Although there is considerable variation in emphasis, there are many issues of common concern, in particular poverty, unemployment, inflation, environment, authoritarianism, and the arms race, there are clear differences (and sometimes striking similarities) between the objectives, analysis and proposals of the various actors, especially in relation to questions of long term economic distribution.

1.6 Differences between the positions of the various actors become most apparent on questions of the mechanisms for achieving long term improvements in economic well-being worldwide. For example, some proponents in the debate argue for a maximisation of overall world economic growth with a liberalisation of world trade, investment and technology and a more sustained 'trickle down'

of wealth to the less affluent social groups is the most efficient way to foster international development and the problem of global poverty. Counter arguments suggest that a more speedy solutions is likely to come, on the contrary, by the developing nations successfully delinking themselves from unequal or otherwise disadvantageous economic and social relationships with the industrialised countries and entering into mutually beneficial exchanges between themselves. In all such arguments, questions of the operation of the international market, of domestic markets, the role of the technology and of state policy and of the need for social and political reforms are central. Underlying the debate are contrasting views on the possibilities for economic growth and social improvement and the trade-offs to be made between economic growth, distribution and social freedoms in various world regions.

1.7 There is general agreement that to achieve reasonable development targets in the next decades major changes in international economic arrangements will be required and necessarily will be accompanied by or contingent upon corresponding changes in international political institutions. The same is true for domestic economic and political relations. New patterns of global interdependence must emerge if long term goals are to be realised.

1.8 The present project sets out to explore these issues with certain specific aims in mind - in particular, as noted earlier, to suggest more satisfying, globally equitable and socially participative ways of life. Thus, the study concentrates, within a broad framework of analysis, on issues related to new patterns of international trade, changes in systems of production and consumption, the creation of personal technical and social skills and the formation of political institutions consistent with greater personal social and economic participation.

1.9 In view of its importance to many of the issues to be considered "technology" is taken to be a central variable in the analysis, a major variable, subject to human choice conditioned by and conditioning other social and economic variables. Responsible policy towards science and technology requires an understanding of long term social, political and economic factors, since the lead times for the implementation of many desirable technologies (including research, development and diffusion) may be several decades.

1.10 This project differs from others within the United Nations programme on long term development objectives both in the issues emphasised and in the approach adopted. The foci of the study reflect a current awareness of the central role of technology in economic and social development. (This is witnessed by the forthcoming United Nations Conference on Science and Technology). Further, this project reflects the recognition that discussions of previous development strategies have concentrated too narrowly on economic variables (e.g. national per capita levels of income, volumes of trade) and have paid insufficient attention to other economic and non-economic factors (income distribution, technology and socio-political variables).

The Overall Method of Analysis

1.11 The present study attempts to contribute to, and integrate contributions from, different but overlapping areas of analysis. Among them are: long term development planning exercises such as those conducted by international organisations, more theoretical work concentrating on understanding of processes of development, futures studies including global models with a normative emphasis on the creation of desirable long term futures, and other studies concerned with more concrete and immediate local, sectoral and national policy. In this light, we shall discuss our method of analysis.

1.12 Three techniques are used principally in the study: modelling, scenario analysis and case study analysis. For each there is a distinctive approach to be contrasted with other studies. We shall elaborate on the distinctive features of these techniques in the relevant sections. Here we give only a summary description.

Macro-economic Modelling

1.13 The macro-economic model constructed is a highly aggregated model of North-South development, representing the interaction of different income groups and markets, and several sub-models which focus on specific issues. The importance of productivity and consumption in basic goods sectors (such as agricultural products) for production and distribution in

the economy as a whole are emphasised. The 'North-South' model (described in detail in Section 3 and Appendix 1) is directed towards the central question of the role played by technology in determining through the market income distribution (within and between) the two regions of the North and South. A more sophisticated and disaggregated version of this model (the Alternative Interdependence Model - AIM) described later is being developed: a larger number of regions, sections and actors are to be described and non-market phenomena (e.g. income redistribution policies, tariffs, etc.) are to be included.

1.14 In these models we take a level of aggregation and an accompanying set of actors and variables that help quantitative understanding while not hindering or obscuring qualitative understanding. One particular characteristic of our modelling work is that sub-models are constructed here to study special issues, as opposed to the more general practice of developing sub-models to deal with sub-sectors of the economy only. The idea is that in order to study more pointedly a particular issue, it is useful to single out the particular actors and relations, which are in general only some of all those considered in the comprehensive model. In addition, a smaller sub-model allows for better analytical study and also the interpretation of the numerical computer results. One further important feature of the study therefore is that the model (and sub-models) are sufficiently simple in terms of the number and complexity of the equations contained for explicit algebraic solutions to be obtained for any major results, which yield better qualitative understanding, they do not depend on a computer to give analytical results. As far as possible, the approach has been to avoid very cumbersome, lengthy computer modelling.

1.15 In the initial stages of the project the models are used not so much to give quantified estimates but to look for tendencies in various under different sets of assumptions and to guide the analysis of detailed issues; the AIM model and sub-models being developed are expected to be tools for development planning and projections, at least as appropriate as other existing models.

Scenario Analysis

1.16 Our approach seeks to quantify relationships as far as possible through the modelling work but where quantification cannot be satisfactorily achieved (because, for example, theory is too complex or statistics are inadequate) the scenario and case study approach is used to enable account to be taken of the non-quantified factors in the quantitative analysis. Furthermore, because as noted above many opinions and prescriptions are advanced in the debate about world development, our scenario analysis is to be used to clarify the issues of the debate and the prescriptions offered.

1.17 It should here be emphasised that our methodology for scenario analysis is different from most (see Appendix 2). Since, in addition to using it as a device for classifying our own assumptions and for linking together the quantified macro-economic parts of our study with the less quantifiable social and political aspects and with more detailed case studies, it provides a means of making a relatively impartial critique which permits us to evaluate different perspectives on development.[1]

1.18 One major component of the study, therefore, is a systematic evaluation of selected contributions to the debate about North-South development identifying positions, prognoses and long term strategies put forward and relating these to the historical and current situation of the actors involved. This evaluation also takes into account the mutual critique of the proponents of the different perspectives. This critique is not an end in itself. It serves to clarify certain fundamental issues in the construction and analysis of a set of development scenarios and experiments which attempt to confront the different perspectives and evaluate them. The scenarios to be developed in the light of the above analysis focus on specific issues relative to our normative concerns. What this analysis is ultimately concerned with is the combinations of policy with regard to changes in the mode of production and accompanying adjustments to domestic and international economic, social and political institutions which will lead to selected goals; in particular, those of reduced social and economic inequality.

1 We distinguish in the study between 'perspectives' and 'scenarios': the former are frameworks for understanding the scenarios, which are postulated future developments (e.g. long term economic and political prospects)

Case Studies

1.19 While the scenario analysis and macro-economic modelling can display broad patterns for future development at the level of major groups of actors (e.g. regional economic blocs, political groupings) the arguments made with respect to major issues and dimensions of the analysis (e.g. environment, technical change, skill formation) can often be illuminated by reference to particular examples and case studies. In the present study the scenarios and model findings are to be illustrated by selected case studies of sectors, countries of social groups. These case studies are chosen to provide insights into the detailed links between choice of technique and relevant economic and institutional variables. The level of generality of these studies supported by the scenarios varies. There is no attempt at this stage to aggregate, in any sophisticated sense, from case studies to macro-economic variables. For example, discussion of the innovation, transfer and diffusion of technology has to take place within a consistent framework but also has to be backed up by relevant examples which both support the general positions put forward and also illustrate the diversity encountered in specific cases and hence the difficulties involved in generalising them.

The Scope of the Pilot Study

1.20 The work so far carried out is not uniform across all aspects of the study. The underlying approach has been to deal first with macro-economic and social issues of modelling and scenario analysis. At the same time, exploratory models of the major issues of analysis have been prepared, as well as certain exploratory case studies. Preliminary versions of six contrasting perspectives for the scenario analysis have been developed. Three of these perspectives take a Northern perspective; they are derived from the work and communications of Northern economists, social and political scientists and of institutions representing the interests of the industrialised countries such as the Trilateral Commission and OECD. Similarly, three of the scenarios take a Southern perspective and are based on the work of Southern oriented scientists and institutions such as CEPAL and IDEP. Work to date on these scenarios is summarised in a later section and described in detail in the appendices.

1.21 For the modelling work the necessity has been to prepare the specification of a basic North-South model which has been used to explore problems of income distribution, technology and trade. The content of the model and of sub-models derived from it which deal with selected issues, its calibration and other aspects of the work are described briefly below and in a set of technical appendices. In addition, explanatory "runs" with the model are described. Some of these tests have been prepared with an eye to future integration of the modelling and scenario analysis and some tentative preliminary links are indicated in this report.

1.22 The bulk of the integrative work follows upon the studies of the technology, trade and life style dimensions and upon the satisfactory testing of the corresponding sub-models. Below, and in the appendices to the report we summarise and describe the work to date and the objectives of each study. Again, it will become clear that the studies are at different stages of completion and also that a good deal of flexibility has been left in these aspects of analysis.

1.23 Although the foundation for integration of the different parts of the project has been established, work to date has concentrated on setting up the different components, preparing background material, building up the project team and consultants, overcoming administrative and technical difficulties, and so on. The work has not been directed in the first instance to "getting results". There is no pretence here that integration is complete, although the potential for integration in the near future is evident and the major steps will be completed in the next year. In the following year modifications sophistication and detail will be added, in particular, by the inclusion of analysis of selected case studies.

1.24 The work completed to date will be summarised in the following order:

(i) North-South perspectives and scenario analysis

(ii) A model of technology, trade and income distribution

(iii) Issues and sub-models

(a) ways of life

(b) technical change

The divisions here are to some extent arbitrary and there is a good deal of overlap; indeed, it is an assertion underlying the study that the dominant issues cannot be treated well in isolation. In (ii) and (iii) we indicate future collaboration with other United Nations agencies (CEPAL, UNESCO, ILO)

SECTION 2 ALTERNATIVE PERSPECTIVES OF NORTH-SOUTH DEVELOPMENT AND SCENARIO ANALYSIS

Introduction to the Scenario Analysis

2.1 It is widely accepted that the world economy of today differs from that of the 1950s and 1960s. In some perspectives the problems of inflation, poverty, regional inequalities, under-used capacity, and unresolved issues of international organisation form a series of only loosely connected crises - the energy crisis, the debt crisis, the monetary system crisis and issues related to the environment, population growth, etc. In other perspectives these phenomena are intimitely linked: they are all aspects of a structural crisis of the world order. Whichever approach is correct, we believe that the present state of the world economy reflects a process of significant restructuring of international relations and national economic systems.

2.2 The current uncertainty over future directions is not restricted to economic processes alone, however: political and social affairs are also in flux between and within countries. It is important to take into account the nature of this restructuring in our study of North-South relations because (i) it may imply a break with the, say, 1950-70 situation to such an extent that theory and empirical material derived from this period is of reduced relevance to present and future developments, (ii) at such time of flux there seems to be more potential for major discontinuities in existing patterns of North-South relations (for example, increasing competition among Northern countries may improve the bargaining position of the South) and (iii) because whether or not (and how) previous patterns of growth are re-established is of vital importance to the future course of world development.

2.3 While all interest groups concerned with present events and with long term development questions tend to share a common set of concerns they have quite different priorities and see different mechanisms for change. This is especially true with respect to the degree of linking in the world economy and of the political institutions required to bring about change. The contrasting proposals for change put forward by different actors which reflect their interests are often confusing, partly because these interests and proposals are rarely spelled out in detail, partly because they are rendered

ambiguous or even contradictory by the divergent use given to terms such as new international economic order, collective self reliance, basic needs and so on, and partly because proposals are usually an attempt to compromise conflicting interests.

2.4 In part to clarify this debate in relation to our own position and in part to provide a methodological tool for our analysis we use a version of scenario analysis in the present study. This has been developed from previous work[1]. To avoid further confusion it is necessary to distinguish our use of this term.

2.5 The term 'scenario' was introduced into forecasting studies by US strategic forecasters in the 1950s and was then applied more widely by the 'think tanks' stemming from the experience gained by other forecasters (e.g. in French national planning, etc.). The term was here used to refer to largely qualitative depictions of different 'future histories', of series of events which might take place. Scenarios might in this sense be derived from so called gaming studies, from historical analogy, or from imaginative thinking. The term 'scenario' has a rather wider meaning among futures researchers than the rather narrow sense of an adjustment to a set of quantified parameters (e.g. economic growth rates and levels of trade) often used by mathematical modellers to represent future directions of development. Indeed, scenario analysis is one means of introducing qualitative material into our studies[2].

2.6 Our methodology of scenario analysis rather different to most, even those defined so broadly, for we seek also to explicate the theoretical assumptions which underpin different forecasts. For instance, in the present study[3] we develop scenarios focused on two distinct sets of issues - the current world recession and strategies for overcoming it, and the situation of the South within the world economy. In the development of these scenarios we take into account distinct 'perspectives' representing the contrasting positions in the debate of major actors. This point and the choice of perspectives we use are discussed in more detail below.

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[1] In particular, World Futures: The Great Debate, (eds.) Freeman and Jahoda, Martin Robertson, 1978; also "Scenarios of World Development", Cole, Gershuny and Miles, Futures, 1978.

[2] See Appendix 2

[3] See Appendix 3

2.7 With respect to the above set of issues, contrasting perspectives derived from different actors within and between the North and the South are considered. The rationale behind developing this procedure is not that we believe that the two sets of issues can be separated for analytic or policy purposes - clearly they cannot - nor that we believe that different theoretical stances are all equally valid, but rather for the following reasons:

(i) by systematically treating different approaches to the world system and its problems, we can depict a set of strategies that are presently being proposed, and identify a range of important issues for further analysis; likewise we can develop our own evaluations of these different strategies.

(ii) We identify the interests associated with particular approaches, the possible coalitions or contradictions among these interests and their possible relative power and thus consider the extent to which they may be realised as well as the extent to which the policies and scenarios derived from them might be implemented. This depends also on the adequacy and internal consistency of the approach as well as on the support it receives.

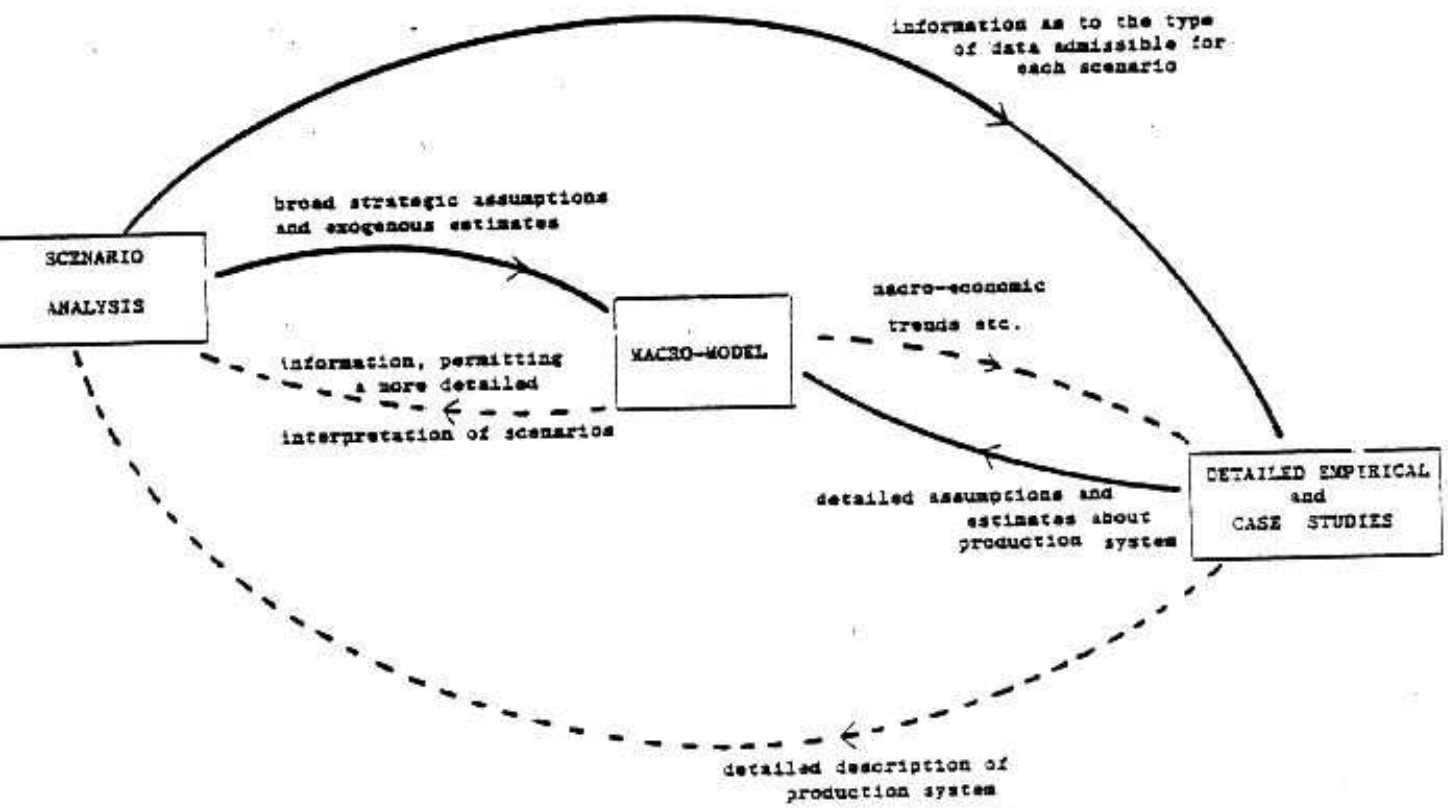
(iii) We can define our own theoretical perspectives and prescriptions relative to those of others and thus expose our own assumptions and analyses to critical scrutiny raising crucial questions that may be addressed to the modelling and case studies.

2.8 A main purpose of our use of scenario analysis is therefore to permit us to be as explicit as possible about the implications of preferences and targets, to clarify and demark policy issues and constraints, and to identify the long run implications of social and economic policy.

2.9 From a methodological point of view the approach to scenario analysis (indicated above) and the treatment of selected issues such as technology, trade and environment is fundamental to the integration of the different components of the study. For example, the scenario analysis provides a broad conceptual framework within which the alternative development paths to be explored using the model may be considered and implications of socio-economic theories and perspectives explored. The scenario analysis also helps to ensure that the modelling assumptions made are internally consistent. This consistency is important for the setting up of the alternative versions

of the model, the choice of data to be used, and the experiments to be conducted. The linking of the different parts of the analysis is described in Appendix 2, and summarised in Figure 1.

Figure 1 The Relationships between the Scenarios, Modelling and Case Studies



Note Full lines indicate procedures for setting up the model experiments; broken lines indicate the interpretation of the model results and reformulation of the scenarios.

The Choice of North-South Perspectives

2.10 In order to understand different accounts of the world system it is useful to consider the way in which the world development debate has developed over the last thirty years - although themes in this debate have been raised for well over a century. In turn, to understand the evolution of this debate, it is necessary to consider the performance of the world economy over this period. Appendix 4 traces the evolution of selected economic indicators worldwide during the post war period. Trends in economic growth, levels of trade and income distribution are indicated in Table 1.

Table 1 (a) Income Inequality (1960-1970)

Proportion of National Income Received by Poorer and Richer Groups in 14 Countries

	lowest 20% of income recipients			highest 5% of income recipients		
Brazil	1960: 5%	1970: 5%	(0)	1960: 23%	1970: 27%	(-)
Canada	6.5%	6.4%	(-)	14%	14%	(0)
Colombia	3%	4%	(+)	36%	33%	(+)
Denmark	5%	4%	(-)	16.9%	22%	(-)
India	4%	5%	(+)	27%	25%	(+)
Iran	4%	5%	(+)	32%	25%	(+)
Israel	7%	8%	(+)	13%	13%	(0)
Mexico	4%	4%	(0)	29%	36%	(-)
Netherlands	4%	3.1%	(-)	23.6%	22%	(+)
Turkey	4%	3%	(-)	33%	32%	(+)
United Kingdom	6%	6%	(0)	15.7%	15%	(+)
United States	4%	6.7%	(+)	16%	17.3%	(+)
Venezuela	3%	2%	(-)	27%	40%	(-)
Yugoslavia	7%	7%	(0)	17%	15%	(+)
	(5+, 5-)			(8+, 4-)		

Notes: (1) (+) indicates trends towards greater equality, (-) towards inequality

(2) These data concern income recipients, not the entire population. The proportion going to poorest 20% of population is likely to be smaller yet.

(3) These data concern income, not wealth; there is no contradiction between any given trend in income distribution and an increased concentration of capital. Capital ownership confers social power; income enables individuals to achieve their own well being.

(4) G. Kohler (1978) calculated on the basis of such data that the top 20% of the world's population received 71.3% of income, the lowest 40% , 5.2% of world income: an overall distribution more concentrated than that within most countries. Kohler points out that the affluent minority is preponderately white, and describes this as a situation of global apartheid.

