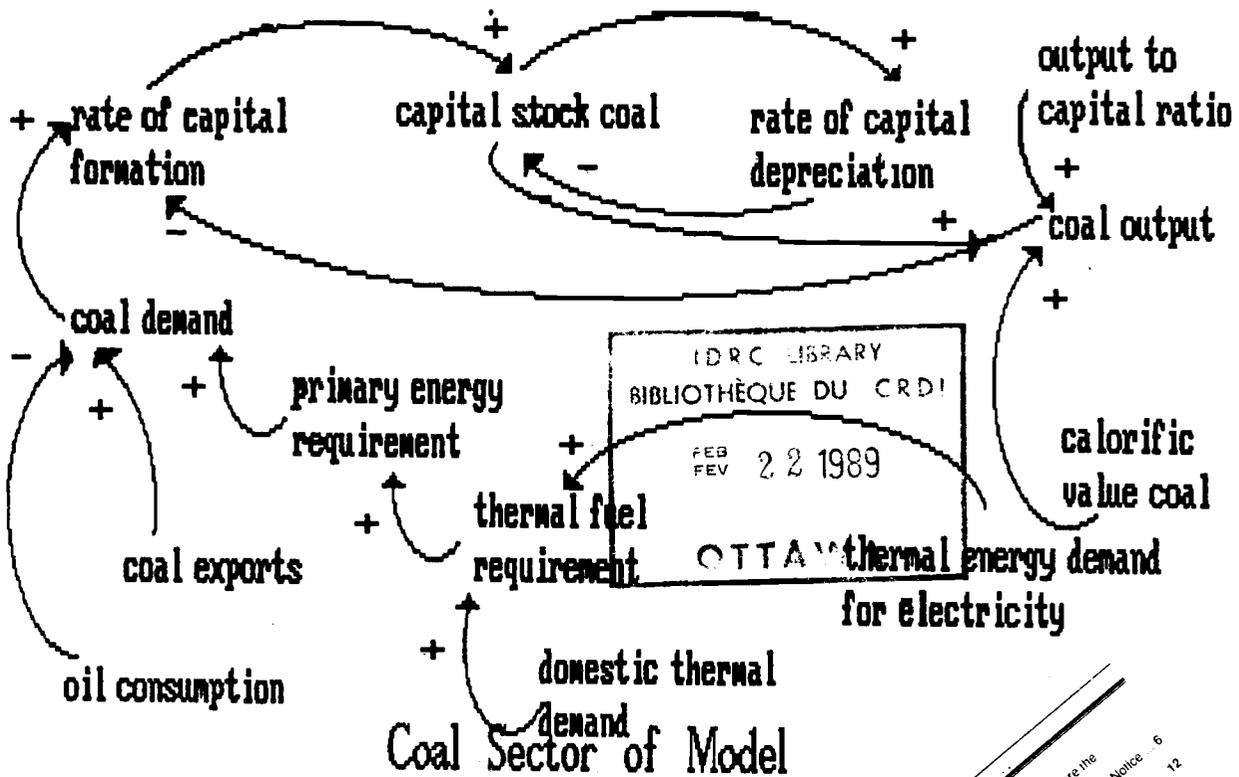


ICDM Newsletter

A Quarterly from the Information Centre for Development Policy Modelling

Where The Bruntland Commission Took Over . . .

and where it left off . . .



A Report on the state of sustainable futures management

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Publisher

Prof. J. G. Krishnayya

Editor

Anupam Saraph

Editorial Team

Shripad Dharmadhikary

S. D. Pardeshi

G. Harikumar

Circulation

G. Harikumar

Printed by

Mr. B.M. Rao of Office Management Services for the ICDM

The ICDM

The ICDM is cosponsored by the *IDRC* of Canada and *SRI* of Pune to raise the level of awareness in South and East Asia about the existence, availability and utility of development-policy models and provide information services in the area of modelling so as to help an *invisible school of modellers* start using and building models.

The Centre serves visiting scholars, officials and policy makers through discussions, advice and trial "runs" of relevant models, and through access to the Centre's large collection of literature on Models, Modelling methodology and Uses of Modelling in LDCs. The Centre publishes a Newsletter providing information about the field, operates a Question and Answer Service, provides photocopies on request.

Interested individuals, government agencies and research institutions can avail ICDM services by enrolling as members of its User Network. The network user is automatically eligible to several services and products including the newsletter free of charge.

Information Centre for Development Policy Modelling, 17-A Gultekdi, Pune 411037, India

☎: (0212) 420323 Telex: 146 265 JNMP IN

What after the Bruntland Commission?

The Chinese proclaim that, "of all things people are the most precious". And so they are. All human actions centre around people. Policy makers have concerns about Sustaining the people in their regions. The increasing numbers, 'grey' waves, 'young' waves in several nations make more acute the pressures on the policy makers to try and meet the needs and aspirations of the present without compromising the ability to meet those of the future.

Lewis Carroll's quote through the mouth of Alice and the queen aptly describes the plight of several nations in the development race:

"Well, in *our* country', said Alice ... 'You'd generally get to somewhere else -- if you ran very fast for a long time, as we've been doing.'

'A slow sort of country!' said the queen. 'Now, *here*, you see, it takes all the running to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!'"

The increasing difficulties in even maintaining the state of the world or the countries *as is* has not passed unnoticed. The *Bruntland Commission* has rubber stamped the concerns of recent times that originated with the *Club of Rome's* activities. Global models and Country level models in the recent years have made it possible to obtain an increasing handle on the understanding of the issues.

The computer models, which have cast an *electronic oracle*, are not final words about the system. They are tools that help increase the understanding of the system we deal with. They serve the purpose of helping to explore the effects of the policies in advance and with great rapidity. It is only clear that there is a lot to be said in favor of a synergetic use of the modelling paradigm and the Bruntland Commission's report if we would like to head towards a sustainable future.

We attempt in this *Newsletter* to do just this.

Much work still needs to be done to enable policymakers use this or other such tools on a *regular basis*. If we are to tackle effectively the global problems described by the Bruntland Commission or 'even to keep in the same place' by running hard we need to take a step in the direction of understanding the systems we deal with.

Anupam Saraph

June Newsletter

I plead guilty for my ignorance of the existence of ICDM and its Newsletter service. Today accidentally I saw June 1988 issue and was impressed by the same, especially the article on Hydrology - models. They are pretty educative. Will I be able to get future issues - exgratia? Please do inform.

Prof S K Gajendragadkar
65, Patil Estates, Pune 411 005
India

You can certainly have our future issues. All you need to do to ensure regular flow of our newsletters is to write to G. Harikumar, Circulation.

ICDM's Information Map

Martha just sent me a copy of your new publication Sustainable Futures: An Information Map. The copy I have is unbound, and apparently yet to be corrected. I just wanted to write and tell you it looks very nice.

Gerald Barney,
Institute of 21st Century Studies,
1611 North Kent Street,
Suite 610 Arlington,
Virginia 22209-2111 USA

ICDM NEWS

Ms. Anuradha Sahasrabudhe, Junior Programmer at the ICDM left to join the staff of the Maharashtra Institute of Development Administration, Pune. We wish her all the best.

Mr. Sujeet Deshpande joined ICDM effective July 1988 in the capacity of Junior Modeller. He served at Alfa Laval as a Programmer-Analyst. He is primarily working on porting models to the IBM-PC at ICDM.