(b) GROWTH RATES BY COUNTRY GROUPS

	AVERAGE REAL ANNUAL GROWTH IN GDP (%)				GROWTH IN PER CAPITA GDP			
	1950-60	1960-65	1965-70	1970-73	1950-60	1960-65	1965-70	1970-73
INDUSTRIALISED CONOMIES'	4.1	5.2	4.7	4.4	2.8	3.9	3.6	3.1
CENTRALLY LANNED ECONOMIES'	6.0	4.5	4.3	5.0	4.2	2.9	2.7	3.7
DEVELOPING OUNTRIES'	-	5.6	5.8	6.3	-	3.1	3.2	4.2
OUTH: IGHER INCOME above $375 972)	5.2	6.0	6.1	7.4	2.7	3.5	3.6	5.1
IDDLE INCOME	5.2	5.9	6.0	5.2	2.4	3.1	3.2	3.4
OWER INCOME below $200 972)	-	4.2	4.3	1.6	-	1.8	1.9	0.6
IL PRODUCING	-	6.7	7.2	9.0	-	4.2	4.6	7.4

Source: based on IBRD, World Tables, 1976

(c) WORLD TRADE BY REGION

IMPORTS (US$ x 10^9)	1948	1958	1968	1972	1975
'Developed Market Economies'	41.2	74.1	179.4	312.6	614.3
'Centrally Planned Economies'	18.6	27.6	45.4	71.8	189.3
'Developing Market Economies' (includes OPEC)	3.7	12.8	27.7	45.9	99.6
OPEC	2.6	5.4	7.8	14.1	54.8
EXPORTS (US$ x 10^9)					
'Developed Market Economies'	36.6	71.4	168.8	298.7	578.6
'Centrally Planned Economies'	3.7	12.3	27.3	43.2	85.5
'Developing Market Economies' (includes OPEC)	17.2	24.9	43.6	74.2	207.2
OPEC	3.1	7.4	14.0	27.4	112.1

2.11 The post-war period has seen the emergence of many new and important actors who may have a major impact on patterns of world development in the next decades. Thus, important directions may be set by the activities of governments of the 'old' industrial countries, both from socialist and mixed economies, of new emergent economies, of transnational firms, of trade unions, of political parties, as well as of less traditional, popular movements in the developed and developing countries (e.g. environmental groups, anti-nuclear activists, liberation movements and womens' movements).

2.12 When analysing the future of world development, at least two different approaches can be taken. On the one hand one can study the main actors, interest groups and institutions who have, or may have, a sufficient concentration of political-economic power so as to be influential in shaping this future, such as those mentioned above. On the other hand, one can start from the study of major perspectives which correspond roughly to groups classified by a combination of their outlooks and prognoses, especially with respect to structural change and normative concerns.

2.13 For example, as indicated earlier, in this section we shall describe six such major perspectives. Clearly, the positions of certain actors can correspond at different points in time and in different situations to somewhat different perspectives. For example, coalitions of interest groups with different perspectives (or theoretical outlooks) can and do occur, and interest groups can also change sufficiently to lend support to somewhat different, sometimes very different, theoretical positions. Reciprocally theoretical positions also develop and change in order to make sense of structural change at the international level, to analyse them and/or legitimise them in terms of established outlooks and normative concerns (e.g. the development of Latin American dependencia analysis has often been related to the development of import substitution; Keynesian theory laid intellectual foundation for programmes of public expenditures that many states had already established).

2.14 The two approaches therefore complement each other, even though at certain points this complementarity may take a somewhat contradictory form. At present the study of perspective has taken a larger share of our work. As our research proceeds, however, and we concentrate on particular issues of world development, the two approaches and their interactions will be utilised in a more balanced way.

2.15 The particular choice of perspectives are explained below. First, diagnoses, prescriptions and prognoses of the world system are issued regularly by agencies and organisations whose involvement in the processes of policy making is direct and continuous. Although the long term prognoses of such groups are often only sketchily developed and are in some cases ambiguous these actors are nevertheless likely to exercise considerable influence over the making of the future, and their analysis and forecasts are likely to set many of the terms of the debate and actions that are being development at a public and governmental level. Therefore, we considered these perspectives as one starting point for discussion. Second, the changing world economy - the exhaustion of the long post-war boom, and the uncertainty concerning when and how the present crisis and stagnation will end - has widened the development debate. In this situation, alternative accounts of the world system become increasingly relevant - not only as abstract perspectives but also as possible guides to action. Thus, in our analysis we set out to capture both established positions and a wider range of alternativer perspectives on global development than those usually considered by the major international agencies and organisations.

2.16 Appendix 3 presents a tentative outline of a set of contrasting analyses of the world system. With further elaboration and specification these will form the basis for the perspectives examined in the scenarios to be developed in the study. The different analyses are distinguished, first in terms of whether their starting point and focus of concern is economic and social conditions in the "North" or in the "South". This is clearly a distinction that may be unwelcome to those analysts who claim to be truly internationalist. However, it is nevertheless largely the case that internationalists conclude that one or other region of the world is the fulcrum of change in the world order. North oriented and South oriented analyses are typically derived from and addressed to representatives of Northern and Southern interests respectively. In each set of analyses (for the North and the South) three positions are given, one is a "mainstream" position derived from some major organisational embodiment of the dominant interests in the world region, a second is a position which represents a critique of the mainstream position and a third is a position which fundamentally opposes the mainstream analysis in the name of interests given relatively little weight in the dominant analysis.

2.17 These perspectives therefore are affected by whether the analysis is based on the viewpoint of the developed or the developing societies and, second, the underlying worldview (i.e. ideological and theoretical foundation) upon which the analysis is based. Of course, attitudes towards the world crises and ways of overcoming it are closely related to thse two factors. For example, in relation to their North or South orientation, the perspectives place very different emphasis on the relative roles of the North and the South in their respective past and future development. Except for the internationalist Northern viewpoints the Northern views indicated here pay remarkably little attention to the situation of the South. Southern countries are seen in these perspectives largely as a source of raw materials, an export market and/or a potential economic competitor. Conversely, Southern perspectives, in general, place great emphasis on the responsibility of the North and of Northern oriented actors such as transnational firms in explaining their present economic situation although they differ markedly in their analysis of what the future of North-South economic relations might be.

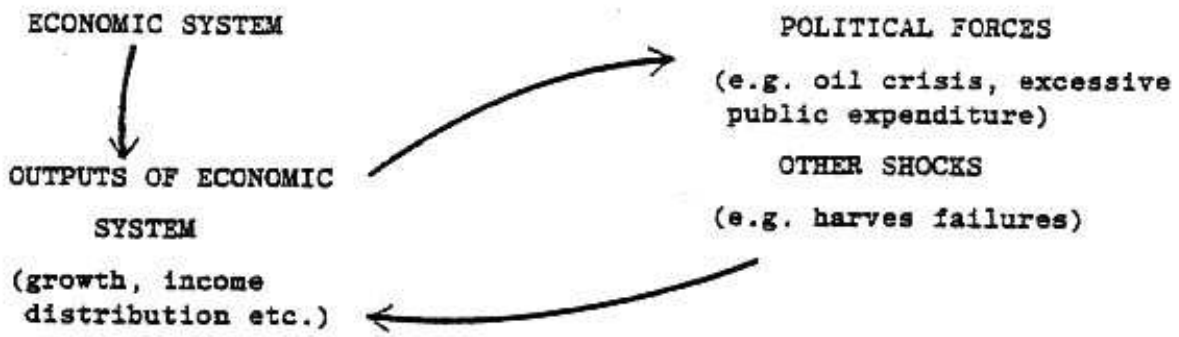
NORTHERN PERSPECTIVES

Liberalisation: Perspective 1

2.18 Several international organisations such as the OECD and Trilateral Commission of the industrial capitalist countries can be identified as currently holding a fundamentally similar diagnosis of the world system. It is likely that current minor differences in their approaches could diverge, especially in the case of increased intra-Northern rivalry.

2.19 According to this perspective, the world economic system is fundamentally healthy and capable of providing sustained increases in welfare. The fact that the world ecnomic system did not achieve its potential in recent years is seen as the result of an unusual (and unlikely to be repeated) bunching of events external to the North (in particular, the oil crisis) and policy errors: the view expressed in other perspectives that market oriented systems and democratic political institutions have failed is rejected. Schematically, the diagnosis of this perspective is shown in Figure 2.

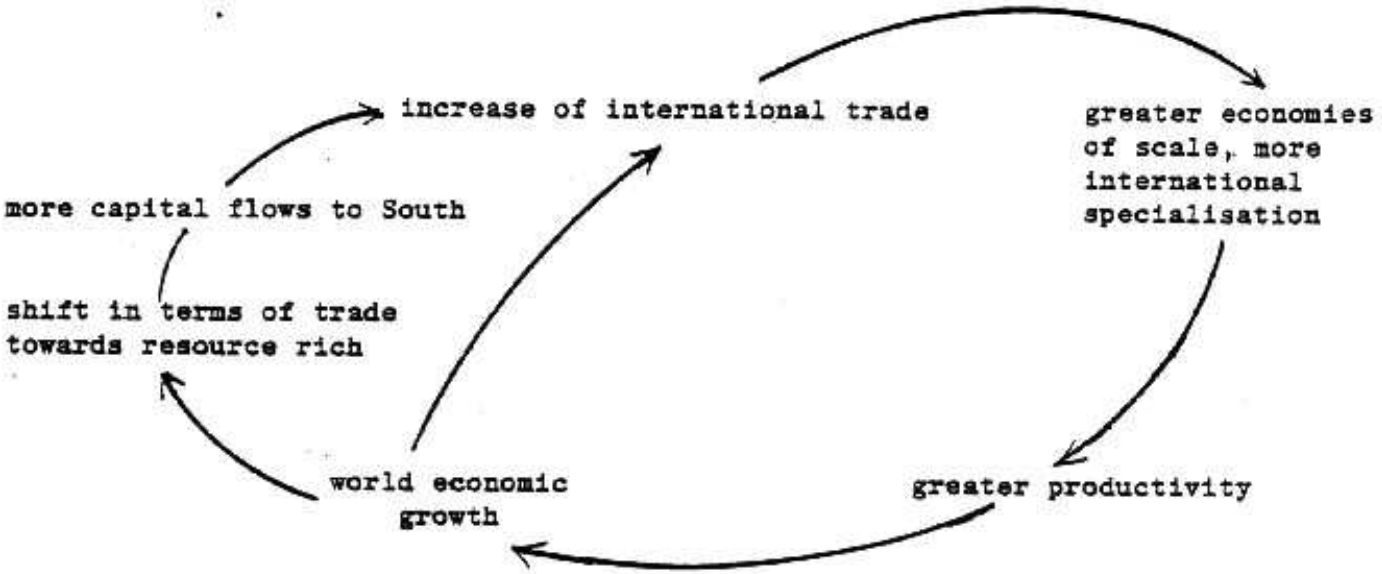
Figure 2 Schematic Basis of the Northern Liberal Perspective



2.20 The prescriptions for revitalising growth emerging from this perspective vary but broadly speaking can be summarised as follows. Nations should accept the common norms of the competitive market with budget setting, restricted monetary growth and efficient public expenditure and there should be some attention to medium term planning. Although the goals are full employment and price stability, to ensure the latter in the medium and long term may necessitate relatively high levels of unemployment in the short term.

2.21 A form of international cooperation is required. Nations is a position to do so should initiate world recovery. To facilitate this short term exchange rate fluctuations should be removed, including barriers to Southern imports (including manufactures). 'Buffer' stocks should be set up to ensure a steady supply of raw materials. Terms of trade shifts may occur in favour of some resource exporting developed and developing countries. The South will experience significant growth through trade with the North and through investment by transnational firms (with adequate guidelines). The North is seen as regaining much of its previous rapid growth although in the long term demand for goods and services may taper off. The prescriptive component of this perspective therefore may be summarised, as in Figure 3.

Figure 3 International Economy and North-South Relations in the Liberal Perspective



We shall consider later what issues arise from this and other prognoses.[1]

Interventionism: Perspective 2

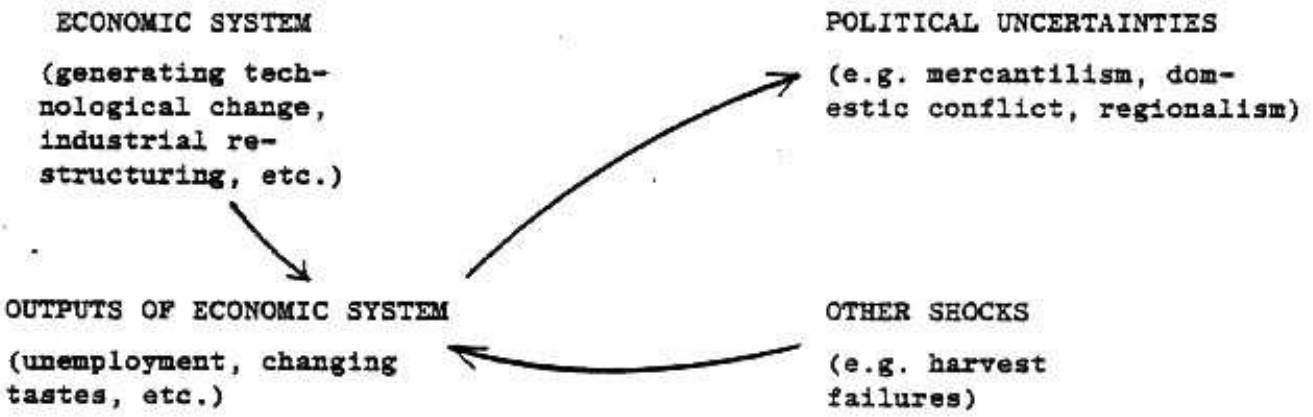
2.22 The second perspective, Northern Interventionist, has emerged partly as a critique of the Liberal position. While it is not as straightforward to identify a 'mainstream' view here nor to tie it to institutions in the world system it can be related to certain elements of OECD and to certain national governments in the North.

2.23 In this perspective 'exogenous' factors are here more incorporated into the system, and an important role is played by technological change and is linked to a much longer term cyclical pattern of behaviour, or even to a continual absence of equilibrium. Thus, current unemployment, inflation, domestic conflict and international rivalry and protectionism in the North are related to interconnected issues of industrial restructuring, technical change and political uncertainty. With transnational investment and increased manufacturing capacity in the South, this suggests sustained high levels of

[1] Some of these issues have already been considered in the modelling work described below.

unemployment. Economic problems are likely to exacerbate political problems nationally and internationally. From this perspective, therefore, the liberal view above is overly complacent. Figure 4 depicts the schematic outline of this diagnosis.

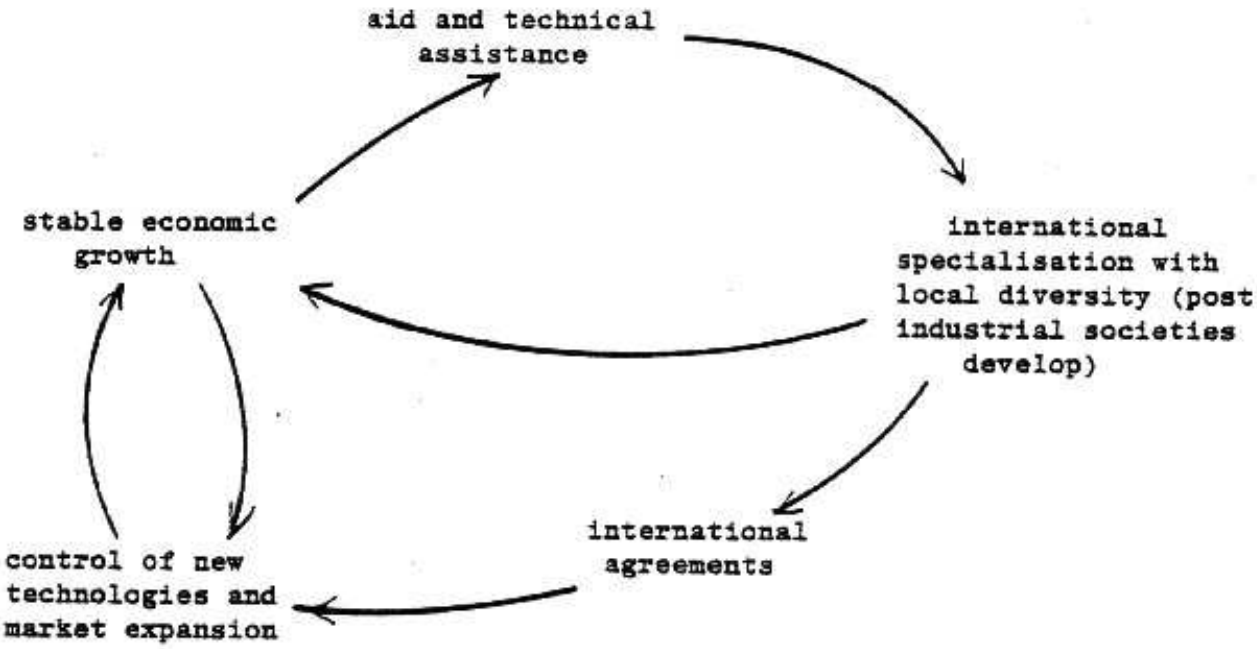
Figure 4 Schematic Basis of Northern Interventionist Perspective



2.24 In setting up their prescriptions advocates of this perspective take the interventionist position that economic structures require regulation and continuing adjustment to reduce instabilities and inequalities. Through incentives and constraints and international cooperation, governments should direct investment, technical change and consumer demand in order to make individual countries more competitive. To do this at the same time as controlling unemployment may involve an economic system combining efficient transnationals and smaller labour intensive firms producing an expanding range of goods and services. It will also require technical competence of a high order.

2.25 Possibilities for assisting the South depend on improving the economy in the North although, in turn, the South is recognised as forming an invaluable market for the North. Provided political and economic threats are overcome, opportunities offered by new technology and international agreements to stabilise resource prices and coordinate expanded trade and aid and technical assistance to developing countries will lead to an economically diversified but prosperous world. This prescription is summarised in Figure 5 overleaf.

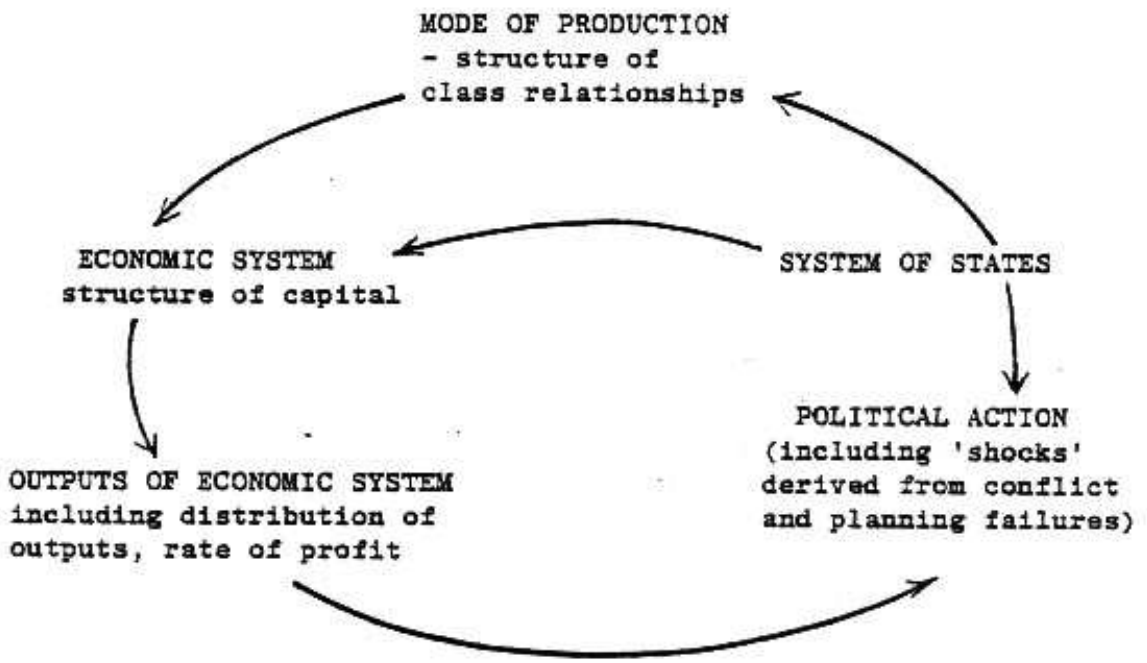
Figure 5 International Economy and North-South Relations



Northern Collectivism: Perspective 3

2.26 The third approach to the world system centering upon a Northern-focused analysis represents more of a break with the two previous approaches in terms of political strategy, although many elements of economic analysis overlap with the Interventionist Perspective. In common with the preceding analysis what is seen as the current world crisis is considered to be more than a temporary phenomenon. However, unlike that analysis it is argued that state activities alone will not overcome the crises and imbalances which are fundamental to capitalism. Of central importance in this analysis is the rate of profit; as it declines real wages and employment are pushed down, leading to a confrontation between capital and labour with possibly authoritarianism and international conflict. The underlying structure of this analysis is shown in Figure 6.

Figure 6 Schematic Basis of the Northern Collectivist Perspective



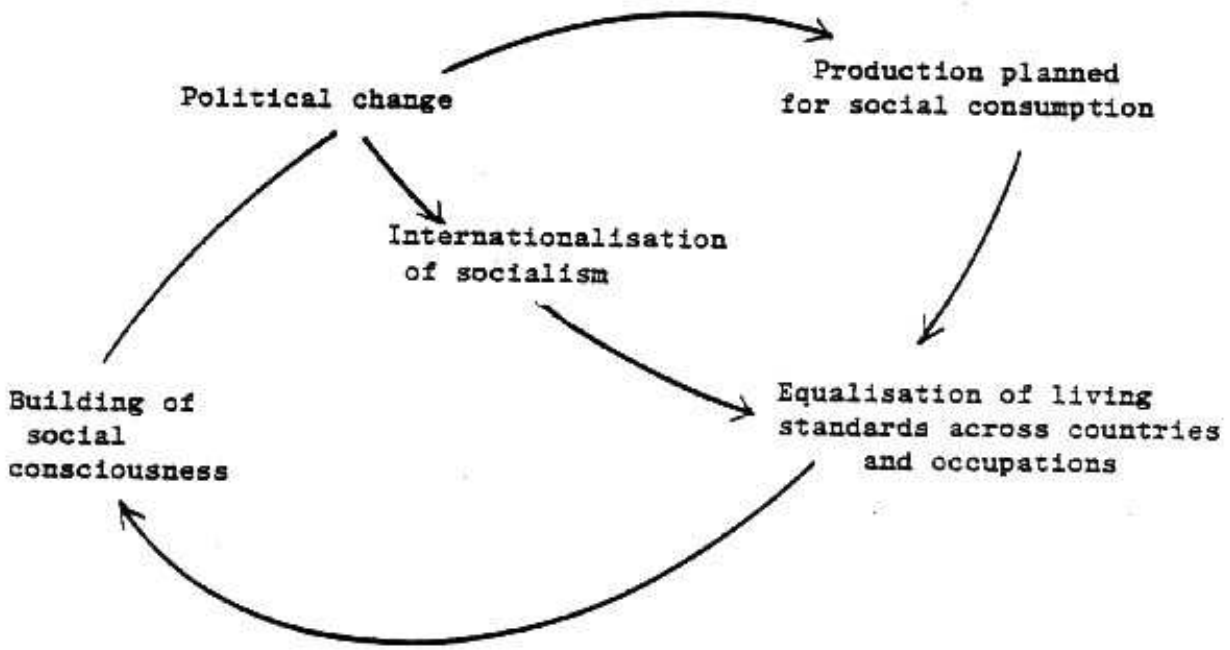
2.27 The strongest organisations drawing on these viewpoings in the Western world are the 'Eurocommunist" parties of Western Europe, although much of the analysis of these parties in their 'national roads to socialism' is criticised by other groupings of the political left and independent radical analysts as nationalistic and mercantilist, it thus resembles the Interventionist analysis.

2.28 The distinctive emphasis of this perspective is that significant political change is needed if economic actions are to have widespread long term benefits. Prescriptions are directed not only at the state, but at worker's organisations. Rather than identifying a common 'national interest', analysts in this perspective argue that there exists an irresolvable conflict between capital and labour, and see the state as having been formed in the interests of the former. The key issue is one of winning workers' movements to this perspective.

2.29 Thus, in this perspective it is argued that there should be an alignment of class forces within and across nations. A transition to a socialism will bring about planned production for social consumption as well as economic efficiency, with provision of basic and non-essential goods for all, and equalisation of living standards within countries and occupations.

Socialist states in the North should aid struggles in the non-socialist South and give financial assistance to socialist developing countries. In the long run there should be a high degree of regional equality, nation states will be displaced by local councils under the coordination of a world planning agency through which there would be a pooling of resources and full transfer of skills and technology. This is summarised in Figure 7.

Figure 7 International Economic and Social Change and North-South Relations in the Northern Collectivist Perspective



SOUTHERN PERSPECTIVES

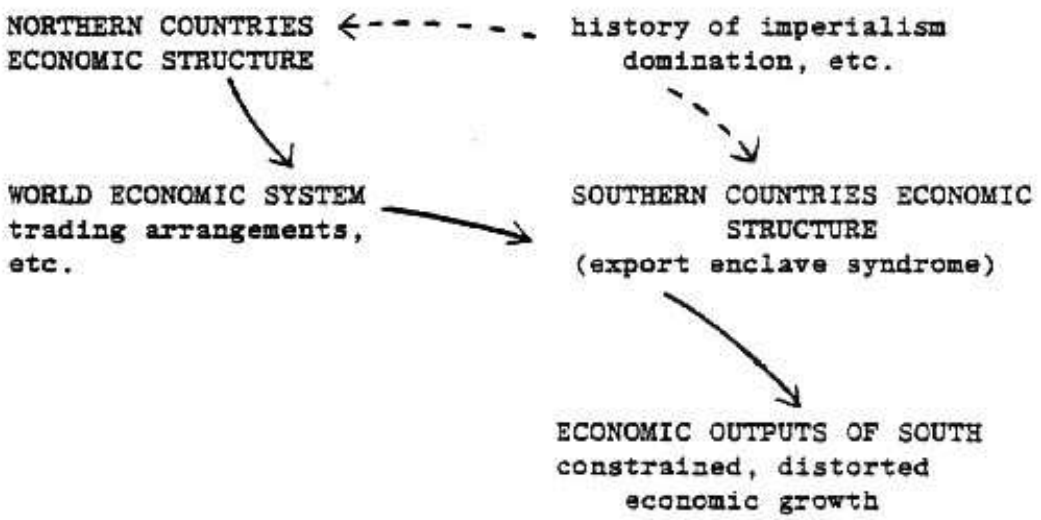
New International Economic Order: Perspective 4

2.30 The New International Economic Order perspective corresponds to that advanced in such 'Southern-oriented' organisations as the Group of 77 and UNCTAD. However, the view presented here is largely constructed from arguments presented from the South during the 1970s including the Lima Declaration (1975) adopted by the United Nations Industrial Development Organisation (UNIDO) Conference and the position of the Group of 77 at the Seventh Special Session of the United Nations General Assembly. The many alternative statements of the NIEO represent compromises between different

interests and theoretical perspectives; many disagreements are masked by common concerns with intial measures. Nevertheless, the NIEO approach does draw fairly heavily upon analyses developed by, among others, the Economic Commission for Latin America (ECLA) group.

2.31 Underlying this perspective is the assertion that the problem for the South is the nature of its economic links with the North; the functioning of the world market is biased against the South. Because, despite political pronouncements, Northern policies are based on self-interest and because the activities of transnationals operate agaist the host countries, the South's earnings are both low and unstable. This position is summarised in Figure 8.

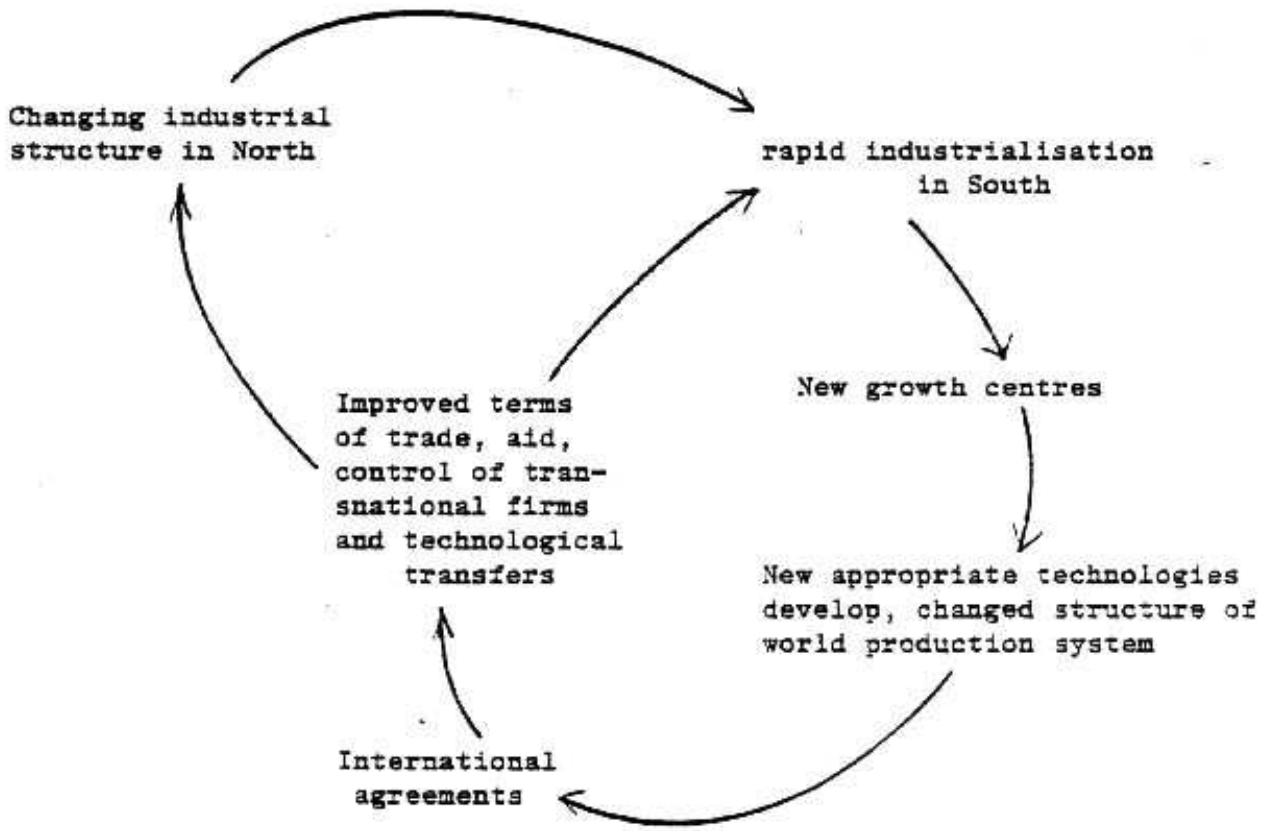
Figure 8 Schematic Basis of New International Economic Order Perspective



2.32 The approach is less concerned with diagnosing the development of the world economic events of the 1970s than with using this as an opportunity to tackle the protracted crises of the Third World. The perspective on the whole accepts the idea that economic growth in the North is beneficial to the South and argues for increased North-South trade but preferential terms of trade for the South and a reduction of the debt burden should be negotiated and there should be increased flows of advanced technical skills and development assistance. Fixed targets (e.g. those of the Lima Declaration) should be aimed at and the activities of transnationals should be controlled.

2.33 The growth path within the countries of the South, in many respects, would resemble that previously followed by the North. Rapid economic growth, a diversified industrial base (with emphasis on heavy industry) and the development of new growth centres are required. Attention would be on the expansion of the industrial workforce and the acquisition of requisite skills; relatively less on the rural sector. In all sectors indigenous, appropriate technologies should be developed. Between the countries of the South there would be exchange of information and increased trade. The North would have to undergo complementary economic changes and accept reduced long term growth, engage in material and energy conserving policies, and carry out research and development which takes into account problems of the South. This view of development is summarised in Figure 9.

Figure 9 North-South Development in the New International Economic Order

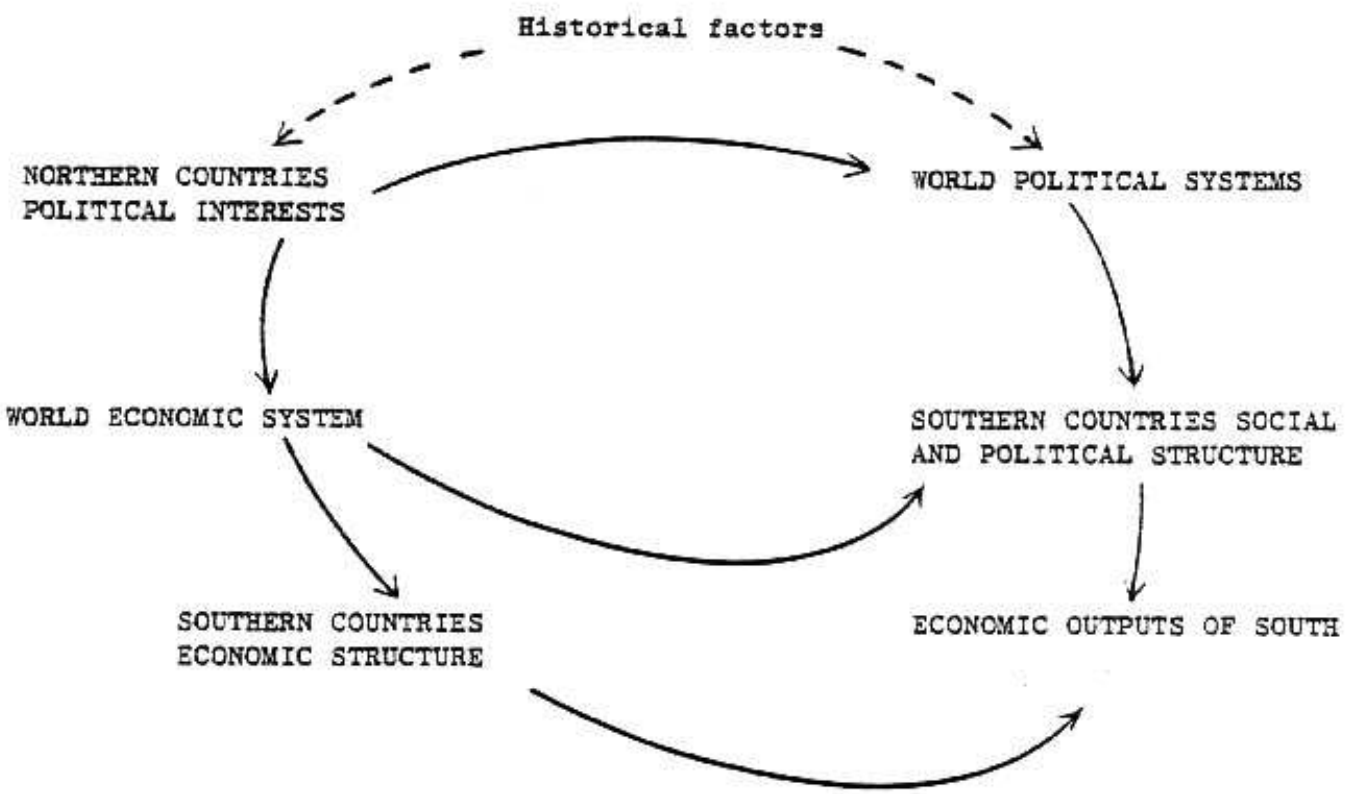


Collective Self Reliance: Perspective 5

2.34 A different approach to world development has been generated in many Southern countries partly as a response to the problems associated with earlier import-substitution policies. Collective self reliance is a term which has been applied in widely different ways by different groups. Here it shall be taken to refer to the positions advanced by social and economic research groups from Asia, Africa, Latin America and Europe. The perspective draws heavily upon elements of dependency theory.

2.35 This view places much less faith on the ability and/or goodwill of the North in relation to the South that the New International Economic Order perspective. Much greater emphasis is placed on the difficulties caused by transnational firms, the development of export enclaves in the South and previous import substitution policies and the failure of these to eliminate poverty or moderate inequalities in the South. In some respects, the present crisis helps the South. Figure 10 provides a schematic outline of the collective self reliance analysis.

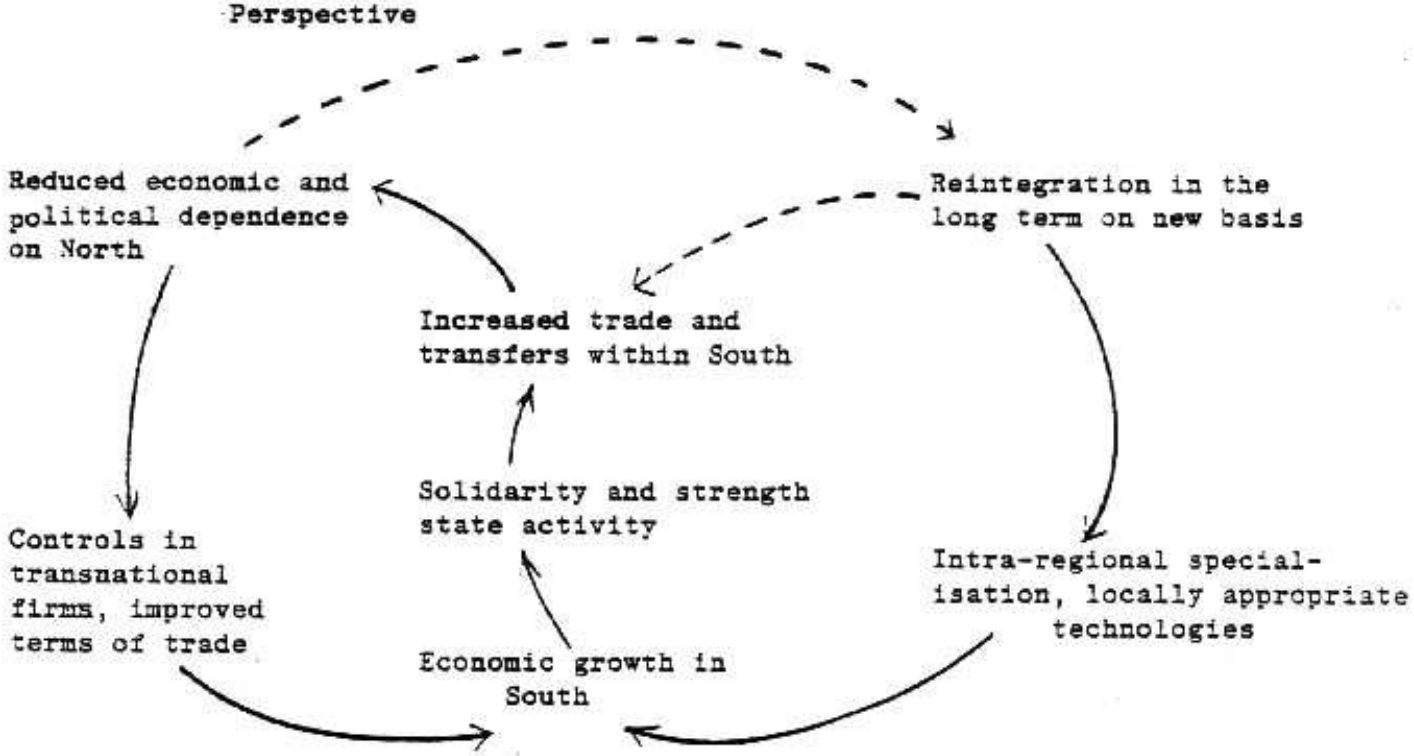
Figure 10 Schematic Basis of the Collective Self Reliance Perspective



2.36 In this perspective, it is argued that by taking advantage of the crisis and economic conflict in the North, the South should attempt to "delink" in a calculated manner from the world economy. This would not be complete autarchy, there would be major reductions in economic and political dependence. Terms of trade improvement and more stringent regulation of transnational firms would be essential, a rapid development of the technological, industrial and agricultural base to lessen reliance on the North is required. Coalitions of Southern nations (independent of their different political complexions) should pool their otherwise inadequate technological, financial, human and natural resources. International economic associations should be set up or revitalised and there should be a planned Southern intra-regional specialisation.

2.37 Within nations some political restructuring (which may meet with internal objections) is required. In particular, state intervention is crucial to achieve investment and technological objectives and to stimulate locally appropriate technological styles and active social objectives and an economic system oriented to the production of basic goods. Again, as in the NIEO view, complementary changes in the North would be essential although in the long run economic reintegration with the North would be possible. This is summarised in Figure 11.

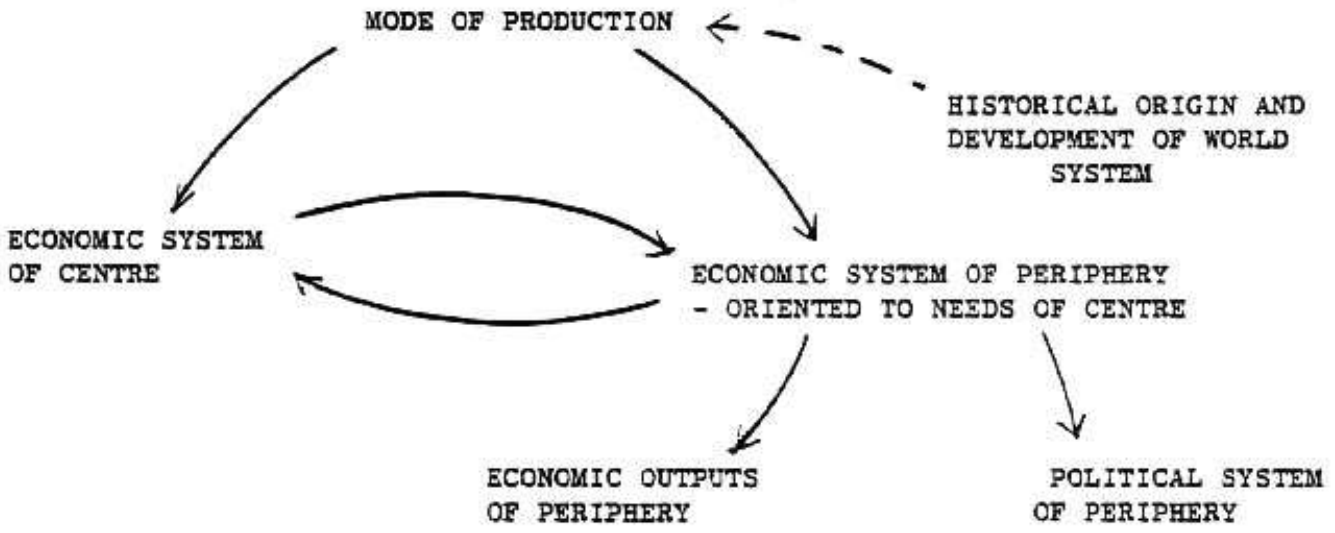
Figure 11 International Relations in the Collective Self Reliance Perspective



Unequal Exchange: Perspective 6

2.38 The third Southern approach in some respects complements the Northern Collectivist analysis: it shares a focus upon class relations, the production and transfer of value, and the contradictions built into exploitative social relations. This perspective argues that there is, in addition, a process of unequal exchange between the centre and the periphery (North and South). Unlike the Northern Collectivist perspective, it is argued here that the nexus of change is in the South and the South should detach itself from the crisis of capitalism in the North. With the policies of the New International Economic Order and Collective Self Reliance perspectives, the South would not escape dependence on international capital and, furthermore, patterns of unequal exchange within the South would be created. Figure 12 depicts this analysis in more detail.