Prof. John Richardson, coauthor of several Books on Modelling (notably *Groping in the Dark* published by Wiley), an eminent modeller with rich experience in modelling socioeconomic and political processes visited ICDM early in October. He made invaluable suggestions to the ICDM on aspects of communication, models and modelling. We hope these will be reflected in ICDM services in the Future.

China to Revamp Environment Problems with ADB Assistance

A grant of \$340,000 has been approved to the People's Republic of China (PRC) by the Asian Development Bank for institutional strengthening of the National Environmental Protection Agency (NEPA).

The grant aims to improve NEPA's organizational arrangements, strengthen an effective management information system, help develop environmental planning guidelines and address short-term and long-term training and human resources needs.

NEPA is the implementing arm of the Environmental Protection Commission, PRC's highest policy-making body for environmental pollution control. NEPA is responsible for policy and program formulation, research, regulatory measures, supervisory and monitoring functions.

It coordinates and supervises environmental protection works carried out by local governments and those ministries where environmental agencies are established. Currently, there are 1,144 major pollution monitoring stations, involving about 20,000 staff, set up under the auspices of NEPA and about 500 monitoring stations establishments

and agencies.

NEPA is a relatively new organization and has not yet developed its capability to perform its sectoral role effectively. PRC's understanding of the urgency to the problems in controlling and preventing pollution is illustrated through the high priority in the Sixth (1981-1985) and Seventh (1986-1990) Five-Year Plans to environmental protection policy.

The large and growing population and rapidly expanding economic activity have caused various environmental problems. Inadequate domestic and industrial waste management has led to surface water pollution, air pollution and solid wastes problems. Major rivers, lakes, estuaries and coastal waters are contaminated. The groundwater resources in many cities are seriously polluted and the groundwater table has been declining. Serious air pollution threatens public health in the heavily populated cities.

The Bank's technical assistance is expected to be implemented over four months from August 1988.

Source: ADB News Release

Unravelling the wrath of the Brahmaputra ...

Floods are the perennial problems of the state of Assam, India, robbing her of economic benefits. Efforts have been made by the different departments of the Government of Assam and India to control the floods in Assam, after independence, but till today no practical solution has emerged in controlling the floods in Assam. Projects have been undertaken to control rivers through computer modelling in U.S.A., U.K., U.S.S.R. and Pakistan and the reports published so far in the scientific journals suggest successful implementation of computer modelling.

The Institute of Advanced Study in Science and Technology (IASST) of the Assam Science Society, Guwhati, has planned a scheme to overcome the perennial flood problem of Assam through computer modelling. With the

data collected from different organizations the computer models will be designed first with a tributary of the mighty river Brahmaputra and if found to be working, will be extended to the other tributaries and then to the river Brahmaputra.

Experts in this field both from abroad and of the country have been contacted and some of them have already shown keen interest to offer their valued help and guidance for the proposed scheme.

In order to draw up a working plan a detailed discussion is to be made on the problem at a workshop on "Simulation and Computer Modelling to Control the River Brahmaputra" to be held by IASST on the 19th and 20th November, 1988.

Source: IASST

Modelling a Sustainable Future: Where the Bruntland Commission took over . . .

By Shripad Dharmadhikary

Shripad Dharmadhikary describes how Global Models which in fact arrived at similar conclusions about the world development and environmental problems 16 years ago, as the Bruntland commission has now, can help to take up from where the Bruntland Commission has left off...

March '87: Bruntland Commission
We are not forecasting a future; We are serving a notice...

The UN Commission on Environment and Development, popularly known as the Bruntland Commission (after its chairperson, Gro Harlem Bruntland), released its widely hailed plan to save the globe's environment.

The Commission, to quote, believes that "people can build a future that is prosperous, more just and more secure. Our report, **Our Common Future**, is not a prediction of ever increasing environmental decay, poverty and hardship in an even more polluted world with ever decreasing resources. We see instead, the possibility for a new era of economic growth, one that must be based on policies that sustain and expand the environmental resources base. And we believe such growth to be absolutely essential to relieve the great poverty that is deepening in much of the developing world."

"But the Commission's hope for the future is conditional on decisive political action now to begin managing environmental resources to ensure both sustainable human progress and human survival. *We are not forecasting a future; we are serving a notice* -- an urgent notice based on the latest and best scientific evidence -- that the time has come to take the decisions needed to secure the resources to sustain this and coming generations."

The report of the commission has been widely hailed, and has been accepted by many governments in prin-

ciple as a document for policy making.

In this context, it will be interesting to see how the decade of Global Modelling has analysed and studied global problems, and how their analysis compares with the Bruntland Commission's report.

Global Models *The Same Insights...*

Global Modelling can be said to have started around 1972, when the results of the first global model WORLD 3 was published in a popular book form -- *The Limits to Growth*. Since then,

Basic needs are not being met now because of social political structures ... not because of absolute physical scarcities

many global models have been built, each trying to analyse the global problem with their own emphasis and their own methodology (see Table 1.

Major Global Models of the seventies).

In 1978, IIASA organised the Sixth Symposium on Global Modelling. This symposium, a little different from the earlier ones which dealt with specific Global Models, had the aim of reviewing and taking stock of the *state-of-the-Art* of Global Modelling till then. The report of the symposium "*Groping in the Dark*", summarises what had been learnt about the world's problem and about modelling; and it is very interesting to see that it comes up with the same insights and conclusions that the Bruntland Commission has to offer -- almost 10 years later.

The Global Problematique *Questions of Sustainability*

Groping in the Dark describes the way Global Modellers see global problems:

"Is the exponential growth of the world's population and capital stocks sustainable by the world's resource base and ecosystems? What might happen if the resources became strained?

How do national policy and interna-

Model	Project Directors	Paradigm
World 3	Jay Forrester Dennis Meadows	System Dynamics
Mesarovic-Pestel	Mihailo Mesarovic Eduard Pestel	I/O, System Dynamics, Econometrics
Bariloche	Amilcar Herrera	Optimization
Moira	Hans Linnemann	Econometrics
SARU	Peter Roberts	Classical Economics
FUGI	Yoichi Kaya	Optimization, I/O, System Dynamics
UN World Model	Wassily Leontief	I/O

Table 1. The Major Global Models of the seventies (Source: *Groping in the Dark*, John Wiley and Sons, Chichester(1982))

tional markets for trading food allow widespread hunger to exist? What kinds of policies could reduce hunger?

Is it possible for all basic needs to be provided for the world's people over the next several decades? How?

In our mental models the most important, urgent, compelling, inadmissible problems are global. Nuclear armaments, depleting resources, growing strategic vulnerability of nations, abject poverty, threatened ecosystems are the problems we see and we also see interconnections among all these problems. These are just the complex, interlocking, interdisciplinary sorts of issues that we know cannot be handled by mental models alone."

Teachings of Global Models

Possibility for a new era of economic growth ...

Groping in the Dark then goes on to list what we have learnt from Global Models. There is no known physical or technical reason why basic needs cannot be supplied for all the world's people into the foreseeable future. These needs are not being met now because of social and political structures, values, norms, and world views, not because of absolute physical scarcities.

- Population and physical (material) capital cannot grow forever on a finite planet.
- There is no reliable and complete information about the degree to which the earth's physical environment can absorb and meet the needs of further growth in population and capital. There is a great deal of partial information, which optimists read optimistically and pessimists read pessimistically.
- Continuing 'business-as-usual' policies through the next few decades will not lead to a desirable future -- or even to meeting basic human needs. It will result in an increasing gap between the rich and the poor, problems with resource availability and environmental destruction, and worsening economic conditions for most people.