Figure 12 Schematic Basis of the Unequal Exchange Perspective

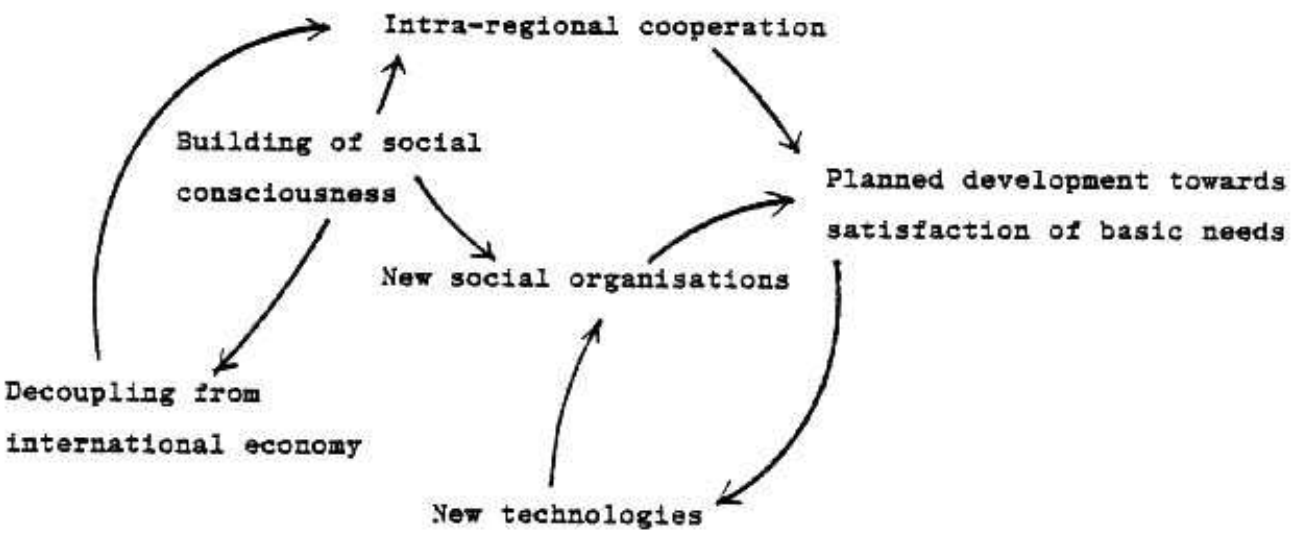


2.39 In this perspective the choice for the South is either dependent development or a new form of self-centred development oriented to the social needs of the South (even perhaps at the expense of conventional economic growth). To achieve major shifts in consumption and production requires new technologies and corresponding major changes in the mode of production; the South must organise exchange of raw materials, technology, finance, and political initiatives independently of the North. To avoid unequal exchange within the South, political consciousness and national and inter-

national aliances must be established between working classes and marginalised groups. Development would be towards the construction of advanced industrial economies once countries have passed the stage of satisfying mass basic needs. This path of development is shown schematically in Figure 13.

2.40 In this perspective, contrary to Perspective 4, contemporary Northern state socialist countries should not attempt to impose their own bureaucratic models of development on the South. Future relationships with the North would depend on directions taken by the North.

Figure 13 Development from the Unequal Exchange Perspective



Issues Arising from the Perspectives and their Prescriptions

2.41 Each perspective and corresponding strategy rests on certain critical assertsions as the mechanisms and goals of world development. Table 2 summarises the perspectives and questions arising from them. In addition to these, issues arising from the possible coalitions among interest groups and actors represented in these perspectives will be analysed.

2.42 For international economic relations questions arise of terms of trade and future patterns of trade; what are the relationships between trade, aid, growth and domestic distribution and how do they vary under different conditions, in particular what are the trade-offs between economic growth and distribution? What are the relationships between different markets for food, raw materials, industrial products (including armaments)? Do international economic relations place such heavy constraints on domestic policies that national social objectives cannot be achieved? What are the possibilities for greater self-sufficiency at a national and regional level in the South and also in the North? What is the time-scale for such adjustment? How are different strategies relevant to developing (and developed) countries at varying stages of development and different endowments. What is the depth of penetration of transnational firms at all levels of the world economy; how strong is their political role?

2.43 With regard to technology specifically, there is the question of under what conditions in the South new and locally appropriate technologies might be created. To what extent, in situations where social institutions foster dependency and exploitative reslations, is it possible to design 'appropriat' technological forms which overcome or ameliorate the effects of those relationships? In the North, what are the possibilities for resource saving, is technical change and investment in such a direction as to inevitably bring about a fall in the rate of profit long term? Will social and economic factors ameliorate this? What is the relationship between the size of domestic and international markets and increases in productivity etc.? How important are 'economies of scale'? What is the role of inflation in redistribution - what are the economic and other mechanisms whereby redistributive policies are dissipated?

2.44 With regard to political issues there are major questions also posed. What is the possibility for economic and political policy coordination in the North and the South and between them, for what groups of countries and under what conditions? What is the depth of 'goodwill' of the North to the South? What is the possibility of new forms of neo-colonialism by the North (both East and West). What is the role of institutions, such as the International Monetary Fund? Are neo-imperialist centre-periphery relationships likely to grow? What military and political blocs will emerge? What major coalitions will emerge on a North-South and South-South basis? How important are the relative 'endowments' (raw materials, technical capability, size of markets, military strength) of different nations and blocs in such alliances?

2.45 With regard to social behaviour questions about the possible social mobilisation of working classes on a national and international level and possible counter tendencies arise. Also, in relation to different modes of production, what may be the long run pattern of domestic consumption, what is the relationship in the short and long term between consumption in the North and South? To what extent are patterns of consumption commercially induced by following a set of socially conscious choices.

2.46 While we do not attempt to answer all these questions, clearly this cannot be done, they guide both our choice of issues of development and also our study of these issues in our future work. At many points we must make assumptions about the answers to these questions and assess the implications for our future scenarios.

Table 2 A Summary of Diagnoses and Prescriptions

PERSPECTIVE	CONCEPTUALISATION OF PROBLEMS, MAIN EXPLANATORY DEVICES [a]	ADVOCATED BASIC PRESCRIPTIONS [b]
1. Liberalisation	World economic system is fundamentally healthy, but increased interdependence means vulnerability to exogenous shocks, including political errors. International organisation has lagged behind economic linkages. Private enterprise system basic, but needs limited support through state agencies	Increased consultation and cooperation among Northern countries (Trilateralism) to develop orderly mechanisms to bring about adjustment and accommodation to the localised costs of resumed growth. Development of new, liberal, trading and monetary arrangements which can facilitate moves toward optimal international division of labour
2. Interventionism	Emphasis on disequilibriums in investment, technological change and consumption. Identifies problems of long-term structural unemployment as associated with patterns of innovation forced upon firms and countries by competitive pressures. Resolving these problems needs both increased international coordination and greater planning of economy.	Extensive state intervention in deliberate restructuring of national economies, coordinated with international negotiations concerning regional rationalisation of industries. State-created firms to promote new technological products. Possible development of major aid programmes to create effective demand in South, East-West rapprochement.
3. Northern Collectivism	Crisis is an inherent tendency of the capital accumulation process, and is presently manifested in a range of organisational and economic problems. The resolution of crisis is a matter of class conflict and will depend upon both the power and organisation of different classes, and on the stability of the eventual pattern of relationships established, which will determine the future rate of profit.	Combination of parliamentary and extraparliamentary pressure to democratize state activity and bring large enterprises under public control. Democratisation of state and economy, reorientation of production to social needs. Creation of new enterprises under workers control, development of international socialist solidarity.
4. New International Economic Order	Historical dominance of Northern countries have promoted a distorted economic growth in the South. The current world crisis provides an opportunity for redressing imbalances, and can in part be resolved by a revised world order, in which the dynamism of private enterprise is channelled so as to distribute its benefits more evenly.	New International Economic Order: freeing Southern countries to pursue more rapid economic development, to gain more diversified economies, to produce more manufactures, and to gain more from aid and trade. Requires Southern political pressure to renegotiate world order, strengthening of Southern state power.
5. Collective Self-Reliance	Problems of South reproduced through penetration by transnational corporations which both promote economic dependence and political subordination of South to North (and unresponsiveness to local needs). National business classes can make common cause with professionals, workers and peasants to promote democratic national development in many cases.	Third World solidarity in programme of collective self-reliance, in which relationships are reconstituted by Southern action rather than negotiation. Major effort to overcome cultural and technological dependence as well as economic problems; requires stronger states in South, but also their reorientation towards popular pressures and basic needs.
6. Unequal Exchange	Problems of South integral to world capitalist system, and will be maintained in only more indirect forms with partial reforms. Class structure of South pits social groups against each other, and industrialists and dependent state political structures inevitably place limits on autonomous development and satisfaction of basic needs.	Third world decoupling from international economy, strengthening of links between progressive countries and reorientation of consumption patterns to mass consumption goods and employment-creating productio

PERSPECTIVE	CONDITIONS NECESSARY FOR REALISATION AND SUCCESS OF PROGRAMME c	QUESTIONS ARISING CONCERNING IMPLEMENTATION AND OUTCOME OF PROGRAMME d
1. Liberalisation	For trilateralism to work, Northern countries need to establish substantial bases for cooperation among themselves and for taking common stands when confronting Southern countries. Means of reconciling international economic policy with domestic political needs would be required	(1) Is cooperation among Northern countries feasible to the extent envisaged? If so, would it be multilateral, of under US leadership? (2) What are the possibilities for conflit in North-South, East-West relations here? (3) Would the envisaged pattern of world growth provide for the basic needs and/or the rapid growth of the South? (4) What forms of political change are implied in the North - is this a 'corporate state' scenario in practice?
2. Interventionism	For maintenance of an equilibrium between investment and consumption, technological change and employment in the North, new products would have to be developed at a rapid rate, and possibly new market outlets developed. International competition might be a disruptive factor to be regulated here.	(1) What new technological products and processes are envisaged, and is it feasible for all, or even most, nations to pursue them? (space and oceanic industry, biotechnology, robotics, telecommunications e (2) Does this scenario imply an increased degree of protectionism in the North? If so, how is this prevented from developing into trade wars and conflicts over zones of influence in the South? (3) What production does the South engage in according to these perspectives? (4) What new systems of incentive and reward are postulated? How would these affect inequality and social structure?
3. Northern Collectivism	For socialism to achieve economic growth in the North, countries must be able to exercise substantial control over transnational capital and to resist political pressures from both East and more particularly West. Political and economic change here requires extensive mobilisation of working class and other groups around common platforms.	(1) Is a socialist strategy feasible which takes on board the questions of technological change posed by the interventionalists? (2) What strategies are necessary to ensure that socialist democracy is not overtaken by bureaucratic and oligarchic rule? (3) What are the conditions of a developing of the consciousness necessary for the extensive political changes here postulated? What is the danger of fascism as a response to this? (4) How would North-South relations develop here - in what way would they be transformed?
4. New International Economic Order	Southern countries need to be able to exert both power and persuasion to renegotiate international order. Agreement on limited reforms might allow for joint agreements on more extensive world restructuring, through a series of world conferences and less public dialogues. Supranational agencies would coordinate trade, aid and technological interchanges.	(1) What new institutional arrangements are necessary to institute a NIEO? (2) What are the chances for North-South confrontations, for the development of dislocations of various sorts? (3) To what extent would a NIEO benefit the South in general, and the poorer groups and countries in particular, given the dominance of the North in capital ownership and the direction of technological change? (4) What are the consequences of increased Third World manufacturing and industrial production on Northern economies? Are 'post industrial' societies viable?
5. Collective Self-Reliance	Groups of Southern countries develop strong policies to increase mutual interaction and unilaterally determine the degree of linkage with North. New Southern institutions fostering local cooperation and communication regional integration, and the like. Populist and progressive governments must stimulate local industry and attempt to draw broad masses into fuller economic participation	(1) What factors contribute to, and which mitigate against Southern solidarity? What domestic political changes must be forthcoming? (2) To what extent would centre-periphery relationships simply be prone to re-emerge within the self-reliant South? (3) How great a community of interest exists between classes within Southern economies? Is a strong state compatible with democratisation? (4) What would be the consequences of reduced access to the South for the North? What confrontation and conflicts might result?
6. Unequal Exchange	Weakening of existing ruling groups in Southern countries enables popular movements to gain control of territory and state power to aid each others' struggles. Socialist self-reliance strategies pursued involving decoupling from world economy, regional cooperation, and basic needs development.	(1) Under what conditions of national development and international power relations are large portions of the world liable to achieve socialism? (2) Are Third World socialisms necessarily harmonious, or are conflicts between countries in South likely to continue to obstruct cooperative development? (3) What forms of technological development are appropriate to this strategy of Southern development? (4) What political consequences would ensue in the North?

SECTION 3 A MODEL OF TECHNOLOGY, TRADE AND INCOME DISTRIBUTION

Introduction

3.1 From the perspectives considered in the previous section, fundamental questions arise about the implications of the world market behaviour for income distributions within and between countries. For example, the Northern Liberal view (Perspective 1) and the New International Economic Order (Perspective 2) both emphasise the importance of expanded international trade between the North and the South in fostering world development but derive different prescriptions. These views also emphasise the importance of trade in raising the living standards of lower income groups through 'trickle down' and other transfers. Other perspectives dispute that perceived serious malfunctioning of world markets as they currently operate can be overcome or argue that the outcomes of the operation of the unregulated market itself are often detrimental to the interests of developing nations and to low income groups in the North and the South. These issues are fundamental to our study and we will argue below that they cannot be satisfactorily explored using current models. These either exclude entirely questions of income distribution within countries (and implicitly assume a continuation of present tendencies) or (as in the Bariloche model) assume a perfectly egalitarian distribution of basic consumption goods within each economic region. Further, current models in the main ignore the effects of the operation of domestic and international markets on distribution and provide only an oversimplified account of the role of technology. Models which do deal with questions of domestic income distribution do not simultaneously take account of the operation of the world market. A more detailed critique of selected national and global models is given below and summarised in Tables 3 and 4.

3.2 The remainder of this section will describe the specification, major analytic results, initial calibration of the model used in this study, as an attempt to overcome deficiencies in present models.

A Critique of Current Models

3.3 Existing global models used in present studies have a number of shortcomings for dealing with many of the above issues (see Appendices 5 and 6). In particular, the treatment of income distribution, technical change and social and political factors are considered inadequate. Even though they appear very detailed, existing models are in essence models of capital accumulation in which GDP growth rates are the product of investment and improvements through time in capital productivity. Similarly, levels of employment (and hence unemployment) are based on limiting assumptions about labour productivity, investment and population growth. The results of the models are very sensitive to both these assumptions.

3.4 Assumptions about trade and aid are somewhat less critical to the results but are nevertheless important components of the development strategies devised on the basis of the models results. The above assumptions limit the range of policies considered in those models. For instance, they bias the design of policies towards somewhat unrealistic optimistic levels of investment and rates of technical change, disregarding other important variables. But even if the targets set for the models could be met (e.g. a doubling of per capita income levels in the poorest countries by the year 2000) with reasonable assumptions about investment and technical change, without redistribution in these countries the living standards of the poorest would still be well below minimum needs. In fact, with the exception of the Latin American (Bariloche) model in which a perfectly egalitarian distribution of basic consumption goods is assumed, global models do not account for income redistribution.

3.5 Income distribution is not only to be considered for normative reasons, but also for better understanding of the economy. Through the operation of domestic and world markets and through many other social and political relationships between the different world actors there is a strong linking of income distribution with trade and growth. A model which does not include these factors can thus play only a limited role in the understanding and forecasting of major trends and planning for normative goals in the world economy, especially in a period of structural change.

3.6 In general, one must accept limitations in the construction of models appropriate to the study of the complex issues discussed here. However, certain characteristics of present models compound these problems. In particular, their high level of disaggregation leads to demands for data which cannot be realised and inflexibility of the relationships. All this adds to the unreliability of results.

3.7 For the majority of current global modelling studies, the level of aggregation is sufficiently high and, even if the results were reliable, it is not possible to draw detailed policy conclusions from the models at the level of existing administrative institutions. There are also many technical limitations in the model with regard to data and methods of calibration and projection. For instance, the data that is used is necessarily based on outdated national accounts and input-output tables, is quite unsatisfactory for the policy oriented objectives to the models. Often it appears that parametric fitting is designed to give "plausible" projections and that what is plausible is largely a function of the modellers' personal and ideological predispositions, although this is rarely stated. A clear underlying theory is usually absent from the studies and they often become exercises in mere projection. In view of the above, detailed quantitative projection over long time span is of doubtful value. Results are at best schematic or illustrative of possible tendencies.

3.8 All that is required is that the choice of aggregation should be such that the main qualitative results obtained should not differ if greater detail was added. More detailed phenomena have then to be deduced from an "enlightened interpretation" of the results of the aggregated model. Since a major criticism of existing large multisectoral models is that insufficient sensitivity testing is carried out and that the models inevitably contain somewhat arbitrary assumptions, it is important to show how the results depend on the assumed structure of the model and the relative magnitudes and details of the relationships. Apart from questions of clarity, in this sense therefore the advantage of retaining a simple model is that a relatively large number of scenarios and alternative assumptions may be tested.

Table 3 A Summary Comparison of Selected Single Region Models with Issues Dealt with in the Present Study

STUDY	FOCUS OF STUDY	ASSUMPTIONS ABOUT TECHNOLOGY	ASSUMPTIONS ABOUT TRADE	ASSUMPTIONS ABOUT DISTRIBUTION	ASSUMPTIONS ABOUT MARKET	NUMBER OF PRODUCTION SECTORS
Ahuwalia and Chenery (1974)	A simple growth model for a segmented economy to demonstrate distribution under technological and institutional dualism	Harrod-Domar or Leontief fixed coefficients assuming capital is always a constraint with no technical change	Not considered	3 income groups determined by ownership and physical assets and wage differentials	Prices and wages given exogenously with profits as residuals	4
Foxley (1975)	An optimising multi-sectoral model of the effects of redistribution on production and employment in Chile	Fixed coefficient with no technical change	Foreign sector treated through fixed input-output components	Only redistribution between 2 consumption classes and changes in employment levels considered	Prices, wages not considered. Rate of profit determined by technology	15
Adelman and Robinson (1973, 1976)	A non-linear dynamic macro-economic model of Korea to explore factors affecting income distribution in the short and medium term	Cobb-Douglas production function with capital-labour substitution. Experimental rates of technical change	Imports fixed exogenously and export targets set	15 consumer categories and 6 skill groups with 500 wage rates for firms and sectors	Prices and wages determined endogenously. Employment etc. determined through market via profit maximisation	29 (with 4 firm sizes)
Rodgers, Wery and Hopkins (1976)	A long-run simulation model (BACHUE) of employment and demographic factors in the Philippines with most economic variables exogenous, e.g. output, investment and trade	Fixed technology via input-output tables	Imports and exports given by input-output table subject to balance of payments constraints	Distribution between labour classes depends on employment characteristics of technology	Prices given exogenously with wages derived from separate labour markets for urban/rural and skilled/unskilled	(24)
Taylor and Lysy (1978)	A multi-sectoral general equilibrium model of Brazil	Constant elasticity of substitution production function for skill types and aggregate capital. Pure labour saving technical change	Trade levels given exogenously through input-output tables	6 skill categories and entrepreneurs income given by wage, profit rate and employment	Prices and wages determined endogenously. Fixed differentials between sectoral rates of profit	25

Table 4 A Summary Comparison of Selected Global Models with Issues Dealt with in the Present Study

Study	Relation of Social and Political Variables to the Model	Assumptions about Technology	Assumptions about Trade	Domestic Distribution	Number of Regions	Assumptions about Market Behaviour	Perspectives Generally Supported by the Study
Limits to Growth (System Dynamics) (Meadows 1972)	A 'holistic' approach with variables and sub models dealing with selected sociological phenomena	Based on historical US experience with anticipated future diminishing returns to investment	Not considered but implicit continuation of past trends	Not considered but implicit continuation of past trends	1	Prices increasing as resources become depleted. No other explicit market assumptions	World stagnation scenario
World Integrated Model (Heirarchical Systems Theory) (Mesarovic & Pestel 1974)	'Political' judgements are introduced as exogenous policy variables	Fixed capital-output ratios calibrated to give model internal consistency for base year	Exports and imports are a fixed share of total world trade per region	Not considered but implicit continuation of past trends	10	Constant prices supply and investment bound to available consumption	World stagnation scenario plus elements of Northern liberal and NIEO
Fundacion Bariloche (Herrera 1976)	A conceptual model describes social & political aspects of the society, whose physical viability is demonstrated by the mathematical model	Cobb Douglas production functions with exponential change parameters used to calibrate model over 1960-1970 period. Optimisation is used to allocate capital and labour inputs	Imports and exports are a fixed share of gross output	Egalitarian distribution of basic goods	4	Constant prices except for land	Collective self-reliance plus unequal exchange
UN Input Output (Carter 1976)	Almost no discussion of social and political factors, although it is claimed that the model can be used to analyse a wide range of scenarios	Technical coefficients assumed to depend on per capita regional income, largely based on US experiences	Exports fixed share of total world exports, imports a fixed proportion of regional consumption of the good imported	Not considered ,but implicit continuation of past trends	15	Prices of raw materials and pollution abatement increase with growth	Northern liberal plus Internationalist NIEO
RIO (Tinbergen 1976)	Mainly discussion of transnational political and economic institutions and desirable human goals	Qualitative sector by sector analysis of major transnational issues	Discussion of trade. Different strategies for different issues including international division of labour, cartel formation and collective self-reliance.	Need for more North South equalisation up to ½ of present inequalities, qualitative considerations only	Not applicable	Qualitative discussions only	Internationalist NIEO plus some aspects of collective self-reliance
The Great Debate (Freeman and Jahoda, 1978)	Analysis of economic development 'profiles' based on competing social theories. A construction of corresponding 'images of the future'	No macro economic parameters assumed. Specified industries and technologies considered in relation to economic profiles	Different assumptions for different scenarios	Alternative explanations of changes in domestic and international distribution hypothesised semi-quantitative considerations only	From 2 to 8 depending on issue	Critique of different assumptions and implications derived from them	Northern structuralist

The Modelling Approach for this Project

3.9 A central objective of the study is to develop a model useful for the study of income distribution within and between countries of the North and the South, as mediated through market behaviour and its effects. The model developed emphasises the importance of productivity and consumption in basic goods sectors (such as agricultural products) for production and distribution in the economy as a whole[1]. It is also directed towards the central questions of the role played by technology in the determination, through market operation, of income distribution within and between the countries of the North and South.

3.10 The specification of the North-South model used so far in the pilot phase of this study was given by Chichilnisky (see Appendices 1 and 7). It has two regions, each one produces and exchanges in domestic and international markets three types of goods: basic consumption goods, luxury goods and capital goods. There are two skill/income labour groups in each region which, together with non-wage earners, make up for three income groups. These income groups are differentiated not only by their earning patterns but also by their patterns of consumption of basic, luxury and capital goods. Further details of the model are given below and the equations are reported in Appendices 1 and 7. This model has been calibrated with Brazil and U.K. data representing the South and the North. The calibration and computer programme and basic runs are reported in Appendix 8.

3.11 While the model is crude in terms of detail, it is relatively sophisticated in terms of its theoretical content, which is important to the qualitative as well as quantitative behaviour we wish to analyse. Since we are primarily concerned to understand certain basic relationships between technology, trade and production and consumption, within the context of alternative paths of global development, we take a level of aggregation and an accompanying set of actors and variables that help our quantitative understanding while not hindering or obscuring our qualitative understanding. The model is used not so much to give quantified estimates, in the first instance, but to look for tendencies in variables under different sets of assumptions and to guide the analysis and further our understanding of detailed issues and policies[2].