- Because of these difficulties, continuing current trends is not a likely future course. Over the next three decades the world's socioeconomic system will be in a period of transition to some state that will be, not only quantitatively, but also qualitatively, different from the present.
- The exact nature of this future state, and whether it will be better or worse than the present, is not predetermined, but is a function of decisions and changes being made now.
- Owing to the momentum inherent in the world's physical and social processes, policy changes made soon are likely to have more impact with less effort than the same set of changes made later. By the time a problem is obvious to everyone, it is often too late to solve it.
- Although technical changes are expected and needed, no set of purely technical changes tested in any of the models was sufficient in itself to bring out a desirable future. Restructuring social, economic, and political systems was much more effective.
- The interdependencies among peoples and nations over time and space are greater than commonly imagined. Actions taken at one time and on one part of the globe have far-reaching consequences that are impossible to predict, (maybe at all) with computer models.

There is an urgent need to evaluate various policies before piloting the real world to sustainability . . .

- Because of these interdependencies, single, simple measures intended to reach narrowly defined goals are likely to be counterproductive, single, simple measures intended to reach narrowly defined goals are likely to be counterproductive. Decisions should be made within the broadest possible context, across space, time, and areas of knowledge.

- Cooperative approaches to achieving individual or national goals often turn out to be more beneficial in the long run to all parties than competitive approaches.

- Many plans, programs, and agreements, particularly complex international ones, are based upon assumptions about the world that are either mutually inconsistent or inconsistent with physical reality. Much time and effort is spent designing and debating policies that are, in fact, simply impossible.

Thus, we can see how effectively the Global Models have analysed and identified the key leverage points in the Global problems. And this, I believe, is applicable to even regional and national and sectoral models -- thus bringing out the fact that models can be one of the most powerful tools in policy analysis and decision making.

A Case for Synergy

Here is the possibility of opening up new avenues in exploring sustainable futures..

This of course, in no way denies, or decreases the importance of the Brundtland Commission. The commission's goals were, obviously, to identify key policies necessary to resolve the global problems, and put them across effectively to the policy makers.

It is for the modellers to pick up from here. Though the Commission has indicated broad policy directions along which to move, what is needed is for the policy makers to evaluate these policies, build up various scenarios to study the possible outcomes and then decide on how to implement these policies. And this is where modelling would come in. In short, what is needed is to back the mental verbal models built up by the Brundtland Commission into more vigorous mathematical computer models and evaluate the policies suggested by the commission.

If this comes about, a group of modellers working with policy makers could complement each other, and take us a few more steps ahead in our quest for a sustainable society. □

A Tool to Meet the Bruntland Commission's Notice

The Bruntland Commissions urgent notice calls for the quick explorations of alternate scenarios towards sustainable paths. The Global models are possibly rightly criticised as lacking real world actors. Here the ICDM editorial team explores the utility of a country level model to complement the Bruntland Commissions report by allowing policy makers to do quick scenario explorations before formulating policy...

Development in India

Percapita income has risen from Rs. 466 in 1947 to Rs 745 in 1984 but much of India's population is still in abject poverty..

India is probably a very interesting case to examine for sustainability for a number of reasons. First and foremost, it is a vast country, peopled by diverse communities, speaking over 14 different languages and hundreds of dialects, residing in equally diverse physical settings. It has a huge population of about 800 million, and an equally vast resource base. On one hand, India appears to have made great strides in terms of development (especially since Independence), and on the other, a large section of its population lives in abject poverty.

India has made rapid strides in development since independence. Thus, its national income rose from Rs.16,731 crores in 1951 to Rs.54,000 crores in 1984, while the per capita income rose from 466 Rs per annum to Rs.745 in the same period. The foodgrain production also went up from 50.8 m tonnes to 149.8 m tonnes. The rate of growth was between 4-6%. However, inspite of all this, a substantial part of India's population leads a life of poverty and misery today. To meet this challenge, the Government of India is determined to maintain and enhance this rate of growth. Here is where we ask, how can policies for a sustainable future be explored rapidly before experimenting on the real world fragile system with long response times?

Sustainability

Diverse sectors with their own dynamics contribute to sustainable development...

We cannot talk about sustainability without the conditions of sustainability. Here we can probably put two very simple basic conditions.

a) The development process should satisfy the most essential needs of all the people. These needs would include food, water, shelter, clothing, energy, education and health.

b) In doing so, the process should preserve the quality of the environment

With these two things in mind, we can explore now how sustainable the current growth process is.

The development process consists of many diverse separate sectors, all behaving according to their own dynamics; and all interrelated to each other. Let us take a quick look at some of these.

Population

The population of India has two distinct parts -- the rural population and the urban population. The population of any place can change by two ways -- births/deaths, and migration.

development is not just a matter of a single "rate of growth", but it consists of many many processes, each with its own rates

The total birth are a function of total population and fertility, which itself is a complex function of many factors like culture, economic status, perceived mortality etc. The deaths are a function of total population and death rate, which depend upon availability of health services, environmental factors, poverty and so on.

Migration of course, is more related to economic phenomenon; and normally an urban area would have migration

into it; the rural area away from it.

Agriculture

For a country like India, Agriculture is the major economic activity; the majority of the Indian population is engaged in agriculture. Agriculture depends upon the land and water resources of the country. Irrigation in fact is the largest consumer of water.

About 143.5 mha of land is under agriculture, out of which 46.2 mha is irrigated land. Part of this land is used for cash crops; the rest produces food.

The productivity of these lands depend upon a number of factors like irrigation, use of fertilizers, methods/practices followed etc.

The interlinkages now start becoming evident. More fertilizer availability (and production) would imply the need for more fertilizer factories, more capital investment, higher use of oil and gas and so on. More irrigation would mean more load on water resources; more capital investment into irrigation and infrastructure.

Industry

The Industry is the second most important part of the economy after agriculture. There is a wide range of industries in India. The production by industry depends on the capital invested and output to capital ratio. This ratio will in turn depend upon whether it is a small, medium or large industry; level of technology used, reliability of supply of raw materials, energy and so on.

Energy

If we look carefully enough, we see that energy is the most crucial of all the elements in development. When we normally say that something is scarce (say some metal), we mean that it would be too expensive (would need too much energy) to extract it or use it. Ultimately, most resource scarcities can be traced back to energy (rather, the lack of it). Thus, the way energy is obtained and used is critical to the process of development and its sustainability.

Every sector of the economy needs energy -- for cooking, heating, lighting, for manufacturing fertilizers, for irrigation for construction, and to drive the transport services and industry.

For industry to develop, more energy is needed; more population means more vehicles, more cooking -- hence more energy.

Model of the Development Process

Compatible growth rates within sectors in the system..

The first point that emerges from a study of these is sectors and their inter-connections is that development is not just a matter of a single "rate of growth", but it consists of many many processes, each with its own rates (of growth, decline etc); and these rates are interrelated to each other, affect and are affected by one another, and hence, sustainability becomes an issue of sustainability of various rates, which have to co-exist in a certain proportion, a certain balance.

To explore policy scenarios in this kind of a process, we need a tool. A tool which will allow us to look at the all the different rates involved, allow us to study as to what happens when all the processes go on simultaneously, and how these rates and processes change with external influence.

Probably the best tool for this kind of a study would be a dynamic simulation model; this kind of a model would incorporate the various interrelationships between sectors and allow us to see the behavior of any/all of these over time.

We at ICDM constructed such a (very

crude) model for India under the guidance of Prof Malcolm Slesser of University of Edinburgh (see ICDM Newsletter Vol4, no1.). This was a highly aggregated, crude model, covering only the very broad and obvious linkages between sectors.

The Model covered only the most important and obvious sectors; in the structure of these individual sectors, only the most important elements and relationships were covered. This means that many elements/relationships were lumped together into a highly aggregated structure. For example the population was divided into urban and rural elements but no agewise or sex-wise distinction was made at this stage (as described in John Sterman's Model on page 16 of this Newsletter).

The purpose of this model is thus only to show how such models can be used for policy analysis and to generate various scenarios. For actual analysis purposes, a more complex, more comprehensive model is necessary.

This model consists of a number of sectors like agriculture, industry, services, population, energy, housing, water and so on (some of which we

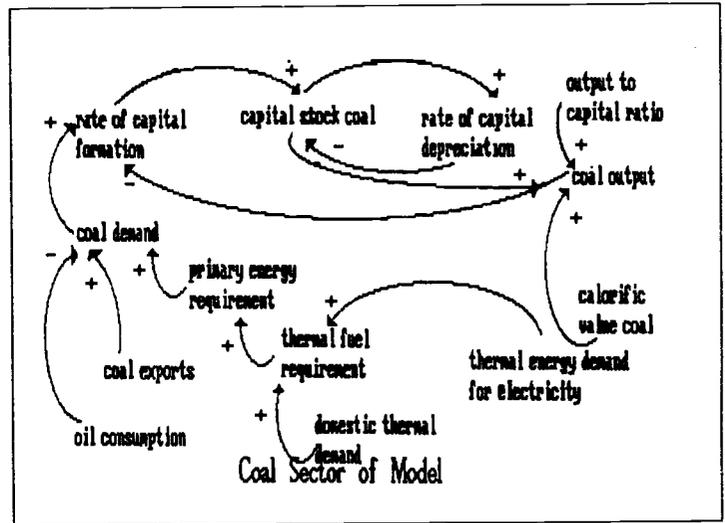


Figure 1.

A Causal Loop Diagram for the Coal Sector in the Model

described earlier). Each of them is related to one another (see Fig. 1.).

Criteria for Sustainability
How do the policies affect the Material Standard of Living?

What is referred to as the Material Standard of Living (MSOL) in the model can serve as an indicator of sustainability. For example, the value of this can either be specified as a desired policy goal, or conversely the effect of various policies can be seen on this.

Thus, we can say that we want the value of MSOL to be more than a minimum limit -- then how will we have to plan for development of coal, transport, agriculture? Or, if we invest so much in energy, agriculture, welfare etc, what will be the MSOL at the end of 10

- Food Output Increased by Intensification of Irrigated Land
- Goal Nutritional Level set Exogenously for the whole population
- 100 % self sufficiency in cereals desired
- Coal Extraction intended to meet Thermal energy demands
- Birth and Death Rates Exogenous
- Balanced International Payments by making exports pay for imports; pay off debts slowly

Figure 2. Assumptions Implicit in the Scenario

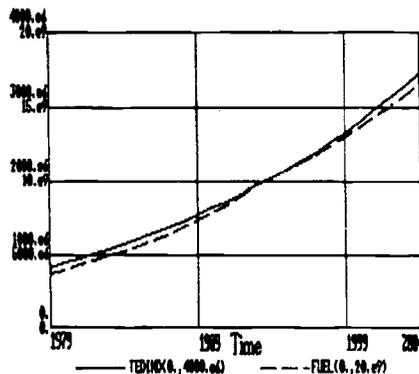


Figure 3. Simulation Output Thermal Fuel and energy Demand for Electricity

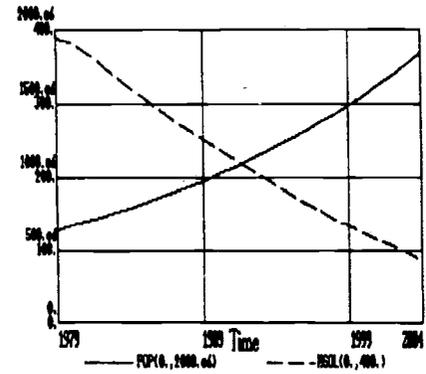


Figure 4. Simulation Output Population and Material Standard of Living

years?

Thus, the MSOL, in the form of a desired policy goal can be used as a criteria to represent the condition that we want for sustainability. Now, when the model is run, we can see what happens in the various sectors, and this can clearly give us an idea about the sustainability of the process -- though of course only of physical sustainability.

For example, we ran our model over 20 years, (Figures 3,4 and 5.) and found that if the current rates of growth continue for the period, there will be a rise in population, rapid increase in energy demands, severe pressures on water resources, and a declining MSOL. This implies that the growth is not sustainable. This kind of imbalances can be seen all around us. For eg., in China "there are the country's booming coastal provinces, some of which have grown so fast that the government can no longer supply sufficient power to run the factories" (Newsweek, Oct 10, 1988, pp.26)

But the crucial question is, are these merely temporary imbalances, mismatches of allocations, or are they of a more fundamental nature? Going back to our model, we find that water is a critical resource. That the water availability increases upto a certain point, keeping pace with population, but beyond a threshold value, the per capita water availability starts declining. The reason is that now water is so energy expensive to extract, that the per capita availability goes down.

Thus, we are now coming face to face with the basic issues in unsustainability. The stocks of water are not inexhaustible; they are renewed every year, and if we exploit them faster than this, they will start depleting. The major energy resources i.e. fossil fuels face a worse problem. They are not even renewable. So no matter how slowly or fast we use them, they are heading for depletion. *And this means that any system based on fossil fuels is inherently unsustainable, though of course, the fossil fuels may last us for*

another 100-150 years -- so this may not be so apparent. However, if we consider the environmental conditions put on the use of fossil fuels (greenhouse effects, climatic change...), we can certainly say that we will have to curtail severely our use of fossil fuels.

The Tools Capabilities

The general Behavior can be reflected even in an aggregated model

There are three important points about the model: The first is that though a crude and aggregated model, it is capable of showing the general and broad behavior of the system; i.e. indicate the direction in which the system will move. Secondly this model can be used as a driver for a detailed model of any sector. For example a detailed Agriculture model could draw its inputs from this model. Thirdly, the model can be used to study the impact of various policies on resources. In this mode thus, if we specify that industrial output per capita should be so much it will automatically draw in the corresponding amounts of energy, minerals and capital to industry. Any shortfall can be automatically made up by borrowings. Thus if we specify a desired output, the model will allow us to see the resource implications of this.

With some refinement this is the kind of tool that can take over where the Bruntland Commission left off... It will help policy makers to decide how to overcome the development and environment problems that confront us by allowing a rapid exploration of the consequences of their policies. □

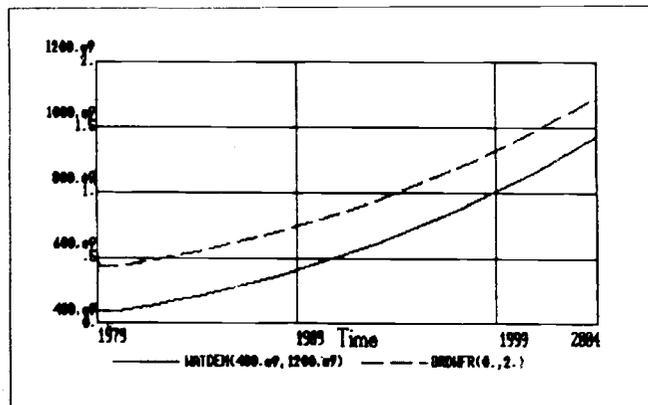


Figure 5. Simulation Output

Water Demand and Fraction Ground Water Used

Modelling in an Unsustainable World

For how long can I continue to do what I am doing at the given rate? And if the answer is "sufficiently long", I would say it is sustainable.