1 The model is a natural outgrowth of previous work on the Latin American World Model of Fundacion Bariloche: Catastrophe or New Society?, IDRC, Ottawa 1976 and "Development Patterns and the International Order", Chichilnisky Journal of International Affairs, 1977

2 See Appendices 2 ... 7

3.12 One particular characteristic of our modelling work is that here sub-models are developed to study special issues. This is in contrast to the more general practice of developing submodels to deal with subsectors of the economy only. For instance, submodel I (described below) was developed to study North-South terms of trade and domestic distribution; submodel II was developed to study the possible effects of aid. The idea is always that, in order to study more pointedly a particular issue, it is useful to single out the main actors and relations which are in general only some of all those considered in the comprehensive model. In addition, a smaller model allows for better analytical study and facilitates interpretation of the numerical computer results of the larger model.

3.13 Other sub-models are being developed and are in different stages of completion and of integration with the North-South model for the study of other issues. Furthermore, in the future work these submodels and their results are being combined within the larger 5-region, 6 market Alternative Interdependence Model (AIM), which is at present being developed.

3.14 At present an exploratory submodel of transnational corporations behaviour and two models of technical change and innovation are in different stages of completion. They are referred to in detail in Section 4 of this report. Table 5 summarises the different modelling activities completed and in progress.

3.15 In constructing the present model and submodels we focus on the crucial variables in order to eliminate as much detail as possible from the model. In the pilot phase we have not attempted to produce a detailed model calibrated on precise data, but rather to select the economic variables considered to be important and to model, using available (or in some cases adequate "plausible") data, a caricature of the situation under consideration. The results so far are thus better suited to indicate possible inherent tendencies in a given economic arrangement than to offer detailed quantitative forecasts. However, since the larger existing world models offer little more, on balance this seemed a better strategy. In the future work, more detailed modelling (AIM) is envisaged, as described at the end of this section.

Table 5a A Summary of Completed Work

CHARACTERISTICS AND MAIN RESULTS / PRESENT MODELLING	Main Issues of Study	Number of Sectors	Number of Regions	Number of Income Groups	Basic Findings and Comments
NORTH-SOUTH MODEL (Appendices 1 & 7)	Background model for study of technology distribution and North-South relations	3: basic consumption and luxury and capital goods	2: North & South	3 in each region	Reported in Submodels I & II and dynamic runs below
SUBMODEL I (Appendix 9)	Terms of trade and domestic distribution	2: basic consumption and luxury/ investment	2: North & South	2 in each region	Conditions studied under which export led policies of the South worsen or improve North-South terms of trade and domestic income distribution in the South: abundant labour and dualism in production as special cases.
SUBMODEL I (Appendix 10)	Relations of growth of the North and of the South	2: as above	2: as above	2: as above	More growth of the North increases exports of the South but may under certain conditions worsen terms of trade and total revenues of the South as well as domestic income distribution of the South. In this case, for same growth the South must now produce more investment goods domestically.
SUBMODEL II (Appendix 11)	Effects of North-South aid in overall equalisation of welfare	2	2: as above	3: 2 income groups in North, 1 in South	Transfer of basic or luxury goods from the high income group of the North to the South is shown to improve the North's welfare and under certain conditions, worsen the South's unless it worsens the welfare of the poor in the North. Other economic actors: governments & an international organisation that effects transfers.
PRELIMINARY DYNAMIC RUNS (Appendices 8a, 8b, & 8c)	Effects of simultaneous changes in technology, investment, population & trade	3	2	3	Increasing labour productivity and population growth tend in general to reduce welfare; investment increases it. As in above models, trade may or may not increase welfare depending on economic conditions.

Table 5b A Summary of Ongoing Modelling Work

CHARACTERISTICS AND MAIN RESULTS / MODELLING	Main Issues of Study	Number of Sectors	Number of Regions	Number of Income Groups	Basic Findings and Comments
SUBMODEL III (Appendix 24)	Vintage capital and embodied technical change	1	1 or 2	1	Illustrates importance of relationship between productivity and investment, suggests possibility of unemployment arising from labour shedding induced by foreign competition.
SUBMODEL IV (Appendix 23)	Long-wave Kondratieff cycle	2: Traditional and new	1	1	Estimation of the proposed relationship between technical change and long-term cycles in unemployment.
SUBMODEL V (Appendix 25)	Transnational corportations and financial advantages	1	1	2	Conditions for increase or decrease of direct investment and share of returns of transnational corporations.
SUBMODEL VI (Appendix 26)	Product cycle	2	2	3	Not yet available. Other economic actors: governments and firms
ALTERNATIVE INTERDEPENDENCE MODEL (AIM)	General background model for future issues of interdependence and development alternatives	6: for international trade 3: for domestic	5	3 in each region	Not yet available. Other economic actors: governments and transnational corporations.

Modelling Work in the Pilot Phase

3.16 As noted above, the first task has been to specify and construct a basic North-South model which is to be a building block for the future modelling. This North-South model brings together certain major features we wish to explore, in particular a representation of global and domestic markets useful for our goals; it also permits certain technical matters of future model construction to be dealt with. As opposed to the general approach of the scenario analysis described in Section 2, the first work on modelling has concentrated on more specific issues. The North-South model described here, therefore, is a first simplified version of the 'alternative interdependence' model (AIM), to be used in the evaluation and development of the scenarios.

3.17 In addition to the existing model and submodels (described below and in later sections of the report) other submodels are under construction in preparation for the next phase of the study. We now summarise in turn:

i) the specification of the North-South model
ii) analytic results of submodels I and II
iii) initial calibrations and runs of the North-South model
iv) technical matters.

Although detailed correspondence between the model analysis and perspectives is not reported here, throughout the section the relevance of the preliminary work to the scenarios is explained. Even with the current structure of the model, the findings tend to lend support to one or another of the perspectives and scenarios considered here, depending on the types of economies the model is simplified or calibrated to at present; this flexibility of the model is important for the adequate interaction of the model with the scenarios.

The Main Features of the 'North-South' Model

3.18 In this model, described in Appendices 1 and 7, two regions or groups of countries (the 'North' and the 'South') are considered. These regions do not necessarily represent the whole of the developed world or the whole of the developing world. For example, depending on the parameter values (and the detailed form of the functional relationships) the two regions may

be taken to represent a chosen region of study and its economic trading environment. For many purposes this is the most appropriate way to examine the situation of individual economies in the context of our global scenarios.

3.19 Within each region we consider two groups of workers, respectively labelled 'skilled' and 'unskilled'. This distinction, which mostly separates high from low income workers, is introduced because the factor supply situation with respect to certain technologies and particularly in developing countries, is often marked by an abundance of unskilled labour and a shortage of skilled labour. This, of course, affects possibilities or both the creation and diffusion of certain technologies. In order to simplify the study of employment and macro-economic behaviour in the present model there is no substitution between skilled and unskilled labour (or with capital). In addition, in the model ownership of capital goods (wealth) is assumed to be unequally distributed between the skilled and unskilled group and rates of profits and wages are calculated separately. Thus, three income groups are implicitly considered according to ownership of the two skills and of capital goods.

3.20 The unskilled group receives lower incomes and it is their economic welfare which is the main indicator of whether the basic needs of a population as a whole are satisfied. Three types of good are produced as outputs in each region: basic goods, non-basic (or luxury goods) and capital goods. Basic goods, an adequate supply of which we assumed essential to the satisfaction of 'basic needs' comprise the bulk of the consumption basket of the unskilled group, even though they may not always coincide with those goods necessary for satisfaction of basic needs. Luxury goods form the larger part of the consumption of the skilled group. The demand or level of consumption of each group is subject to a budget constraint, for each good it is determined by their utility. In the aggregate each group spends on the three types of goods what it receives as wages and returns on capital use. The proportions of consumption on the three goods are adjusted to the relevant data according to income.

3.21 Production and trade takes place within and between the two economies in each of the three goods. A temporary equilibrium of the global economy is calculated by assuming that markets for labour and capital either clear or attempt to clear (i.e. supply and demand of eachtend to equalise), yielding in the process an endogenous determinatinn of world market prices, imports and exports, employment, wages, rates of profits and levels of consumption in each region. For dynamic versions of the model investment demand within each region links successive short-run equilibria through time. Other variables (e.g. the supply of labour) are simultaneously adjusted in these runs. A simple diagram of the model is given in Figure 14.

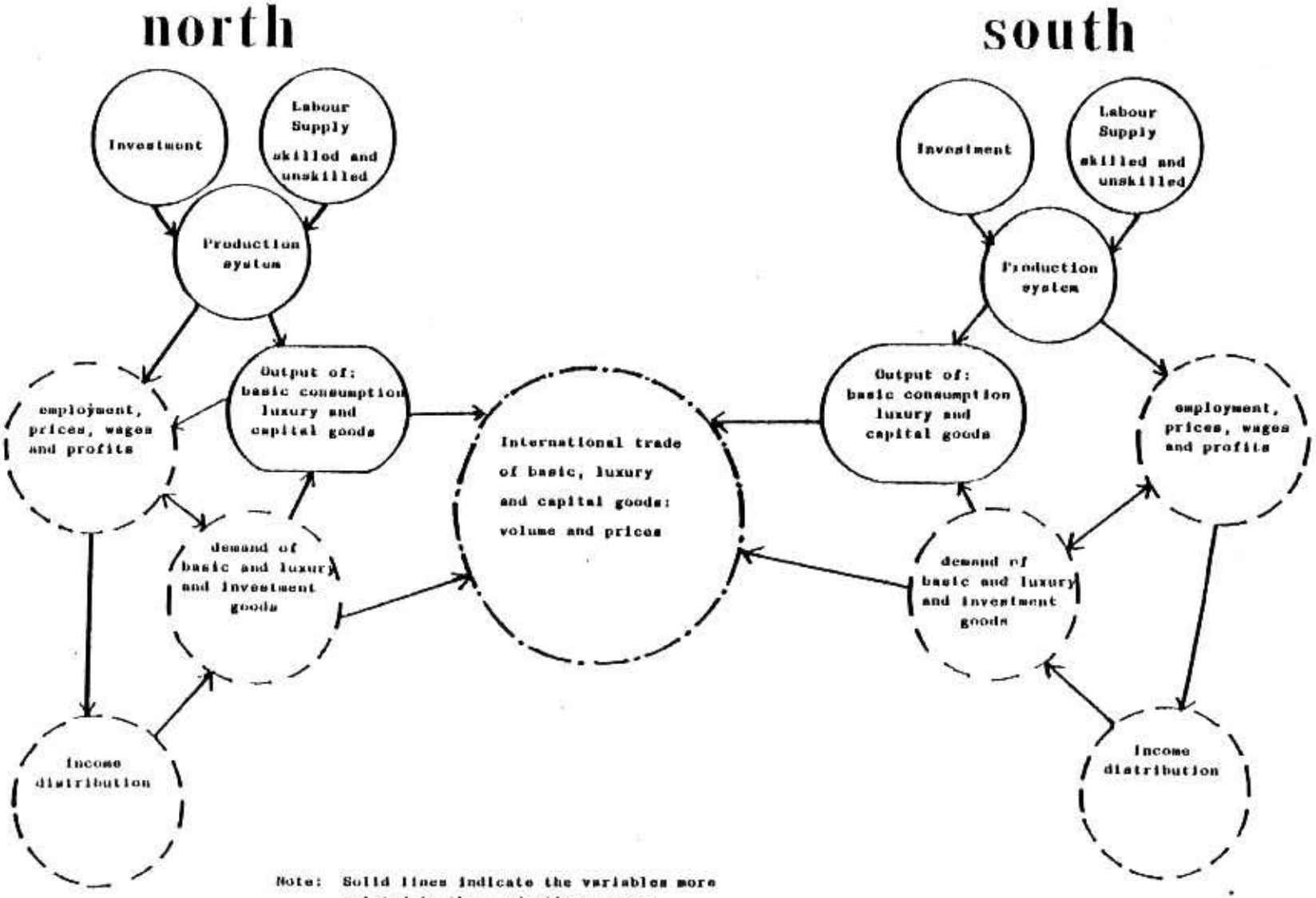
Some Results and Submodels of the North-South Model

3.22 For some purposes, in order to understand well the analytic behaviour of the basic model in a comparative static and dynamic framework, it is useful to simplify it further, focusing on some of the actors and relations. In particular, versions of the model considering only one skill type in each region and a single consumption good provide useful insights of the functioning of the North-South model as a whole. Therefore, in addition, two submodels of the North-South model called in the following submodel I and submodel II have been developed to assist in the analysis of specific issues and are reported here.

3.23 Submodel I differs from the North-South model, described above, in that it considers in each economy, one wage earning group, i.e.there are two income groups in each region, and two types of goods: basic and luxury/investment goods. In Appendix 9 (summarised below) submodel I is used to obtain analytical results on the relationship between North-South terms of trade and domestic income distribution. These results support the numerical results obtained on the basis of the North-South model with a calibration for the U.K. and Brazil[1]. In Appendix 10 submodel I is used to study relationships between the growth of the North and the growth of the South. Some preliminary results derived using a dynamic version of submodel I are also described in Appendix 8. These results are summarised below and in Table

1 See Appendices 7 and 8

north-south model



Note: Solid lines indicate the variables more related to the productive process

Broken lines indicate those variables more related to the socio-economic process

3.24 Submodel II was developed to study relationships between North-South transfers (or aid), terms of trade, and North-South welfare differentials. In Appendix 11 the analytical results obtained by use of this submodel are reported. Submodel II differs from the North-South model in that three income groups are considered: two in the North and one in the South. The transfers are assumed to be obtained from the resources of the high income group in the North. Also, as opposed to the North-South model, there are only two types of goods considered (basic, luxury investment) and it is a pure exchange model, (i.e. no production is considered). An extension of the results with production is underway.

Terms of Trade and Domestic Distribution: Export Led Growth with Abundant Labour (Submodel I)

3.25 Appendix 9 reports on applications of the model to relationships between international trade policies and domestic income distributions. The results of this paper are also of interest in terms of the debate among different perspectives described in Section 2. Since, while certain main assumptions of the model conform to neoclassical thinking, the results and findings conform more, instead, to ideas first introduced by dependencia theorists in the less formal development literature. This will be explained below.

3.26 The paper points out and analyses in some detail what characteristics of the North-South economies and of the policies involved may be crucial in determining whether or not export led growth may be benefical to a developing country. By studying in detail the effects of certain parameters such as labour supply, technologies and structure of demand our results allow for better case by case studies on the effects of particular policies. This is discussed in more detail below.

3.27 Submodel I is used here[1] in which the South trades with the North, - which has different technologies and elasticities of supply of factors. In Submodel I the computer results of the North-South model are studied analytically and qualitatively and also numerical results are obtained. (See also Table 6). Under the assumptions that the South has very abundant labour supply and significant dualism in the production of goods[2], if the economy of the South attempts to increase growth by increasing the exports of the basic consumption good (which is produced in a relatively labour intensive way) while maintaining the level of domestic investment demand, the domestic price of the exportable good will decrease with respect to that of the importable good, and the purchasing power of wages will also decrease. This effect is accentuated with increases in domestic investment demand for further growth (see Table 6).

3.28 We briefly summarise the rationale for this result. Under the conditions described in Appendix 9 the very high elasticity of labour supply and the differences in labour and capital intensities between sectors in the South give income effects an important role. Because of the high elasticity of labour supply and the labour intensity of the exported basic good in order to obtain an increase in the export level of the basic good (i.e. an excess domestic supply of basic goods) it is necessary to consider the effects of increased employment and accompanying increased demand for the good by the local population. In fact, if increased output and employment in the basic good brings about a significant increase in the

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[1] Submodel I is used here: a two region, two income, two good production exchange model as described in more detail in the Introduction to this section. Submodel I is basically a neoclassical two region/production exchange, temporary general equilibrium model except for two main characteristics, not usually considered in the neoclassical framework. One is significant dualism in the production techniques in the South (very labour intensive basic goods, respectively much more capital intensive capital goods). A second characteristic is the assumption about abundance of labour supply in the South. Both these characteristics of Southern economies reflect views of some of the dependencia theorists, such as Prebisch and, more generally, the early CEPAL perspectives as studied in Appendix 18. The second characteristic (abundant labour) is also related, for instance, to W.A. Lewis studies, done on a less formal basis, of the impact of abundance of labour supply on domestic and international proces. A main divergence with Lewis' analysis is that he considers infinitely elastic labour supply and a fixed minimum real wage, while we do consider a highly, but not infinitely, elastic labour supply and available real wages. This last feature is quite important in our model in order to compare different policies' effects on welfare and income distribution

[2] Here, dualism refers to very different techniques of production, not to other separations (in market or other terms) of economies into two parts.

domestic demand of the good, domestic excess supply of basic goods (the surplus available for export) may actually decrease.

3.29 This last effect obtains because if prices of basic goods increase, total domestic supply under the conditions respond "normally" by increasing. However, this is accompanied by a proportionally higher increase in domestic demand for basic goods due to significantly increased employment because of the labour intensity in the production to labour availability and the fact that wages are very close to the minimum subsistence level, so they cannot be substantially reduced. Since wage income tends to be spend in basic goods, this significantly increases the demand for these goods domestically. The net result is that exportable supply of basic goods is a decreasing function of their price. Therefore, it is only by curtailing domestic demand that exportable supply can be increased. If total exports of basic goods do increase in the new market equilibrium, the price of these goods will be necessarily lower than previously. Finally, since it is proven that wages and prices are positively related, as the price of the basic good decreases with respect to those of the investment goods, so do wages. In addition, the purchasing power of wages in terms of the basic good is also shown to decrease.

3.30 Another relevant result obtained in Appendix 10 using Submodel I was when it is assumed that the economy of the North has relatively homogenous technologies and relatively inelastic labour supply and that the economy of the South has the characteristics described above ; then if the South pursues an export led high growth policy, the terms of trade will deteriorate against the South and the purchasing power of wages within the South will also decrease. If the increase in exports by the South is due to an export subsidy policy, the the market in which this deterioration of the terms of trade takes place may also be a stable one (see Table 6)

3.31 In Appendix 10 we have extended the results, showing that they also apply to cases where the exports are the wage good, whose demand is derived only from wage income and that this is independent of the abundance of labour supply. Under these conditions it is proven that more exports of wage goods by the South both lower the price of wage goods, i.e. worsen the South's terms of trade with the North, and also worsen the income distribution of the South.

Table 6 Equilibrium Solutions of Submodel I showing a Worsening of Terms of Trade and of the Domestic Income Distribution in the South as Basic Goods Exports Increase

Market Equilibrium of the Basic Run

The North

Wages	Rates of Profit	Employment	Domestic Consumption of Basic Goods	Total Output of Basic Goods
16.88	0.08154	2.668	566	563

Total Output of Investment Goods	Imports of Basic Goods	Exports of Investment Goods	Price of Basic Goods	Revenues from Exports
1.788	3.034	.2881	0.0949	.2881

The South

Wages	Rates of Profit	Employment	Domestic Consumption of Basic Goods	Total Output of Basic Goods
2.31	0.04437	24.42	604.6	607.6

Total Output of Investment Goods	Exports of Basic Goods	Imports of Investment Goods	Price of Basic Goods	Revenues from Exports
.4619	3.035	.2881	0.0949	0.2870

World equilibrium price of basic goods in the basic run = 0.940

Market equilibrium of the run with increased investment in the North.

The North

Wages	Rates of Profit	Employment	Domestic Consumption of Basic Goods	Total Output of Basic Goods
13.62	0.08437	2.551	540.4	537.3

Total Output of Investment Goods	Imports of Basic Goods	Exports of Investment Goods	Price of Basic Goods	Revenues from Exports
2.256	3.19	.2557	0.0801	.2557

The South

Wages	Rates of Profit	Employment	Domestic Consumption of Basic Goods	Total Output of Basic Goods
1.936	0.05354	24.16	598	601

Total Output of Investment Goods	Exports of Basic Goods	Imports of Investment Goods	Price of Basic Goods	Revenues from Exports
.4943	3.193	.2557	0.0801	.2554

World equilibrium price of basic goods in the run with increased investment in the North = 0.801

Note: It should be noted that in the run with increased investment in the North (from 1.6 to 2.0), the North exports less investment goods (but at higher prices) and imports more basic goods (at lower prices). Domestic use and consumption of both goods in the North has increased. Not only prices of exports but also revenues from exports by the South have decreased. This means that less investment goods are delivered to the South. In addition, domestic consumption of basic goods in the South has decreased and income distribution in the South worsens. Finally, in order to keep previous levels of investment the South now needs to produce domestically more investment goods. This result may have relevance to some of the perspectives discussed in Section 2.

3.32 The results discussed above and the numerical results summarised in Table 6 pose doubts about the general reliance on export led growth to help bring about equal development in the South, especially when, as in Perspectives 1 and 4 in Section 2 , relative advantages are emphasised. It should be noted, however, that the results discussed here apply to certain economies and trade policies only. This is discussed in more detail in the conclusions to this section. The results lead to a need for careful appraisal of case by case studies about the advantages of increased trade, especially focused on the parameters studied here. If the general conditions in which the results of Appendix 10 are obtained are satisfied then increased trade (of basic goods exports by the South) is not favourable to NIEO goals. This may also be true if the South exports goods which are substitutes at the consumption or at the production levels, for basic consumption goods.

3.33 These results point in particular to the fact that growth of the South cannot be, in general, based on the cheap labour provided by extreme mass poverty. Such elastic labour supply will, in the long run, seriously deteriorate the terms of trade for the exported, even though in the short run total revenues for exports accruing to a small elite could be increased.

3.34 However, it should be noted that if there are better income distributions within the South that imply larger domestic markets, and if this is accompanied by lower rates of population growth (for instance through satisfaction of basic needs) then the results quoted above on deterioration of terms of trade may be reversed. This is, in a sense, the main point: the protection not only of local production (i.e. import substitution, infant industry) but also of local markets seems necessary in order to prevent deterioration of international terms of trade. This is a policy that has been followed successfully, for instance, by Japan.