For how long will I be able to use coal as a fuel (...before the coal stocks of the world are exhausted?)? May be 500 years. Sustainable? The answer could be yes, or no.

Now if I ask for how long will I be able to use coal as a fuel (... if I want that the total CO₂ concentration in the air should not go above a certain value?) -- May be 100 years? See how dramatically the answer could change? Sustainable now?

The problem becomes far more complex when we start talking about the sustainability of two or more processes together. For how long will I be able to use coal as fuel and have sufficient water resources for ...?

As the development process consists of hundreds of different process integrated together, to study its sustainability is a very difficult and complex problem. Yet, it has to be solved.

Models are a substitute for the real system. They are the simply described real system. They serve the utility of being able to communicate the real system, to explore the actions on it in much the same way as civil engineers would test structures they build or aeronautical experts would carry out flight simulations before any crucial flight. They can help serve as a laboratory for exploring various policies before implementing on the real system.

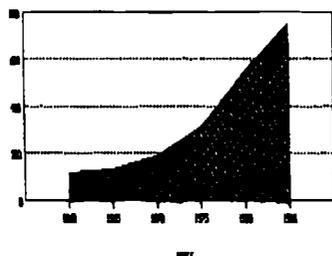
Today's fossil fuel based development path, where industries and industrialized agriculture means progress, is showing signs of unsustainability. Ecological imbalance, pollution, potential climatic changes and the possibility of oil and gas supplies running out within 50 years are all putting question marks on not just the sustainability of the current development process but on the very survival of the human race itself.

If we are to get out of this trap, and move to a better society, what we need are alternative approaches to development and some way in which we can evaluate whether these are sustainable or not. □

Liberated Army!

Since 1985, China has *demobilized* about one million servicemen, *nearly a quarter of the People's Liberation Army*. Many have found employment in the defence industry. However it wouldn't make much sense to keep churning out more weapons for fewer soldiers, so factories have been shifting to civilian goods. The Changfeng Machine Factory at Lanzhou used to turn out radars and electronic goods for the military; now it is mostly making household appliances. Some 400,000 washers and 80,000 TV sets came off the huge assembly line in 1987, with output aimed both at domestic sales and exports to Hongkong, India, West Asia and the Soviet Union. The factory has become a model for others planning to convert military plants to civilian

World Military Expenditure
(Billions of US \$ per year)



Tourist Booms

The Tourism Authority of Thailand's "Visit Thailand Year" campaign last year proved so successful that it has been supplanted with another year-long campaign called, "Thailand Arts and Crafts Year 88". The new slogan may not have quite the same ring to it, but no matter. The tourists keep coming anyway. Arrivals are widely expected to exceed the growth target of 8% this year. That would boost tourist numbers to 3.7 million compared with 3.4 million this year. It will also cement Thailand's place as the third most popular Asian destination after Hongkong and Singapore.

Source: Asiaweek, June 3, 1988

consumer products. Plans call for 70% of China's arms industry to undertake various civilian works by 1990. Since the factory switched from radars to washers, its annual turnover has risen from about \$19 million in 1985 to \$57 million last year.

Source: Asiaweek, June 24, 1988

Another Powerful Controversy?

The rivers that carry the annual run-off of melting snow from the Himalaya have a potential for providing 83000 megawatts of hydroelectric power (equal to about 75 large nuclear power stations). But sparsely populated and underdeveloped Nepal has had little need for more than a tiny fraction of that power. It currently generates about 160 megawatts. The Himalayan kingdom is planning a major dam in the Arun River Valley near Mount Everest. Nepal's major foreign aid donors have agreed to provide assistance. The dam will generate about 400 megawatts, enough to serve the electric power needs of central Nepal until the mid-1990's. The project is to be built in stages, with the first 200 megawatt segment coming on line in 1991.

Source: Asiaweek, June 3, 1988

Mapping Software Launched

Themaps, a software package providing for digital map editing and for quick production of thematic maps was launched on October 8th in Poona, India, by the Systems Research Institute.

The Package includes a DBMS for statistical data on areas and points and accepts ASCII data from other DBMS. It uses 14 presentation techniques and a variety of hatchings, line types and point symbols to represent information. Model results can be output through THEMAPS to show spatial changes.

SRI News Release

NOVEMBER

8th Annual Conference of the Association for the Advancement of Policy, Research and Development in the Third World

Theme : Towards a World Decade for Scientific and Technological Cooperation for International Development

Venue: Kingston, Jamaica

Dates: 20-25 November, 1988

Contact: Dr Mekki Mtewa, Executive Director, Association for the Advancement of Policy, Research and Development in the Third World
P O Box 70257, Washington DC 20024-1534 USA

International Conference on Environmental Impact Analysis for Developing Countries

Venue: New Delhi, India

Dates: 28 November - 2 December, 1988

Contact: Dr S B C Agarwala, Head, Pollution Control Research Institute, Bharat Heavy Electricals Ltd, Ranipur, Hardwar 249 403 India

DECEMBER

Third National Conference on System Dynamics

Venue: Dhanbad, India

Dates: 15-17 December, 1988

Contact: Dr Anand Mohan Agrawal, Organising Secretary, Third National Conference on System Dynamics, Dept of Industrial Engineering and Management, Indian School of Mines, Dhanbad 826 004 India

12th National Systems Conference

Venue: Coimbatore (India)

Dates: 21-23 December, 1988

Contact: Dr A Shanmugasundaram, Convener, 12th National Systems Conference, PSG College of Technology Peelamedu, Coimbatore 641 004 India

continued ...

JANUARY

26th Indian Econometric Conference

Venue: Bombay
Dates: 2-4 January, 1989
Contact: Dr M J Manohar Rao
 Dept of Economics, University of Bombay,
 C.S.T. Road, Santa Cruz (E),
 Bombay 400 098
 India

Fourth Conference in Economic Theory and Related Mathematical Methods

Venue: New Delhi, India
Dates: 9-12 January, 1989
Contact: Prof Arunave Sen
 Indian Statistical Institute,
 Delhi Centre, 7, SJS Sansanwal
 Marg New Delhi 110 016
 India

ISEM's Seventh International Conference on Ecological Modelling

Venue: Sao Carlos, Brazil
Dates: 9-13 January, 1988
Contact: Prof J Tundisi,
 Director, Centre for Applied Ecology,
 School of Engineering,
 University of Sao Paulo,
 Carlos Botelho 1465 Sao Carlos
 CEP 13560 Brazil

6th IFAC Symposium on 'Dynamic Modelling and Control of National Economies

Venue: Edinburgh, UK
Dates: 27-29 June, 1989
Contact: In-charge,
 Conference Division,
 The Institute of Measurement
 and Control,
 87 Gower Street,
 London WC1E 6AA, UK

PEOPLE

Mr Peter Goldmark was appointed the new President and Chief Executive Officer of the *Rockefeller Foundation*, effective 1 July 1988. He replaces *Mr Richard Lyman*. Director-General *Francis Blanchard* of the ILO appointed *Mr Tadashi Nakamura* as Assistant Director-General in-charge of ILO activities in Asia and the Pacific.

Dam ('nd) Controversy Dammed

What do the Duke of Edinburgh, the Housewives Society of Kanchanaburi, the Thai Union of Civil Liberties, Prince Bernhard of the Netherlands, the International Council for Bird Preservation and the Sierra Club in California have in common? The diverse group was united in its opposition to the proposed *Nam Choan* dam in western Thailand. The Electricity Generating Authority of Thailand (EGAT) wanted to submerge about 140 square kilometers in Kanchanaburi Province for the project. The dam's opponents -- including more than 30 domestic pressure groups -- argued that it threatened forests, wildlife and archaeological sites near the Thai-Burmese border. For six months they waged the hottest environmental campaign in the country's history to block the proposal.

Under pressure, Thai authorities decided their plan did not hold water. On April 4 the Council for Economic Ministers suspended the \$400 million hydroelectricity project. Earlier, a special 39-member committee chaired by Deputy Prime Minister *Gen. Thienachai Sirisamphan* had unexpectedly recommended shelving the dam because there was insuf-

ficient information about the benefits. But a more likely explanation, say observers, is that the project was becoming a political liability.

With or without *Nam Choan*, EGAT faces a crisis as demand from Thailand's booming economy threatens to outstrip power output by the early 1990s. EGAT relies on hydroelectricity for 30% of its power. The dam on the Upper Kwae Yai River would have fed up to 580 megawatts into Thailand's grid, enough to meet current needs in the northeast, the biggest and poorest region in the country, but not Bangkok. It would also have irrigated about 132 square kilometers of farmland.

But its opponents calculated it would irreparably damage about 950 square kilometers of forest smack in the center of the *Thung Yai* Wildlife Sanctuary. Together with the adjoining *Huay Kha Khaeng* Wildlife Sanctuary, it cradles a 5,000-square-kilometre pristine forest canopy. The two sanctuaries are Thailand's biggest remaining virgin forest.

Source: *Asiaweek*, June 3, 1988

Floods Ravage Bangladesh

Floods that ravaged Bangladesh inundated 2/3 of the country last month, leaving some 30 million of 108 million people homeless. Rivers such as the *Burhi Ganga*, one of the many that flows into the Ganges, became lakes. The capital city of *Dhaka* was itself 75% flooded. Though now the water is subsiding the threat now is famine.

The government estimated that the deluge wiped out nearly one-fifth of this year's rice crop in a nation where millions live at subsistence levels, even in good times. Moreover, the whole infrastructure of communication and transport has been devastated. Across the country, an estimated 250 bridges and 3500 kms of road were washed away, along with telephone cables, electric lines and so on. The extent of the destruction of transport

links has made even the distribution of emergency food a daunting task.

Floods occur every monsoon in Bangladesh, but this year the simultaneous swelling of two great waterways, the *Brahmaputra* and the *Ganga* created an unprecedented disaster.

The tragedy of Bangladesh brought to the forefront the far reaching effects man's intervention into the environment could be having. Most of Bangladesh's 200 rivers start in the Himalayas, and run through Nepal, Bhutan and India before emptying into the Bay of Bengal. Several analysts have explained the severity of the Bangladesh floods as being a consequence of the upstream mismanagement, dams and deforestation of the Himalayas. (See pg.2 for report of proposed study on flood control).

World Bank to reappraise Narmada Dams?

Informed sources report that the World Bank has ordered a complete re-appraisal of *Sardar Sarovar* beginning Jan '89, and may stop all funding till this is complete.

Sardar Sarovar is one of the large dams planned within the Narmada Valley Project in India. The Narmada Valley Project is one of the most ambitious river valley projects in the world. It envisages the construction of 2 gigantic, 28 major, 135 medium and over 3000 small dams on the Narmada and its tributaries. These are to be funded partially by the World Bank.

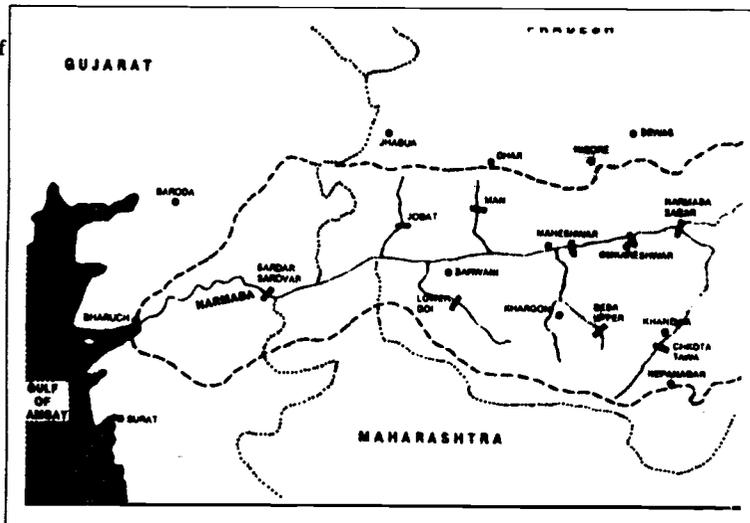
However, as with all large dams anywhere in the world, the two gigantic dams -- *Sardar Sarovar* and *Narmada Sagar* -- have become the focus of a nation-wide controversy. On one hand, the government claims that these dams will be a blessing for India; that they are essential for the development of the nation; and that all measures are being taken to avoid/compensate environmental damage, and to ensure proper rehabilitation and resettlement of those displaced by it. On the other side are a growing group, consisting of organisation of the oustees, NGO's working with environmental issues, economists, engineers, water management experts and concerned citizens who maintain that these dams (and any type of large dams) are devastating in their social and environmental impact; that their cost-benefit ratio is also skewed; and that these kinds of dams are not the only solution to the water problems of the country; a number of alternatives which are far less damaging to

the environment are available.

The clearance of the Planning Commission was the last clearance due; and hence, many people feel that now with clearance to the *Sardar Sarovar* dam given by the Planning Commission on the 5th Oct '88, the issue is over. However, those opposing the dam have declared their intention to stop the construction of the dam, and are demanding that the Government conduct a thorough re-appraisal of the dams as well as give serious consideration to the alternatives. Thus, the controversy, instead of ending with the Planning Commission's clearance, seems to be hotting up.

The controversy over the Narmada dams (and other such dams) has brought out the need for a number of studies that need to be made on this issue. Globally, we have now many decades of experience of building large dams; however, much needs to be done in evaluating the human, social and environmental impacts such dams. In spite of a small number of commendable studies, there is an urgent need for a range of studies - post facto analysis of dams, how much of the benefits have really materialised, what have been the costs, human, social, environmental, what are the alternatives to these kinds of dams and so on. And all these studies would need to be carried out in the context of new knowledge and techniques that have come forth in the last 10 years or so -- a multi-disciplinary approach with the full use of modern tools like computers and modelling.

The Proposed Dams in the Lower Basin of the Narmada



"A funny thing about regret is, that it is better to regret something you have done, than to regret something you have not done".

Butthole Surfers

"Reason deserves to be called a prophet for in showing us the consequences and effect of our actions in the present does it not tell us what the future will be?"

Schopenhauer, 1851

"If you don't look for the broader horizon, You're not elevating your own estimate of your own significance in life"

Ralph Nader HBS Bulletin, April 1988

"Nothing is more difficult, and therefore more precious, than to be able to decide"

Napolean

"Society is a contract, it is a partnership in all science, a partnership in all art, a partnership in every virtue and in every advancement"

Edmund Burke

"Would you tell me please, which way I ought to go from here?"

"That depends a good deal on where you want to get to" said the cat.

"I don't much care where --," said Alice

"Then it doesn't matter which way you go", said the cat
Lewis Carroll

"I'd rather give my life than be afraid to give it."