3.35 In addition, the results point to a deep relationship between North-South terms of trade and distribution within the South: the North cannot evade certain amount of responsibility for Southern distributions. And, on the other hand, the South cannot separate its demands for better terms of trade with the North from the need to improve its domestic distributions.

Growth of the North and Growth of the South: Export Led Policies (Submodel I)

3.36 Two rather obvious questions were left unanswered in the previous analysis and we study them here. One is whether, even with worse terms of trade, the revenues of the South increase (or not) with increased exports. This question is of importance here because if, with increased exports, the South could obtain higher revenues than it did before from trade, when the savings propensities are sufficiently high, then the South's growth will have a net benefit from increased trade. This case will correspond to the point of view of perspectives 1 and 2, described in Section 2, that more trade can benefit the overall growth of the South if only domestic savings were sufficient, even when income distribution and terms of trade may deteriorate in this process. The second question is whether, or under what conditions, the growth of the North can be transmitted to the South, increasing the South's growth. This second question is related to the first. If more growth of the North is interpreted as more investment of the North, then the question becomes whether or under what conditions more investment in the North increases trade and revenues from trade by the South, and what effect this has on investment in the South for its further growth. In the following we shall summarise the findings with respect to the two questions just posed.

3.37 It is shown in Appendix 10 that more investment of the North increases exports (of the wage good) by the South. Prices of these exports, however, and total revenues from exports by the South (under the conditions studied here) both become lower. This effect on revenues results from the implied elasticity of supply of exportables by the South which derives from the demand and production conditions already described. While these international trade effects occur, domestic distribution of income in the South is shown to deteriorate. The analytic results which are confirmed by the computer runs, show the following final events taking place: the North increases its investment at the new equilibrium and also its domestic consumption of basic goods increases (these goods are now cheaper). The South's consumption of basic goods decreases as well as its total revenues from its increased exports of basic goods, so that imports of investment goods decreases. Therefore, in order to keep the same previous level of investment the South

must now produce domestically more investment goods than it did before. This result relates to elements of the Southern perspectives described earlier.

3.38 While the results are not universally valid, their degree of generality is such as to question the general applicability of the view that the growth of the North is necessarily beneficial to the growth of the South. The results again call for a case by case investigation, especially of these parameters seen here to be important for the outcomes before endorsing export led policies.

Aid, Terms of Trade and the New International Economic Order (Submodel II)

3.39 Appendix 11 focuses on the conditions under which more equal development is favoured by aid policies. Further, it explores the extent or the conditions under which New International Economic Order recommendations such as betterment of North-South terms of trade may be consistent with transfer policies. It is argued in this Appendix that in some cases the transfer targets from the North to the South sponsored by the New International Economic Order and Interventionist perspectives may be seen as historically unrealistic, even more so now in view of the problems facing the economies of the North. If the transfers were of the proportions they have been historically, their impact is, at best, not significant. However, the question arises: even if dramatically increased aid targets would be obtainable, would they be consistent overall with other goals advocated by the same above perspectives, such as equalisation of North-South welfare and improvement of North-South terms of trade? This latter point is of importance especially because these perspectives rely on trade for development of the South.

3.40 Using as a basis submodel II:(described in the introduction of this section) it is shown that,in general, aid and terms of trade policies may conflict. Aid may also turn out to help the giver more than it helps the receiver. The results are based on a study of the functioning of international and domestic markets in the form of significant real transfers of luxury or investment goods (or armaments) from the endowments of thehigh income groups in the North, to the South. This is shown, under certain conditions, to turn the terms of trade against the exportables of the South.

This deterioration of the South's terms of trade may be sufficiently high that, after the transfer takes place, the North is strictly better off, having somewhat less resources, but much more valuable in market terms, and therefore having more real wealth, and the South strictly worse off in terms of real wealth.[1,2]

3.41 In submodel II, used to study the effects of aid, the economy of the North is disaggregated into two income groups: the rich and the poor. In one case, we study a transfer of real resources, consisting of luxury or investment goods (or armaments) from the high income group in the North to the South. This would be a favourable equality-promoting transfer since it is the rich and not the poor in the North who are assumed to give from their initial resources. Nevertheless, if initially the low income group

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[1] Paradoxically, such possible perverse effects of transfer (the donor is strictly better off and the receiver worse off after the transfer) was first studied in a geometrical example by Leontief, who endorsed real transfers in his global model for the United Nations as a way of equalising North-South wealth. As discussed in Appendix 11 the issue of transfer-terms of trade was, however, studied by Leontief in the context of post-war reparations.

The 'orthodox transfer problem' studied, for instance by Samuelson, questioned whether the donor had or had not a so-called 'secondary burden' added to the loss of its initial endowments, in the form of deterioration of its terms of trade. This question was more meaningful in cases where the economies considered were 'equals', i.e. at similar levels of development. This case was important in the issue of post-war reparations. Because, with added initial resources, the receiving economy would be able to out-compete the donor, for instance to demand more of the goods that the donor's demand is mostly composed of raising the prices and thereby decreasing the purchasing power and real wealth of the donor. Whether the transfer problem disclosed or not a 'secondary burden' for the donor might have been important at the time to give less or more legitimacy to the moral imperative of post-war reparations.

However, the orthodox question may be reversed when 'unequal' economies are considered and this is discussed in Appendix 11. The issue is here whether the receiver may or may not suffer worsening of its terms of trade. By studying the transfer terms of trade question for the case of two regions at different levels of development in the transfer problem (and one with two income groups - the North) we examine is not an orthodox one of 'secondary burden' to the donor, but rather that of a 'primary burden' for the receiver.

[2] It should be noted that these results discussed here only apply at the global level, i.e., for transfers from the North to the South as a whole. The results do not study--and therefore do not necessarily apply to--transfers between any given pair of countries. They especially do not apply to the case where one of the countries is very small, when domestic markets are barely existent, or when the effect of the aid policy is not likely to be significant on domestic or international markets.

in the North and the South as a whole have very little endowments of those goods transferred, the terms of trade are proven here to turn against the South through the market mechanism so that (1) exports from the South increase, and prices for these exports decrease, (2) real consumption in the South decreases, and (3) real consumption in the North increases as a whole.

3.42 A second aid policy is considered using submodel II. The high income group in the North now transfers basic consumptinn goods to the South from its initial endowments. Under the same conditions as above the outcome through the market adjustments that follows the transfer is either (1) the real wealth of the South increases after the transfer of basic goods, but the real wealth of the poor in the North decreases and the welfare differential between poor and rich in the North increases, or else (2) the welfare of the South decreases after the transfer of basic goods, and the North-South welfare differentials increase.

3.43 Tbe results indicate that the goal of decreasing overall inequalities may not necessarily be generally ohtainable, or even consistent with, aid in the form of real transfers of either basic or non basic goods. In particular, this indicates there may be a contradiction between the interests of low income groups in the North and in the South, which runs counter to the Northern Collectivist perspective. The question then becomes: are these conditions under which aid would be helpful to decrease overall inequalities likely to exist or is it more likely that (1) either the existing conditions preclude the effective use of aid as a means of equalising incomes; (2) the existing political forces can always manipulate the relevant parameters to bring about the conditions that would turn aid to the advantage of the donor? These issues obviously require case by case study which focuses on the values of the parameters that are studied here, especially if it is desired to avoid negative outcomes. Furthermore, if those parameters' values are within the set that produce negative outcomes, part of an aid policy should be to attempt to change these parameters wherever possible. The findings of our study, however, point to a strong plausibility that in many cases questions (1) and (2) above do not generally have a favourable answer for the supporters of aid policy. This would also be consistent with Collective Self Reliance perspective and the findings of the Bariloche study, which did not, however, consider market behaviour at all. In the conclusion of this section we elaborate more on this point.

Preliminary Runs of Dynamic Version of the North-South Model

3.44 Appendix 8 explores dynamic versions of the North-South model. Analysis of trade in the dynamic model is presently in a very primitive state, but the findings can be compared with the comparative static analysis. One of the runs described here is based on a calibration which does not satisfy the relevant conditions for terms of trade reversal, studied above, and does not give rise to those previously discussed results on worsening terms of trade for the South with respect to export led policies, which were obtained in a comparative static analysis . In the dynamic model many parameters which are assumed to be exogenous to the temporary equilibrium model are changed simultaneously (i.e. population, capital and labour output ratios investment and consumption preferences).

3.45 Again, the model represents two interacting regional economies engaged in domestic and international price equalising trade; the first is an industrialised Northern economy exporting investment goods, the second is a 'dual' Southern economy exporting basic labour intensive goods and importing the bulk of the domestically employed investment goods. Rates of investment (as a fraction of domestic product) in the North are higher than in the South. Population growth in the South is greater than that of the North and the pace of labour displacing technical change is higher in the North. In this situation there is growth of real wages in both the North and the South, but this growth is much higher in the North. In addition it is shown in the runs of Appendix 8 that there is a strong tendency for the capital sector in the Southern economy to decline and for the South to become dependent on the North for capital goods requirements.

3.46 Effects of a far more intensive investment strategy in the South with a much higher rate of technical change are also explored. With uniform technical change in basic and non-basic sectors, the collapse of the manufacturing sector is avoided in the South although there is little growth in the South. If instead the increased investment and technical change are concentrated in that sector (implying a neglect of the rural sector) significant growth in the manufacturing sector and a far less dependent growth pattern emerges. Clearly these studies need to be taken further, but it is evident that each carries with it relevance for questions of both income distribution and dependence. Since many of the results of these runs were not studied analytically so far, the findings call for further formalisation and study.

Initial Calibrations of the North-South Model

3.47 Appendix 8 reports on preliminary calibrations of the model using data for the U.K. and Brazil. The purpose of the calibration was to achieve an approximate model of real economies in order to test estimation and convergence procedures. For a number of reasons - the data sets are drawn for different periods, Brazil and the U.K. are not exclusive trading partners and the overall size of the two economic systems has been adjusted to our purposes - the model should not be thought of as actually representing either Brazil or the U.K. The data sets used in Appendix 8 are intended simply to be representative of countries in the North and the South. The allocation of skill types and the aggregation for the basic, non-basic and capital sectors is illustrated in Table 7. The economy of the South is less capital intensive than the North, has a relatively low ratio of skilled to unskilled workers and a more elastic relative supply of the latter. The ratio of the wage incomes of the skilled groups is approximately 20 in the South and 4 in the North, with the wage of the low income group in the North 9 times that of the South. The ratio of skilled to unskilled employment is a factor of 2 in the North but 1/40 in the South. Production in the North is mainly of non-basic goods, accounting for 3/5 of the total; the remaining total split equally between basic and investment goods. In the South, production of investment goods is well below that of basic and non-basic goods. The rate of profit is about 9% in the North and 13% in the South. This forms an initial description of the representative economies which conforms to the overall characteristics of the North and the South. The parameters used in the model are given in Table 8.

3.48 Appendix 8 also reports on experiments carried out with linked and unlinked versions of this and similar calibrations of the model. In some cases algebraic solutions of the full North-South model are found with relatively few approximations than for the simple two sector model described above. So far, however, a tractible general algebraic solution to the model has not been found, and the model has been programmed in such a way as to permit a simple solution by an iterative procedure.

Table 7

Example of Brazil Data

Allocation of High and Low Income Groups and Basic Needs Goods

Sector	Proprietors		Family Farm Workers		Sharecroppers		Uneducated Workers		Primary Educated Workers		Middle Educated Workers		Superior Educated Workers		Employers
	Number	Payment	Number	Wage	Number	Wage	Number	Wage	Number	Wage	Number	Wage	Number	Wage	20,090
1. Agri. veget.	419,220	0.31159	311,029	0.0979	61,600	0.2349	314,111	0.2055	15,093	0.4110	-				
2. Agri. animal	141,540	0.31153	60,000	0.0979	20,000	0.2349	35,589	0.2055	5,000	0.4110	-	-	-	-	
3. Commerce	116,000	0.71043	-	-	-	-	68,000	0.2955	82,560	0.5919	19,730	1.4774	850	5.0000	
4. Electricity	-	-	-	-	-	-	3,017	0.2294	2,953	0.5535	424	1.6470	26	5.5003	
5. Services	112,500	0.39540	-	-	-	-	131,350	0.1359	49,950	0.3719	3,515	0.9294	165	6.0500	
6. Mining	147	5.90307	-	-	-	-	3,701	0.6974	625	1.3257	18	3.5134	1	7.9165	8,720
7. Nonmet. min.	1,550	2.43911	-	-	-	-	12,551	0.3623	2,125	1.1063	139	2.9375	3	5.2336	
8. Metallurgy	256	5.89733	-	-	-	-	8,619	0.6342	7,852	1.2055	506	3.1994	135	6.2645	
9. Mach. tools	93	8.80133	-	-	-	-	2,397	0.6459	3,377	1.2334	360	3.2735	6	3.8845	
10. Elec. goods	32	12.61958	-	-	-	-	1,730	0.5437	3,399	1.0336	678	2.7431	23	5.2761	
11. Tran. goods	141	4.30795	-	-	-	-	3,133	0.6953	4,431	1.3217	472	3.5978	11	5.5846	
12. Wood & furn.	1,610	3.40354	-	-	-	-	8,700	0.3126	4,636	0.9740	131	2.5841	3	4.4050	
13. Paper	26	18.11914	-	-	-	-	2,617	0.6485	1,384	1.2327	55	3.2716	1	5.4234	
14. Rubber	10	29.68333	-	-	-	-	748	0.6136	1,164	1.1753	135	3.1206	10	5.0543	
15. Leather	209	4.01795	-	-	-	-	1,583	0.5574	635	1.0595	45	2.8119	1	4.0494	
16. Chemicals	186	10.14329	-	-	-	-	4,547	0.5795	7,074	1.1030	947	2.9365	63	4.5129	
17. Textiles	244	19.65780	-	-	-	-	20,914	0.5140	11,335	0.9770	280	2.5929	7	4.1408	
18. Clothing	611	6.11452	-	-	-	-	4,972	0.4591	3,959	0.8708	246	2.3111	2	4.2200	
19. Food	2,524	4.94336	-	-	-	-	16,071	0.5705	7,556	0.9595	355	2.6262	5	4.0959	
20. Beverages	239	3.74504	-	-	-	-	2,785	0.6719	1,307	1.2772	61	3.3495	1	3.8106	
21. Tobacco	17	8.85793	-	-	-	-	871	0.6252	410	1.1944	19	3.1541	1	3.9309	
22. Publishing	153	7.70502	-	-	-	-	1,268	0.4859	3,868	0.9236	591	2.4513	22	6.7411	
23. Miscellany	143	6.08576	-	-	-	-	1,496	0.5025	1,915	0.9555	232	2.5359	8	3.5771	
24. Construction	3,500	5.00000	-	-	-	-	54,166	0.2519	22,765	0.5939	1,335	1.5115	216	4.0010	
25. Trans. services	-	-	-	-	-	-	111,000	0.2600	30,100	0.4032	500	0.8047	-	-	
26. Government	-	-	-	-	-	-	50,325	0.2193	24,565	0.4390	31,533	1.0970	4,652	5.0010	

low income group

high income group

Table 8 Initial Parameter Values in the U.K./Brazil Calibration of the North-South Model

Technical Coefficients	"North"	"South"
Unskilled labour by sector:		
basic	0.185	12.38
non-basic	0.306	15.27
capital	0.185	15.69
Skilled labour by sector:		
basic	0.448	.237
non-basic	0.459	.439
capital	0.448	.303
Capital by sector:		
basic	3.025	2.292
non-basic	3.448	1.134
capital	5.445	2.984
Labour supply parameters		
unskilled	23872	647442
skilled	13039	750
Utility-demand parameters		
low income	3,0	1.68
high income	0.5	1.93
Capital owned		
low income	13450	268
high income	121050	2685
Investment		
low income	802	26
high income	7215	258

TABLE 9 Percentage change of different variables over 15 years for three runs of single-region North and South models

Percentage change in:	NORTH				
	rate of profit	unskilled employment	unskilled wages	'Basic good' consumption by unskilled	GNP
Labour productivity of both groups increasing at 2% p.a., no population growth or trade	45.7	2.9	1.8	32.1	36.8
Labour productivity of both groups increasing at 2% p.a., population increasing at 2% p.a., no trade	70.7	3.0	-22.6	30.8	38.3
labour productivity of both groups increasing at 2% p.a., trade increasing at 5% p.a., no population growth	45.5	2.2	1.7	32.0	36.8

Percentage change of different variables over 15 years for three runs of single-region North and South models

Percentage change in:	SOUTH				
	rate of profit	unskilled employment	unskilled wages	'Basic good' consumption by unskilled	GNP
Labour productivity of both groups increasing at 2% p.a., no population growth or trade	-18.5	38.7	37.0	91.4	80.5
Labour productivity of both groups increasing at 2% p.a., population increasing at 2% p.a., no trade	55.2	44.8	15.2	64.5	108.1
Labour productivity of both groups increasing at 2% p.a., trade increasing at 5% p.a., no population growth	-12.4	35.3	34.5	83.0	78.1

Qualitative Effects in Preliminary Runs of the North-South Model

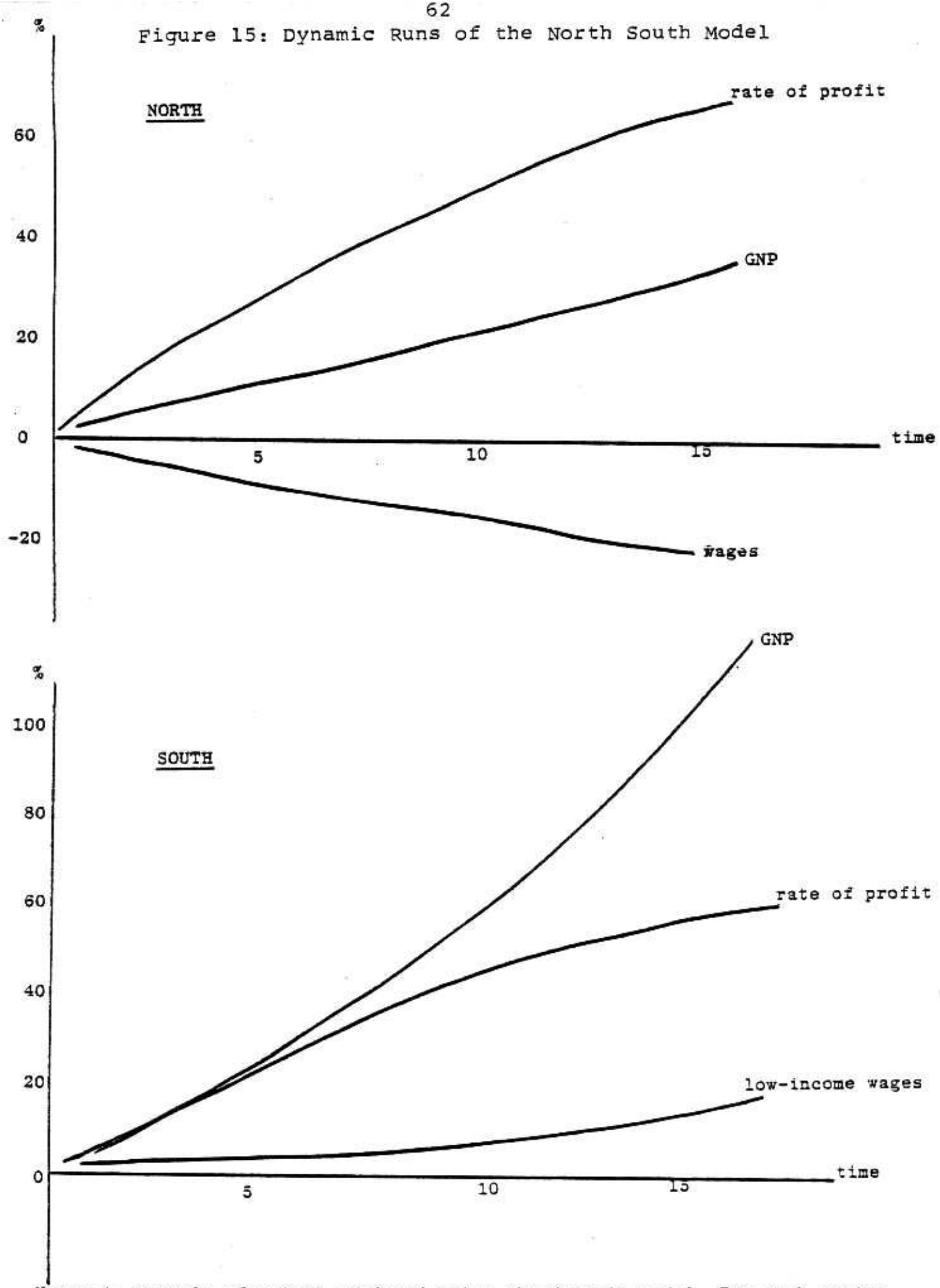
3.49 Appendix 8 studies a number of qualitative effects which are suggested by the North-South model as applying to both regions when they are experimented with separately (i.e. the prices calculated are domestic prices and levels of trade are given exogenously). Such runs of the model with isolated regions eventually may be relevant in particular to the discussion of more self reliant scenarios and scenarios in which the international market is strictly regulated.

(a) Static analysis of decoupled calibrated models: the following are qualitative effects derived from the runs on the North-South model, some of which were also algebraically analysed. As it is to be expected from the structure of the model in a temporary equilibrium analysis, a straightforward increase in the productivity of both types of labour in all sectors has the effect of reducing wages and employment and increasing the rate of profit. Income differentials are, therefore, reduced if the higher income group becomes relatively more productivity. Increases in capital stock in use raises wages and consumption. The effects of changing labour productivity come from the assumption (in the model) that capital stock is given exogenously; this forms a constraint on output, and hence if labour productivity is increased, employment, and hence wages, are necessarily reduced relative to prices and profits increase. The explanation of population growth is similar. Despite qualitative similarities between the experiments with the two regions, the quantitative effects of given changes are very different. For example, in the South an increase in unskilled worker productivity dramatically increases profits while significantly reducing employment and basic good production; in the North a similar increase in productivity is accompanied by a much smaller increase in profit and very little change in production levels. Because per capita ownership of capital by the low income group is very low in the South, the decrease in the wage/profit ratio causes the members of this group to suffer a substantial overall loss of income and hence demand for basic goods falls off considerably. Dynamic runs with the single region models are sensitive to the form of investment function employed, in particular, whether investment is assumed to be simply a function of national product or rates of investment.