Lyndon B. Johnson

Do You Have Any Ideas, Thoughts, Insights and Anecdotes to share? Contributions are welcome provided proper credits are given!

Agriculture on a Changing Globe

Here are excerpts from an informal discussion that Prof M S Swaminathan, Eminent Agriculturist, former director general of IRRI, currently the President, International Union for Conservation of Nature and Natural Resources had with the ICDM editorial staff. The State of the World Environment, 1988 shows concern about the green revolution not resulting in marked increase in per-capita food production. With increasing land degradation with existing land use practices what does the future hold? Prof. Swaminathan who chaired the Advisory Panel on Food Security to the Bruntland Commission points out how twenty years from now the world food problem will be of ecological access.

Prof Swaminathan can be contacted at B 41142 Safdarjang Enclave, New Delhi 110 029.

Our Common Problems

Three major developmental issues confront us....

ICDM: What do you feel are the major development issues in front of us today? What is the nature of these issues on the global level and for the developing countries?

MSS: I feel that there are three major developmental issues facing the world today. The first is that of security. There is an urgent need to reduce the tremendous expenditure on arms -- which is now almost a trillion dollars per year. Today, the whole military establishment has become so strong, that changing our concept of 'defense' has become the No.1 issue. Not only is the military establishment diverting tremendous resources from other, more urgent areas, but also, it is leading to a culture of violence. See how the US ship shot down an Iranian civilian aircraft just the other day. It shows how the whole military establishment is breeding violence. What we need is a new developmental ethos with a different concept of defense.

The second major problems facing us today is of course the ecological crisis.

It takes different forms in different parts of the world, toxic waste in the industrialised countries, deforestation in the developing ones etc. But the major problem remains the same: how can we ensure that today's development does not undermine tomorrow's. And the challenge is certainly much greater for the poorer nations. The richer nations have the problem of maintaining their standard of living. For the poorer nations, the question is of how to meet the basic needs of almost a half the humanity.

The third major problem I feel is that of the international economy. Today, the whole of the third world is reeling under massive debts. Infact, now the problem has assumed such proportions that there is a net transfer of resources from the poorer countries to the richer because of interest and other repayments on earlier loans. This problem needs to be tackled immediately.

Moreover, today almost all the technology and other intellectual property is in the control of the richer nations.

The Food Problem is now of economic access . . . Twenty years from now the problem will be ecological access

They have all the advantages in agriculture, industry and services. The poorer countries have to divert an increasing amount of their resources to buy this advantage. Also, a similar gap exists between the rich people and poor people within a country.

ICDM: Do you feel that there is a world food problem? What is its nature?

MSS: Yes, there is a world food problem. And this is the problem of the inability of predominantly agricultural countries to produce sufficient food for themselves. The third world was the cradle of agriculture -- but now they have to import food. What is their future if agriculture does not prosper in these countries?

You see, the nature of the food problem has been changing. In the 60s,

the problem was of physical access. In the 80s' *the problem is now of economic access* -- i.e. the physical stocks of food are statistically sufficient, but people still go hungry because they lack the purchasing power. However, *20 years from now, the problem is going to be of ecological access.* The rate at which ecological degradation is going on right now will prove disastrous to our food producing resources.

There is one more point that I would like to make here. Too often, the problem of food is confused with availability of foodgrain i.e. cereals. I think there is much more to food than cereals; hence, I think I will describe the problems as the problem of nutrition security -- which means physical and economic access to adequate nutrition and safe drinking water.

The State of Agriculture

The long term productivity of Agriculture may be being endangered by some of its very strengths....

ICDM: How are these developmental and food problems related to the state of today's agriculture?

MSS: In three major ways. The first is technological. In many countries, not enough is invested into R&D to elevate and stabilize agricultural yields. Basically agriculture is site specific. So, even though agricultural science can be done anywhere, the technology can be established only in the field. Thus, all countries need to develop R&D in agriculture on their own. Just importing agricultural technology will not help.

The second is services. Agriculture needs a constant transfer of knowledge and skills from the laboratory to the field -- what are called extension services. But it is most important that the knowledge supply is in synchronization with the inputs supply. And this is lacking in many cases.

The third major point in the relation between agriculture and the food and developmental problem is that of public policy. Unless public policy successfully tackles such issues as land

reforms, input/output prices for agriculture, energy management and rural infrastructure, our food and agricultural problems are not going to be solved. For example, in India, out of total operational holdings of 90 millions, almost 80 million are below 1 hectare. How to stimulate production and consumption by these is a major public policy issue.

ICDM: What are the major strengths and shortfalls of today's agriculture?

MSS: The major strength of today's agriculture is that it is now possible to produce more and more food from less and less land.

Its major shortfall is that sustainability of the process is ignored. The long term productivity of agriculture may be being endangered by some of its very strengths. I think this is true about the whole process of development. The basic reason is the narrow outlook of our politicians. It rarely extends beyond the next election, or the next coup, in case of a dictator!

The Green Revolution

The green revolution has given rise to ecological, economic and energy problems...

ICDM: Can you explain for our readers the concept of the Green Revolution? What is your retrospective evaluation of it?

MSS: The term Green Revolution was coined by *William Gadd* of the United States Dept of Agriculture almost exactly 20 years ago -- in July 1968. It essentially involved increasing the yields of wheat and rice worldwide by using new high yielding varieties and a range of other inputs like fertilizers, pesticides etc. Its immediate success and popularity could be seen in India and Pakistan -- India even released a stamp on 'Wheat Revolution'.

Looking back at it now, I feel that one of its most important successes was in building up the confidence of a developing nation especially one like India, about its ability to feed its people. In the 50s and 60s, the whole atmosphere was gloomy. A lot of people were talking about India never becoming



Prof. M. S. Swaminathan

ing self sufficient in food grains at all. The Green Revolution did much to dispel this gloom and build up the confidence of these nations. There were of course, many other benefits. We did manage to keep Malthus at bay, though just because we can feed so many people is no excuse for letting our population increase.

The other important benefit has been that the green revolution has done much to stabilize food prices. Whereas prices of almost everything have gone up, the prices of wheat and rice have remained steady in real terms over the last 20 years. I think this has helped the poor people survive. Otherwise there would certainly have been much more political instability -- the poor people would have been forced into unrest if food prices had gone up along with others. However, this stability of price has also resulted in an adverse balance of trade between rural and urban areas.

The Green Revolution has also done much for increasing the social prestige of agriculture and agricultural science. However, there has been a negative side to all this.

The Green Revolution has given rise to ecological, economic and energy problems. The last is especially concerned with sustainability.

Technology, Appropriately Technologies need to be grouped and developed according to adoption needs...

ICDM: Many societal factors played a major role in the effectiveness (or otherwise) and reach of the Green Revolution. Is it possible that technology can be developed to include and plan for societal factors, so that its effectiveness is increased?

MSS: Yes, very much so. Not only can technology be so developed, but it must be. In fact, in the planning of any development strategy, social engineering aspects need to be given as much, if not more importance than just technological factors. In fact, I feel that all technologies need to be grouped (and developed) according to the adoption needs. Agricultural technology would need to be grouped under the three categories -- technology at the level of individual farmer (seeds, labour, non-monetary inputs), technology at the level of government action (large scale irrigation, agro-industries etc) and technology at the level of group action (village commons, rainwater harvesting etc.) It is the third level which I believe is the weakest. Thus, technology needs to be planned keeping these levels (and their social implications) in mind.