(b)Dynamic analysis: a dynamic form of the calibrated North-South models can be used to examine the relative effects of the counteracting influences of technical change, capital accumulation and population growth. Investment in each time step augments the capital stock available in the next, while productivity and population are subject to exogenous rates of change.[1] Figure 15 and Table 9 show some results obtained from decoupled North and South models; details of the investment function used are given in Appendix 8. Similar trends in investment behaviour and technical change are used here purely for purposes of illustration of the different effects of such trends suggested by the model when calibrated to represent regions with different economic structures. An assumption of lower investment and higher population growth in the South, for example, would lead to a lower rate of increase (or decline) in wages. As can be seen from Table 9 and Figure 15 the response of the two economies to the exogenous specification of plausibile levels of trade is very different (see Appendix 8). In these runs, calibration does not satisfy the specifications of a reversal of the South's terms of trade and domestic distribution. The static effect of increased trade for the South (not shown in the Table) is to reduce income differentials; consumption of unskilled labour rises while that of skilled workers falls and the rate of profit declines. However, when the two calibrated models of the North and South economies are linked under the assumption of price equalising trade, comparative static analysis of the temporary equilibria confirm the findings of terms of trade reversal for the export good of the South in the face of increased investment in the North, described above, and studied in Appendices 10 and 9. In some dynamic experiments terms of trade fluctuate, sometimes improving, sometimes deteriorating. Thus, dynamic factors may have a strong influence on the terms of trade.

3.50 Other results are described in Appendix 8. The results obtained depend not only on the data used but also on the form of the relationships assumed. In the light of these findings, a more systematic analysis of the scenarios using data representative of other economic 'types' in the North and South and also analytical study of the combined action of different parameters on the dynamic results is called for.

Figure 15: Dynamic Runs of the North South Model



Note: An example of output produced using the dynamic model. For each region productivity of both types of labour and total population is increasing at 2% per annum. Trade is exogenously set to zero. The vertical axes show the percentage changes in the variables over time from their initial values.

Technical Matters: Data, Calibration and the Convergence Algorithms

3.51 There are several technical points of model construction dealt with at length in the appendices. They are in themselves a time consuming and important, if many times tedious, part of any modelling study. The results described above were all derived using fairly readily available data and some straightforward and other more novel methods of computation recently developed.

3.52 For the future work programme, more systematic data and more automatic techniques of calibration are required. In Appendix 12 the role of accounting frameworks and in particular the social accounting matrix as a unifying concept in modelling exercises is discussed. It is argued that to regard such frameworks as simply presentational devices is to miss the point that the choice of an appropriate form for the mathematical representation of a theoretical model has often played a crucial part in the latter use or non-use of many such models. The integration of input-output data into the North-South model is summarised in Appendix 13. The construction of statistical data frameworks for empirical explorations of short term economic development problems based on the social accounting matrix for a number of developing countries have hopeful implications for those attempting to consider the long term situation of these countries. Moreover the underlying philosophy of this work as defined by the authors seems to contain elements which could be useful in developing a rationale for future modelling in general.

3.53 In principle, most data on world trade flows, input-output coefficients, prices, wages, elasticity of labour supply etc. can be obtained from the major statistical publications of national and international organisations and academic journals, although in some cases as in most existing modelling work, data must be of a surrogate nature. However, it is unlikely that a set of data collected by a variety of institutions for many different purposes (and by implication on the basis of different theories and with different definitions and categories) will fit exactly our model or variants of it. Even if this were not the situation, data are subject to measurement

error and sampling fluctuations while the model itself is necessarily a simplified representation. The problem of calibrating the model is discussed in Appendices 8 and 14.

3.54 At the present stage of the work a tâtonnement is employed. The question of speed of convergence to the equilibrium solutions is important to both calibration of and experimentation with the model (see Appendices 8 and 15). The most straightforward method for obtaining solutions is through computing an exact algebraic form, but in general this is too difficult. Further, although calculation of equilibria by the most straightforward iterative procedures is possible for the simplified versions of the model, in general, it is unsuitable for the larger models. In the present model the Walrasian algorithm is employed. In addition to the Walrasian algorithm, other methods have been explored. The results of Appendix 15 show the Walrasian algorithm to be quite stable with little variation in computing time or number of iterations required, although final accuracy may be limited. The Walrasian algorithm also proves to be more efficient than the 'simple' Hirsch-Smale for our model. With other algorithms accuracy is higher but stability is sacrificed.

Modelling Work in Preparation

3.55 The programme of work for the future modelling activities centres on the following activities:

(i) the construction or refinement of submodels and details of the macro-model;

(ii) linking the model and scenarios to micro-economic studies;

(iii) detailed data analysis of specific sectoral or national situations;

(iv) the building of the Alternative Interdependence Model (AIM) and the integration of model components;

(v) linking of the model projections and the scenarios.

3.56 Much of the work described previously is in a tentative or preliminary stage; for example, the submodels of technical change and the transnational sector. More detailed modelling of these sectors is contemplated. There will be some emphasis on the study of the behaviour of the transnational

sector and the interaction between international transfers and technological development. In addition, in the experimental models variables such as population growth and migration are included as simple exogenous functions and require a more sophisticated treatment. Variables representing direct governmental action with regard to domestic redistribution (e.g. taxation or subsidies), or international policy (e.g. tariffs and quotas) have yet to be included formally in the model. In many cases, these factors can be included in a relatively straightforward fashion.

(a) Submodelling Studies

3.57 In the first instance, as in the examples given earlier, the idea was to develop models which capture the essence of given scenarios and which highlight the significant assumptions. Because it is believed that different policies and packages of policies have relevance in different historical, economic, and social contexts, one device used here will be to calibrate sets of single economy and multiple economy models (based on the North-South model) described earlier for those issues in which the North-South dichotomy is most adequate. These archetypical models will characterise selected economic situations in order to explore, for example, major differences in the interaction of income distribution and consumption in different national types in the context of contrasting global scenarios. It is important to understand the difference between developing economies such as, say, Brazil and Sri Lanka, with attitudes to the role of international capital and domestic distribution, or between countries currently basing growth on the export of raw materials (Bolivia, Chile) or manufacturers (Taiwan) or agricultural goods (Equador, Panama). Similarly, the situation of export surplus and deficit industrial countries (e.g. Germany versus the United Kingdom) and relatively resource rich and poor countries (the United States, Europe). Therefore, for those issues where such differences within the South or the North are of importance the AIM will be used to study them, this permits the consideration of (at most) five regions. The interactions between these groups of countries including those within the South and within the North have to be examined. In several of the perspectives considered the relationship between countries in the North and the South historically has been a function of the relationship between the countries of the North and, in some scenarios proposed for the future, linking of the countries of the South is a crucial element.

As noted earlier, one aim of the analysis of global perspectives is to criticise the relevance of the various theoretical positions to national and social conditions and evaluate their proposed policies. In addition to the illustrative models described above, parallel efforts in more detailed multi-sectoral national studies and the bringing together of submodels within an integrated global modelling framework will be undertaken. The purposes of both these models is to permit more comprehensive national and international packages of policies to be explored.

(b) The Alternative Interdependence Model (AIM)

3.58 This model is being constructed as a development and trade model consisting of up to five regions, trading with each other in up to six markets: foodstuffs, raw materials, energy, manufactures, capital goods and armaments. In each region, five major economic agents (or actors) will be considered. There will be three income groups, identified as in the North-South model by their ownership of skilled or unskilled labour, and of capital on the one hand and, on the other, by their patterns of consumption of three groups of goods: basic consumption goods, luxury goods and capital goods. The two other actors in each region are government and transnational corporations. For international trade, AIM has a structure of a dynamic-general equlibrium market model with imperfections and constraints (to include quotas, tariffs, foreign exchange and balance of payments constraints). Domestically, the action of the large actors, government and transnational corporations, alters the production-exchange market structure of the North-South model. One type of government behaviour to be modelled is Keynesian, which necessitates (at least for the short run) the introduction of a monetary sector in the regional economies that was not contained in the North-South model. The behaviour of government is not to be completely specified in the general version of AIM, so that, for instance, for different issues, different types of government behaviour can be simulated. Analogous considerations hold for a large agent, the transnational corporation .

3.59 As in the case of the North-South model, each issue will be proposed and studied in relation to specific scenarios. The socio-political scenario analysis will then call for a set of actors and relations most relevant to the issue. These will be, in general, a sub-set of all actors and relations

in AIM. Therefore, for the study of each issue a submodel of AIM will be constructed (as focused as possible) as was done for the North-South model with Submodels I and II. For example, in contrast to other modelling studies the regions are to be calibrated to data according to the needs of the scenarios representing, for instance, different coalitions of countries across continents.

3.60 More disaggregated national modelling efforts will be based on input-output analysis referred to above[1] and also coordinated with the work of the ILO. To some extent the ILO work will reflect the distinctive approach and objectives of the ILO, although the overlap is sufficiently high that considerable advantages are to be gained from collaboration. The experience of the ILO personnel involved with certain specific national models including knowledge of available statistics and local conditions is invaluable. A similar form of collaboration is under discussion with CEPAL.

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1 See Appendices 12 and 13.

SECTION 4 WAYS OF LIFE AND TECHNICAL CHANGE - ISSUES AND SUBMODELS

4.1 This section describes preliminary qualitative and quantitative studies of aspects of issues which have in part arisen from the discussion of perspectives in Section 2. The purpose of this section is to indicate work which will lead to a detailed critique of the perspectives described earlier and serve as an imput for our own scenarios and modelling work. The issues focused on here are central to our normative concerns, in particular improvements in the economic and social well being of low income groups in developed and developing societies. For convenience, we group them under the following headings:

(i) Ways of Life

(ii) Technical Change and Investment

In these studies we attempt to demonstrate the alternatives and constraints within each scenario on the prescriptions provided by the different perspectives and begin to identify the policies which in our opinion would foster our objectives.

4.2 The studies described here employ a combination of techniques. Wherever possible it is our intention to identify the quantitative impact on the parameters and variables of the macroeconomic model of the phenomena we describe. In some cases this is done through the formulation of an appropriate submodel. For example, in the following, preliminary attempts to construct submodels of technical change and international investment transfers are described. In others a less formal approach to the integration of scenario and findings is adopted. This will subsequently be incorporated in an endogenous or exogenous manner into the structure of the AIM model.

4.3 The analysis below again adopts the approach of contrasting different perspectives and here we emphasise the point of clarification made in Section 2 about the use of different perspectives. Thus, in preparation for our analysis of the Southern focused 'dependencia' scenarios three alternatives are considered. In the background study of choice of technique, a further distinction is made between deterministic theories of technical change and 'social construct' approaches - subscribed to in the present study - in which some margin for social choice is accepted.

WAYS OF LIFE

4.4 There are a number of issues which concern the evaluations of the North-South scenarios which, broadly speaking, fall under a heading "ways of life". These deal with questions arising from contrasting theories of the evolution of patterns of consumption of goods and services in North and South countries, of education and the acquisition of technical skills and of social attitudes and the cultural determinants of life-styles. Several papers prepared for the project deal with these issues separately for countries of the North and South, although the emphasis is not the same in each.

Scenarios of Northern Development

4.5 'Post Industrial' Economic Alternatives. Underlying all modelling studies and the perspectives considered earlier are crucial assumptions about the direction of present social and economic trends. In particular, possibilities with regard to future patterns of consumption and social organisation in the Northern economies are examined. The traditional theory of economic development embodied in several of the perspectives above suggests that as societies develop there emerges a 'post industrial' society, with the focus of economic activity on the provision and consumption of services. This is of importance for the quantified results of modelling exercises which depend strongly on these assumptions. Appendices 16 and 17 provide a strong critique of some of the extrapolative assumptions underlying trends postulated by some perspectives (e.g. 'post industrial' societies, described below), and attempt to identify the social and economic constraints for achieving more equitable patterns of living in the Northern industrial societies. These may be explored in a more formal way using versions of the North-South and AIM model.

4.6 In Appendix 16 analysis for the North is focused on the determinants of styles of living, work and leisure in late industrial and post industrial societies (based largely on European data but including other OECD countries) exploring in particular possible future relationships between the formal sectors of the economy (e.g. markets) and the informal sector (e.g. households and other non-market activities) from the point of view of the pro-

duction possibilities of significant types of good and the preferences for different activities of different social groups. With respect to the goals of social equality, these issues are, for example, very relevant to the situation of women in 'post industrial'societies.

4.7 Appendix 16 provides the following critique. In the intermediate service sector, technical advances (as elsewhere) increasingly promote dramatic increases in labour productivity (e.g. routine and repetitive technical and clerical jobs are progressively replaced by machines). These are unlikely to be compensated for by the increased demand for skilled labour generated by the process of automation. Employment in final services may also be restricted as in developed countries these may become increasingly 'extra-economic' (i.e. jobs in service industries may be replaced by activities undertaken within households or by other sorts of voluntary associations outside the money economy). As the data of Appendix 16 shows this process has already been seen over recent decades in a number of service industries.

4.8 An economic explanation of this is that as people pass from subsistence to luxury consumption the demand for intangible service products rises, pushing upwards the wages of highly skilled service workers. At the same time, capital investment, technical advance and organisational rationalisation make consumer goods even cheaper, and increasingly sophisticated design makes their use easier, and improves the quality of their output. It thus becomes a matter of rational choice to move from the purchase of finished final services to the purchase of consumer goods - in effect capital items - which are used by the final consumers to produce their own services, using their own labour. Furthermore, although collectively provided consumer services may have grown in the developed world over recent decades - most notably education, medicine and welfare services and provided increased employment - technological advances now enable processes of substitution analogous to those previously found in housework, transport and entertainment. As a result, the increases in employment in the service sector which are a basic tenet for the equalising tendencies within post industrial societies argued in some perspectives, may not be realised. In fact, employment in services may actually reduce.

4.9 Three distinct scenarios (to be compared with those implied by the perspectives described earlier) emerge from the analysis of Appendix 16 and summarised here.

(a) A Northern 'Dual' Economy In this view there would be, on one hand, a 'formal economy', largely based on the production of material goods, increasingly capital intensive and maintaining high levels of increase of labour productivity - and with a decreasing number of jobs, which would themselves be increasingly demanding of technical skills. On the other hand there would be an 'informal economy', centred on the household as a productive unit, using unpaid and relatively unskilled labour, together with an increasing quantity of 'domestic capital', in the production of final services. This 'dual' or 'self service' economy follows from the foregoing arguments, but it is not the only, or even the most likely of scenarios: there are two other candidates.

(b) The 'Hidden' Economy The second alternative involves the development of a 'subterranean' or 'hidden' economy, parallel to the formal economic system. This hidden economy consists of people producing goods and services, working for money, but concealing their activities from tax authorities and trade unions. They are paid low wages, and their employers have relatively low overheads; so the economic advantages of the'self service' economy are undercut by very low labour costs. The central authorities of the state recognise the existence of this economy but, for reasons of expediency, take no action to curb it. The outlines of such an economy are already visible in many developed countries; where the alternative is unemployment, many people are willing to accept low paid, extra-level jobs.

(c) The 'Enforced' Economy The third alternative is almost the converse of the second. In this the state takes vigorous action to curb the 'hidden' economy. At the same time it enforces increasing tax levels in order to pay for employment in service industries which are often undesired by their consumers. In order to enforce these activities the state becomes increasingly 'strong' - the bureaucracy, and particularly law enforcement agencies, become the dominant arms of government. These developments might be accepted by the mass of the population, simply because they enable full employment and economic stability - although at a relatively stagnant level of economic activity.

4.10 These scenarios will be evaluated in greater detail in the next phase of the project. Appendix 16 describes an accounting framework using historical data for the U.K. This model will be used to provide alternative estimates of the parameters in the model representing consumption patterns in the North.

4.11 'Post Industrial' Social Behaviour and Culture Underlying each of the perspectives considered earlier and postulated scenarios above are assumptions about trends in social behaviour and attitudes towards the social and economic environment in Northern cultures. The economic and political pressures associated with world recession and the changing balance of world power may increasingly threaten many of the assumptions underlying several of the perspectives considered. In some cases, the economic crisis has simply brought to the fore underlying problems within particular institutions which were previously concealed during the period of expansion of state expenditure during the post-war boom. In other cases, other tendencies have been set in motion. Social and economic forces are at work which may induce major changes in central social institutions. Appendix 17 explores trends in styles of life,marriage, sub-cultures, crime, job alienation, social participation and analyses various tendencies and possibilities for the future. At present, this study is based largely on U.K. data but later will be extended to take account of parallel work in other industrialised countries.

4.12 As Appendix 17 shows, the approaches already taken to the creation of alternative ways of life by different groups and individuals cover a wide spectrum. In some cases attempts are being made to establish alternative ways of life (as in communal living, cooperative work, free schools etc.), in some cases their practicability is being researched (as in much alternative technology work), and in yet other cases pressure is being put on dominant social institutions to produce reforms or allow for the development of counter institutions. Such issues are of importance for the study of production and distribution of social and material goods and the factors which structure freedom and determinism of choice. They

are important in considering the possibilities for the industrial nations postulated in Perspective 3, in particular, ways of life. There are questions to be raised about the benefits and costs of existing life styles among different groups within the 'worker societies' if inequalities by class, race, sex and geographical region are not to remain, as is often the case, in most industrial nations (whether socialist or non-socialist).

4.13 The study explores the thesis that the root cause of current Northern economic problems is not 'over-consumption' (as suggested by Perspectives 2 and 5) but rather uneven, unequal development, and suggests that the prescription of de-development (proposed in some perspectives) as a means of removing present problems and facilitating the restructuring of the global economy is inadequate. This thesis is to be explored in later modelling studies.

Aspects of Southern Development

4.14 Skill Formation in Southern Economies The focus in the study on skill formation in the South reflects an underlying assumption of the project (taken up in the later section on technology) of the need for developing societies to gain control of technological knowledge if they are to achieve non-dependent development. Appendix 18 explores the contributions made by theorists of dependency in Latin America to this issue for developing societies. In particular, it focuses on how authors, with different visions of the process of industrialisation and of the linkage of Latin American countries to the world economy, have treated the issues of the formation of occupational categories, and how different approaches to the problem of learning and skills can be derived from their perspectives. These issues are fundamental to the understanding of political and economic change and ways of life in Third World countries, although the present focus is on Latin America.

4.15 A central question relevant to the evaluation of the perspectives discussed in Section 2 is the viability (or otherwise) of economic growth within dependent capitalist societies. To clarify this question Appendix 18 sets out three perspectives. The early ECLA (CEPAL) thought, from which these perspectives derive, took an optimistic view of industrialisation

regarding it as 'the cornerstone to development'. It regarded the social structure as presenting 'social obstacles' to the spread of the benefits of technical progress. Social sectors must change and/or disappear to accomplish the new economic requirements. In each of the perspectives which are outlined below this view (which is also still implicit in the Northern liberal perspective and to a lesser extent the New International Economic Order perspective) is questioned.

4.16 (a) The 'Obstacles to capitalist development' perspective provides a break with early ECLA thought, as it analyses the consequences of the presence of multinational corporations in the industrialisation process in Latin America. The approach suggests that there has been a nation in each country that transnationalisation disintegrates; however, a third step, of re-integration on a new basis, is anticipated. The societies are seen as formed by two poles: the transnational nucleus and the rest of the social categories, forming part of two sectors: national-modern sector and the primitive-traditional sector. The transnational nucleus is seen as being responsible for the disarticulation and stagnation of the other part of the economy. The State is seen as mediating in the middle of the two central parts. The reintegration process of societies thus affected brings forward the authors' widely divergent prescriptions of change. Training issues are studied in relation to the cultural dimension of the transnationalisation thesis. This type of training, although dependent, is regarded as having had an effect upon development.

4.17 (b) The 'Development of underdevelopment' perspectives see the overall development of capitalist as the cause for underdevelopment and socialism as the way out of it. Development within the capitalist system is seen as only a process of deepening underdevelopment and, hence, cannot be considered as development at all. A metropolis satellite chain for the extraction of surplus value from the peripheral countries to the central ones is presented. This type of network of exploitative relationships is pointed out as being reproduced in each Latin American country (internal colonialism). In the most recent historical stage, this scenario sees the national entrepreneurs as playing no active role as a social force and thus it calls for workers' control of social change. Their treatment of issues such as the 'super-exploitation' of the labour force and the need for a conscious training of

this class to perceive their situation and act upon it seems to be the main stress in matters of occupational structure.

4.18 (c) In the'Associated development' perspectives dependency and industrialisation are not seen as being contradictory and dependent development is regarded as possible. Sectors of the national entrepreneurial class ally themselves with the transnational interests, in a subordinated way, to be able to obtain part of the surplus extracted by them. These two sectors, together with the State, are seen as the political supporting schemes for the latest process of subordination. In terms of occupational structure, emphasis is placed upon the relation of economic performance and the socio-political behaviour of workers engaged in different labour processes. Political awareness and practice in all spheres of civil society are considered, rather than only economic and technical control.

4.19 The perspectives above provide the overall view of some of the possible ways of handling the issue of skill formation in dependent societies. Further work will concentrate on skill formation within non-dependent or self reliant development. The starting point here will be deal with the topic from a discussion of the place and condition of the occupational category of industrial workers in Latin America. The specificity that the training and skills of industrial workers assumes in this region will be dealt with in terms of issues like the degree of interchangeability of the workforce, the resistance to the implementation of traditional working practices, the conditions of work, the length of working hours, etc. This work is closely linked to other components of the project (described in this section) and provides an analysis of some of the issues relevant to the Third World perspectives presented earlier. In particular, it forms a complement to the analysis of three different scenarios of Appendix 16 in relation to changing occupational patterns in the industrial countries. It deals with some of the consequences of technical choice upon occupational categories, in a way highly relevant to the studies of technical choice and change considered later. In the future this work should contribute to a definition of the categories of skilled and unskilled labour used in the North-South and AIM models and provide data relevant to the models' operation under different assumptions.

Collaborative Projects

4.20 Three additional studies (separately funded) are being conducted in collaboration with the present project and are important components in the evaluation and construction of Southern development alternatives.

4.21 (i) The first study (funded by IFDA) will be described in Appendix 19, it examines questions of authoritarianism and development. As with the Northern scenarios it is essential to take into account the political consideration that certain forms of economic growth may lead both to a worsening of life circumstances for the poorer strata of society and even to a widespread abuse of human rights. Thus a particular concern is to identify linkages between development strategies and authoritarian policies. In the study the relationship between 'forced savings', forms of capital accumulation, labour discipline, and labour management relations, transnational corporations and their relations with national governments are to be considered. A systematic classification of governmental styles and international patterns of relations is needed for a more sophisticated understanding of the connections between different modes of development and the more severe deprivation of human rights.

4.22 (ii) The second study (funded by UNESCO as part of the programme on long term development objectives) is oriented towards the introduction to models of qualitative aspects of development which have an influence on quantitative social and economic change. Examples of the direct connections to be made in the study are (a) the effect of productivity of increased use of time for participatory decision making by workers in enterprises, (b) the introduction into the formal labour market of a progressively higher proportion of women (c) the impact of the progressive incorporation in the market part of developing economies of labour from the subsistence sector (d) the effect on productivity of increasing time devoted to educational activities and (e) the impact of informal productive activity, cultural and voluntary activity. The framework for this study (using activity time analysis) parallels the work carried out for industrial economies (described in Appendix 16).

4.23 (iii) The third study (also funded by UNESCO) explores cultural interrelationships between industrial and developing societies. This study will be described in Appendix 20, and is concerned with the cultural consumption and production of selected countries and how this has been shaped by their location in the world, and the extent to which a culture reflects and reinforces the dependence of authority of different social and national actors. In particular, the study explores the situations in the South when a dominant cultural pattern is imposed (either via importation or through repression) and the inevitable cultural changes and oppositional trends provoked. This study to some extent parallels the analysis of sub-cultures in Northern societies (described in Appendix 17). Finally, the study would take up issues centred on the cultural and other social consequences of the emigration of cultural workers and their work from dependent repressive countries into less repressive first and third world nations. The question of interrelations between ethnic and cultural groups, while not explicit in many world perspectives, is often at root a major emotional input in many perspectives. The ability of cultures to accept or absorb alien ideas and different racial types in the long run has major implications for world trade, the international division of labour and the possibility of global conflict.

4.24 Although much of the current work on Southern scenarios is based on the experience of Latin American countries, it is intended that the scope of the project will be systematically widened to include parallel work in other developing regions. Preliminary contacts have been made in this direction and, in particular, a meeting under the auspices of UNESCO at Sussex in November 1978 will include participants from several Third World groups who have expressed interest in collaboration with the project.

TECHNICAL CHANGE AND INVESTMENT

Social and Technical Relationships

4.25 Underlying the study is the assumption that 'Technology' reflects, reinforces and reproduces a set of economic and social power relations. To the extent that all perspectives agree that technology exists within the above set of power relationships, there are very different evaluations of the importance or implications of this. From the neoclassical perspective underlying Perspective 1 this set of relationships might be viewed as a natural component of a system of production providing optimal overall economic welfare. In a 'dependence' analysis, this tends to be viewed as a set of 'exploitative' relationships between centre and periphery, the urban and rural sectors (i.e. fostering a dual economy) or within semi-feudal local economies (at the village level) or within social groups (e.g. the relative status of men and women in society or in the family). A more radical analysis, for example, would lay particular stress on the exploitative relationship between the owners of the means of production (capital) and labour.

4.26 Thus, the treatment of technology is bound up with the underlying perspective. In the study an attempt is made to highlight the impact of changes in the system of production on the distribution of social and economic welfare within and between countries, and to explore the institutional arrangements and corresponding production techniques contributing to long term social objectives. One important assumption underlying the present study is that a major requirement of development is to gain a measure of control of the system of production. Particular attention is paid to the fact that attempts at an international level to moderate and influence transfer of techniques or to improve domestic innovative capability have been relatively ineffective. Furthermore, the factors frustrating the fulfillment of the aims of the social groups within countries are not dissimilar to those operating among countries. Different techniques of production reproduce and are maintained by different ownership, employment and production characteristics and thus will be more or less appropriate in given social contexts. For example, even in sectors where techniques with high economies of scale appear appropriate in terms of maximisation of overall national economic growth in the short run, nevertheless they may not, depending on social arrangements, be conducive to a goal of redistribution

(even if the necessary legislation exists, the mechanisms for its implementation may be ineffective for social and/or structural reasons) or more long term development goals. Small scale, locally developed production methods may not appear optimal in terms of overall output in the short run but may be compatible with redistributive and other long term development goals provided they help to counteract exploitative social and economic relationships and build more 'balanced' domestic economies.

4.27 The above example relates to the prescription of several perspectives. In particular, central to the thesis of Perspective 2 is the continuing capital intensity of new investment in OECD countries, even though unemployment levels have increased in recent years, (this is also central to the critique of post industrial society given above). This includes the possibility of radically new production methods (e.g. robotive technologies) which are potentially labour displacing across a wide range of manufacturing and other industries (e.g. electronics, textiles, vehicles). These trends have a differential impact on different social groups including, for example, migrant labour and women wishing to enter the formal labour force. They may also have important implications for the relationship of newly industrialising countries with the North, since their relative advantage of lower wage costs is reduced. For example, the possibility of reducing labour inputs in many processes may provoke a relocation of international finance in the old industrialised regions or a similar technological trend in the South, and hence exacerbate unemployment in the newly industrialising regions while at the same time not contributing significantly to employment in the North, as considered in Appendix 16. Some of these effects are being explored using two submodels of technical change and the results are reported later in this section. Further work on this issue is to be carried out using the North-South and AIM models.

Availability of Raw Materials

4.28 In many perspectives a corresponding set of issues arise to questions of the availability of raw materials. Although it is assumed in the study that there are not global physical constraints, it is recognised that institutional or technological blocks could arise at many levels. For example, different opportunities exist for capital accumulation in the various world political and economic arrangements. There are possibilities for both industrialised and developing nations to withold or change the market conditions, materials, agricultural goods, technological know-how and capital. There are many uncertainties, for example the capital requirements of individual mining projects are very high (even though raw materials, exclusing energy, are often a relatively small component of the final cost of manufacture). There is, therefore, for example the question of whether vertically integrated transnational firms would, in the face of possible cartelisation or nationalisation, concentrate research and development activity into increased efficiency of use (i.e. new material designs) of domestically produced raw materials rather than rely on imports. Industrialising countries may, because of other economic links, then be purchasers of these more sophisticated fabrication techniques and materials. Such issues have implications for overall global resource consumption, the continued dependency of deveoping countries on the industrial countries for technology and balance of payments questions.

4.29 The trends and implications of different patterns of trade depends on many of the factors considered in the perspectives described earlier. In most, the importance of international markets is evident. Even though there is dispute as to the extent and under what conditions particular nations might expect to be more or less self sufficient it is probably the case that few could afford to be totally self sufficient. Whatever, it is evident that links between directions of technical change (particularly with regard to the intensity of use of raw materials) and the pattern of resource availability must be taken into account in the evaluation of different scenarios.

The Environmental Dimension in Technology and Development

4.30 To account, in the present study, for the constraints of ensuring satisfactory environmental standards requires that a suitable categorisation of environmental hazards relevant to the model be established. For many purposes (although not all) environmental 'goods' may be differentiated as in the North-South model and in AIM, as 'basic' and'non-basic' (although these are graded differently by different perspectives) and counted as an additional cost on capital used in production. The perspectives considered earlier place more or less emphasis on the components of environmental concern but questions of irreversibility, health and quality of life are present in all. Proponents of some perspectives argue that environmental protection should be a response to unwanted side effects. Policy based on such arguments would imply that standards could vary with local geography and level of development, and polluting industries should be located in areas where lower standards are acceptable. Wildlife and oceans could be selectively protected largely on commercial criteria. On the other hand proponents of other perspectives argue for the setting up of world-wide standards, with anticipatory and comprehensive evaluation with attempts to restore wilderness and oceans.

4.31 In order that this dimension of global development should not be neglected, coordinated with the present study, a project on the environmental consequences of technology and development strategies will explore the qualitative and quantitative differences and similarities in the origins, manifestations, and perceptions of environmental problems in the North and South. This work to be carried out at Fundacion Bariloche in Argentina and funded by IFDA will be closely linked to the modelling and scenario analysis and, in addition, will make use of empirical material and case studies from several countries.

4.32 Decisions taken incrementally or in an ad hoc manner systematically may contribute to an integrated but undesirable pattern of development. Whether or not the problems of unemployment etc. indicated earlier can be avoided in the future in both North and South economies depends on whether satisfactory technology policies can be devised and implemented. This in turn depends on whether adequate institutional arrangements for the innovation, application and diffusion of appropriate technologies can be brought into existence. If this question is of major importance for the Northern countries, it is of extreme urgency for the countries of the South. Appendix 21 takes up these issues and in doing so draws important distinctions between the current situations in industrialised and developing societies. Within the industrialised countries a marriage of science and technology has become institutionalised within the professional research and development establishments of industry and government. These 'modern' sources of innovation, although by no means the sole sources of innovation, are characterised by their increasing scientific content, by their scale and by their high degree of specialisation of function. These properties have for the most part tended to favour the large enterprise and to foster a concentration within industry. (Even though recent empirical studies in the OECD area suggests that this may not always be an efficient use of research and development expenditure).

The rationale of technological decisions in developing countries should be considered on different grounds than in technologically advanced societies. The fact that technological development already has a well established tradition in these societies creates mechanisms of control and the whole system is to some extent self regulating. This does not imply that these mechanisms are representative or satisfactory, as public reaction to transport and nuclear power policy in many Northern countries has shown. But these mechanisms of regulation are frequently non-existent in developing societies and major technological applications are mostly the result of very particular and often erratic circumstances or both, which are exacerbated by limitations on the possibilities for the creation of indigenous technologies.

4.33 Whereas industrialised nations have, for the most part, substituted

traditional methods of problem solving and production by scientific technology generated by a clearly differentiated institutional framework, both traditional and 'modern' methods co-exist within the South. In Appendix 21 this is examined in terms of the degree to which both sources of innovation make the connection between research and production and also meet the needs of a rapidly changing environment. For different reasons discussed in the appendix, both systems fall short of this task. The appendix then goes on to consider the connection between the choice of technique and three sources of technology commonly identified in the literature as 'off the shelf', 'adaption' and'generation'. Each category is described in terms of the constraints placed found within each. An example is seen within the various types of licensing agreements associated with the commercialisation of technology within the 'off the shelf' category.

4.34 Although these three categories do not necessarily fit neatly within different perspectives of North-South futures nor with different stages that the different paths of development would pass through, they do provide a framework which can, to some extent, elaborate the role of technology within each scenario. This appendix will form the basis of further work on this part of the project and links into the modelling and case studies of technology described below.

Selected Examples of Technical Choice

4.35 We shall use available empirical evidence provided by specific case studies in the evaluation and construction of scenarios, in order to illustrate and support both the quantified and un-quantified analysis. In doing this, a major problem is to assess what assumptions about the production system (in terms of the type of inputs required and the nature of the goods produced) it would be reasonable to include in the macroeconomic model in the light of (microeconomic and macroeconomic) empirical evidence and hence what adjustments to make to the reference model in exploring different scenarios. In principle, by examining in detail current and postulated future alternative techniques at each stage in the process of a given consumption good, a chosen development path or scenario may be better evaluated (see Appendix 2). If generalisation was possible, some estimate of the appropriate magnitude of parameters in the model describing the production system could then be chosen. This would be a more

desirable method for the introduction of technological alternatives in the macro model than the methods used in current models. Data limitations however may require a more pragmatic approach. In making assumptions about the numerical values to be attributed to parameters in the model one needs to strike a balance between the use of aggregated statistical data (which often disguises significant alternatives and information) to illustrate the possibility of development paths different from those indicated by the statistically averaged trends. Thus a mixed approach is adopted which we now describe. The macroeconomic model is calibrated against aggregated national data, at the same time exploring specific issues with submodels calibrated against sectoral or sub-sectoral data. Meanwhile a body of evidence to support alternative hypotheses is established.

4,36 In general the approach in studying alternatives for development (i.e. those which are not largely based on extrapolative assumptions) is to explore the impact on development goals of hypothetical trends in the production system (via adjustments in the model parameters) and then to discuss the reasonableness of such assumptions in the light of specific sectoral and case study analysis within the broad guidelines offered by the scenario analysis (see Appendix 2). In addition to the above the case studies are also used to illustrate and provide a fuller understanding of the qualitative arguments presented in our evaluation of alternative development perspectives.

4.37 We now discuss several proposed case studies. The international fruit industry, for example, helps to illustrate the importance of management techniques and the problems of transferring control from transnational firms to local or government enterprises and its implications for profitability, wages and income distribution. The metal extraction and fabrication (e.g. tin and copper) provide examples of the opportunities for cartelisation of supplies, nationalisation, long term trends in material intensity of use, and the difficulties of developing economies very dependent on relatively few export goods. The textile industry exemplifies questions of transfer (raised earlier) of labour intensive manufacturing to developing countries and back to industrial countries as new labour displacing automative

technologies are introduced.

4.38 One particular illustrative study currently under way (see Appendix 22) is of the aluminium industry in Argentina which sets out to examine some of the constraints under which choices of technique are made in developing economies and to clarify what institutional or other changes might be required if those constraints are to be relaxed. Aluminium is very important in many respects. It is a major metal, second only to steel. At the same time the industry of aluminium production and exchange is a signficiant field of interrelation between industrialised and developing countries. Third World countries constituting a cartel account for about 70% of the world production of aluminium ore (bauxite). Most of the smelting capacity is at present created in industrialised countries. However, restrictions in energy supplies and environmental regulations are leading to an increasing relocation of the industry in developing countries. The consideration of conditions under which the industry could be installed in those countries is of general interest, but particularly so because of the technological and environmental issues involved.

4.39 In general one of the main difficulties for the type of study proposed here is to obtain information which is reliable enough. Key information concerning major technological decisions are not easily available and often not available at all. Technological decisions, on the other hand, are not usually the object of a public debate in developing countries. In a few exceptional cases a debate took place and some of the information was made public. In these cases, however, the usual course of action might have been influenced and thus it may be argued that they may not be representative. Public decision making, on the other hand, can be seen as part of the overall decision making process.

4.40 The primary aluminium project of Argentina is therefore an exceptionally favourable case as detailed information is made public. Furthermore, since most of the debate compiled in the published information took place in 1975, about one year after the plant came partially on stream, the decision making itself has not been affected by the debate.

4.41 The central aim of the analysis is to correlate the elements which delineated the project, the mechanism of the decision making and the actual performance obtained when the decision was implemented. It is expected also that this study will illustrate how the role of technology is conceived in a society where major technological achievements are frequently developed with only marginal participation of the local creative capabilities and in which the apparently erratic process of technical choice (indicated earlier in this section) appear as the only alternative with present institutional arrangements at the local and international level.

Submodels of Technical Change and Transnational Investment

4.42 In many current models technical change is treated as a wholly exogenous phenomenon (see Tables 3 and 4). Such assumptions are likely to be misleading in considering many of the scenarios outlined above. In the first place they may assume much more continuity and evenness in technical change than is the case. The advent of microprocessors on a large scale, for example, may be better thought of as a technological breakthrough (akin to previous revolutions in agriculture and industry) or, in more economic terms, as the stimulus to a new long wave (Kondratiev) cycle leading to widespread restructuring of the system of production. New techniques for production in developing nations which are implied by several development perspectives could lead to similar discontinuities (for example nitrogen fixation). Second, extrapolative assumptions in the present model do not take adequate account of the alternative mechanisms inducing change.

4.43 Rates of change of labour productivity are found empirically to vary with rates of change of production. Therefore, the emphasis on development of different sectors of the economy might be expected to lead to significantly different relative rates of technical change and so historical rates of technical change do not necessarily provide adequate projections for the future. In the study more detailed submodels of the production system are constructed to deal with these issues. These submodels are calibrated at a sectoral or subsectoral level to provide insights into the economic aspects discussed above and as inputs to the scenarios directly. Three models developed as part of the project and a more comprehensive theoretical framework designed to accommodate some of the issues raised in the scenario and issue studies are now described.

A Vintage Capital Model

4.44 It is useful to separate the process of the generation of techniques from their so-called 'embodiment' within the system of production. The former is inherently dependent on a large number of uncertain factors and is more difficult to handle using formal modelling techniques. With respect to the latter, technical change is linked with the process of capital accumulation; each successive investment decision may involve the purchase of machines of a type qualitatively different (and presumably more productive) than those already in use. Of particular relevance to the development of North-South scenarios, especially those in which international transfers are assumed to be a function of relative productivity (of labour and capital) is the question of the vintage (age) of capital stock.

4.45 A preliminary model of 'embodied' technical change has been developed to study the effects of various influences in the latter process and is described in Appendix 23. Some of these influences are internal to a given economy (e.g.changing demand patterns and wage rates) while others are external (e.g. international competition). The model suggests that such factors can have an important effect on inducing the adoption of new techniques as older methods become incapable of yielding a profit in the changed market situation. Thus, for example, the degree of exposure to foreign competition might be expected to be a significant determinant of the rate and direction of technical change. The model demonstrates clearly some aspects of induced technical change. For example, even though in the face of increased competition there may be considerable increase in replacement investment in competing countries, net investment may decline as a result of falling profitability and consequently, so that average productivity in the importing country does not close with 'best practice'. From the standpoint of several scenarios considered earlier, a more systematic treatment of these findings would be important.

A Simple Model of the 'Long Wave'

4.46 A dominant question underlying several of the North-South scenarios discussed earlier is that of current unemployment in industrial countries whether it is likely to be more than a short term phenomenon. One basis for discussion of this is the so-called Kondratieff long waves; a principal thesis of this is that long waves are associated with the introduction of

major new technologies, for example steam power, railways, electricity, automobiles and now micro-electronics. Each major new innovation (which lies in the wake of the previous technology) leads to a succession of phases in technical innovation. Initially, innovation is specialised and localised. This leads first to a 'bandwagon' employment creating situation as demand for the new product is created, but eventually gives way to a period of intense competition and radical technical change involving 'process' rather than 'product' innovation. A period of recession begins and labour is displaced. Thus, conflicting tendencies of labour absorbtion (through capital accumulation) and labour displacement operate in such a way that each is alternately predominant. A simple model of 'technological unemployment' based on this theory has been developed in Appendix 24 in order to contribute to the scenario discussion and explore the plausibility of such waves and the underlying mechanisms.

A Model of Transnational Investment

4.47 As the background paper (Appendix 21) discusses, standard economic theory has dealt inadequately with the impacts of direct foreign investment and other forms of capital flow from rich countries on the poor countries to which they are directed. Appendix 25 describes modelling work that explores these issues concentrating on the hypothesis that transnational firms have an 'advantage' over national competitors from poor countries, stemming from their control over a package of inputs including marketing, technology and access to capital markets. And that for a given wage and exchange rate the transnational firm will enjoy a higher profit rate on the fixed capital stock that it controls, and may also have lower dividend payment obligations. On the other hand, transnational firms face uncertainty due to possible nationalisation which increases with this level of 'exposure' (growth). The higher retained earnings of the latter imply that the growth rate of domestic product will be faster when the foreign owned share of total capital in the economy is higher.

4.48 However the growth rate of national product may differ from the growth rate of domestic product, depending on the foreign investment practices. Under these hypotheses, depending on the values of the parameters discussed above and on initial conditions, foreign investors may in the long run produce different effects: (i) a negligible one in the host country economy, (ii) establish a constant share of capital stock, or (iii) come to dominate the economy. Somewhat more complex analysis suggests that similar possibilites arise when the transnationals mediate technology flows to the poor country, or else when the host country manipulates the exchange rate and other policy instruments to maintain a stable balance of payments situation. These findings, which have yet to be integrated in the North-South model, may help to focus on what seem to be major determinants of the long run role of foreign investment in developing economies: the extent of their technical and financial advantages, and the effects on the real wage level and investment and savings behaviour of underdeveloped host countries.

Future Modelling Work on Technical Change

4.49 Incorporating the preliminary modelling work of technical change described above, we attempt to develop a more generalised analytic framework for the discussion of technical change, including innovation and adoption of new processes, which is compatible with the income distribution and trade model and may provide a specification of some of the parameters which are treated as exogenous in the North-South model.

4.50 The model of technical change shares with the North-South model a common set of concepts with regard to the description of goods (as basic, non-basic, and capital goods) and labour (as skilled and unskilled). The theoretical basis of the model outlined in Appendix 26 derives from product cycle and technology gap theories, and the Schumpeter-Freeman interpretation of Kondratieff cycles described above. This is relevant to an evaluation of the 'post industrial' scenarios considered earlier and to take account of some of the constraints on possibilities for technical change indicated above, as well as to represent changes in the production system induced by both the supply and demand side. The direction

of change itself is determined by whether product or process innovation is taking place and the availability of factors and market signals (such as demand or profitability). This would add to the neoclassical theories of choice of techniques by relative availability and price of factors. Because, although, all other things being equal, the direction of technical change in the North suggested by relative price of factors would be towards displacement of labour (especially unskilled labour) from all sectors, and in the South toward displacement of capital, the arguments above will lead to considerable variations of such changes and of the rates at which those changes can occur. These variations are likely to have a significant impact. An extension of the vintage capital model described earlier allows these variations in factor requirements to be studied in more detail.

4.51 There are also other factors to be taken into consideration. For example, several non-market factors may affect the direction of technical change a sector or region; the market 'signals' (i.e. wages, levels of demand) indicated by the North-South model may be distorted by tariffs, transportation costs, taxation, environmental restrictions and so on. Also the transnational sector or sectors in which the composition of firms sizes increased may take market share as a significant factor. This is partly examined in Appendix 25. Finally, as Appendix 21 shows, the direction of technical change will be affected by the technologies which are already in existence and which are also available, through innovation, transfer and diffusion.