ICDM: What do you feel is the direction that agriculture should and will take now? What are the new trends and innovations in agriculture today?

MSS: I think what is most important in agriculture today is the preservation of the genetic diversity. With bio-technology making rapid studies, we need to maintain a wide base of genes for it to select from. We don't know what tomorrow's ideal gene pool is going to be, so we have to preserve all the diversity -- and especially the traditionally cultivated crops. As for the needs of the world, for South and South-East Asia, yield improvement is the only answer. But these will have to come from ecological means. In fact, the new ecological technologies are going to be heavily knowledge intensive. Hence, it is imperative to have a good R&D structure establish for these. For example, a group to start work on how to manage agriculture with relation to the monsoon is most necessary. We also need to do a lot of anticipatory research -- how would agriculture respond to in-

creased CO₂ concentrations 50 years from now and so on.

Also, from the point of view of gainful employment of the millions in the developing countries, agriculture and agricultural services will have to assume a much bigger importance. These will have to become skilled jobs. In fact, for every person in the primary sector, we should ideally have 3 people in the secondary and tertiary sector.

Sustainable Futures

There are two components to the energy inputs to Agriculture... solar energy and cultural energy...

ICDM: There is a lot of talk about "Sustainable Agriculture" nowadays. Could you explain your concept of "Sustainable Agriculture"? How does it relate to the broader concept of sustainability of whole societies or nations or of the world itself?

MSS: I will explain sustainability in this way. Productivity is the ratio of total output to total input added to annualised gain in capital (human, physical etc). Stability is low variation in productivity in the long run across the country. Sustainability is a constant or increasing trend in productivity over time.

In agriculture, sustainability will depend upon how we can manage the use of oil and coal and substitute it as much by solar energy as we can. Also, sustainability will depend much on how we can prevent the present ecological destruction.

Of course, both of these relate equally to the sustainability of whole societies or nations.

ICDM: How does this Sustainable Agriculture relate to energy in general and the availability of fossil fuels in particular? To the potential of solar and other renewable energy sources?

MSS: There are two components to the energy inputs to agriculture -- solar energy and cultural energy (i.e. all other energy input by man). Yield is a function of both these, and in general energy is the key to agricultural sustainability. Hence, I think we have to look at how to make the plant itself more energy efficient, as well as how we can increase the efficiency and effectiveness of cultural energy. The key is to try to substitute, at each point, farm grown input for market purchased (or factory produced) input.

And ultimately, to never forget that there is a physical limit to what a plant can produce. □

Political Scenarios of the Globe

Bremer, Stuart A (ed): *The GLOBUS Model - Computer Simulation of Worldwide Political and Economic Developments*, Campus Verlag (Frankfurt) and Westview Press (Boulder), 1987, pages 942. Price DM 168.00

The GLOBUS Model is the outcome of a major project in global modelling which was initiated in 1977 at the Wissenschaftszentrum Berlin. The main moving spirit behind the project was Professor Karl Deutsch, while the project director almost from the start has been Dr Stuart Bremer, the editor of the current volume. The GLOBUS is perhaps the only world model which has essentially been developed during the eighties, it is a model which has emerged primarily from the discipline of political science (though like most large-scale modelling efforts, it is to a great extent inter-disciplinary).

The model has been disaggregated into countries. This represents a major departure from previous world models, which were either monolithic in nature or used some type of regional disaggregation. For reasons of convenience, the model has been limited to twenty-five countries, with fair representation to the Western and Eastern blocs, and to developing countries (Argentina, Brazil, Mexico, India, Pakistan, Indonesia, and Nigeria, as well as some of the OPEC countries). There is also a rest-of-world entity.

From the sectoral viewpoint, the model has separate modules for economy, domestic political processes, demography, the government budget, international trade, and international relations. Each country has a separate sub-model for the first four of these, while for the last two, the bilateral country-country pair is taken as the basic unit.

The book has six chapters discussing the above modules in turn, each one authored by the researcher(s) responsible. Each chapter covers theoretical structure, estimation and parametrization, scenarios, and future developments. Despite the numerous authors, the presentation is highly unified and easy to go through.

It is not possible here to give a detailed critique of a 900-page book,

especially without access to the model it describes.

The domestic economic module has a dynamic equilibrium-seeking structure with explicit balancing of the demand and supply sides. Six: food/ agriculture, raw materials, primary energy, manufactures, armaments, and non-factor services fall into economic sector.

Conceptually the political module takes as its main theme the idea of political stability. The module is concerned with the levels of support for authority and regime, and how changes in support can lead to instability.

The two modules dealing with demography and the government budget seem to be subsidiary in nature. In fact, demographic processes are treated as exogeneous; the module uses the UN's population estimates and projections as the basis for growth rates for national population, and breaks these down to provide whatever variables are required by other modules (eg. labor force).

Both the international trade and international relations modules take the dyadic country-country pair as the primary unit, thus requiring a great deal of computation.

The international relations module is based on the quantification of exchanges of cooperation and conflict between nations. The behaviour received by one nation is mediated by the existing context (reactivity policy, predisposition and bureaucratic inertia) into an appropriate response, i.e. behaviour sent.

The GLOBUS Model is an exemplary piece of model documentation. It covers the important issues in world modelling and gives a good idea of the current *State-of-the-art* in the field. With the Micro version of GLOBUS now available, here is an excellent way for researchers or policy analysts to get to grips with modelling. □

Dr. Samaresh Chatterjee is Head, School of Management Science at the Maharashtra Institute of Technology, Poona. He is a former staffer of the ICDM. Dr. Chatterjee has been following the GLOBUS model for several years and has had first hand interaction with the GLOBUS team at Wissenschaftszentrum.

Modelling in China Today

By Prof J. G. Krishnayya

Prof J G Krishnayya visited Beijing and Xian in China during May, at the invitation of the Energy Research Institute of the Academia Sinica. He also attended a Conference on Economic Information Systems organized by the Chinese State Economic Information Centre in collaboration with Data for Development of Marseille, France, and the IDRC of Canada.

Towards the end of 1987, ICDM had held a Workshop on Energy Models which was attended by two Chinese scholars, one from the Energy Research Institute and the other from Tsinghua (or Qinhua) University. The invitation from ERI was a result of this contact. At ERI, which has many divisions, my main contacts were with the Rural Energy Division of which the Director is *Zhang Zhengmin* and from where *Mr Li Jun Feng* had come to our workshop. This Division has been collecting data on rural energy consumption patterns since the 1950's and is a rich storehouse of information. Since 1985 they have successfully completed twelve pilot projects at County level (a county in China has around 500,000 persons) to train the local officials in charge of Industry, Energy and Agriculture to develop twenty-year Energy perspective plans.

Three of these had been printed up already, and showed the impressive level of sophistication of the group, as well as their highly practical sense of what was appropriate to this level of community. It must be realized that the "county" in China owns and operates many industries -- electrical and mechanical as well as chemical -- which we outside might not think of.

The perspective plan included an analysis of the most recent consumption patterns, a projection model, and a normative exercise to improve efficiency of any use. While I was there a World Bank team visited to evaluate this project and was much impressed. We hope that SRI and ERI will collaborate over the next two years, with IDRC funding, on developing a family of Energy-Economy-Environment

models at county level suitable for the different regions.

A related organisation in the Academia Sinica is the Commission for Integrated Survey of Natural Resources, Over 600 scientists work here, again in many divisions; about half of them are in the field at any time. I was able to visit the Computer Group where I met the Director, *Dr Sun Jiu Lin*.

Dr Sun's group has not only done remarkable work on the *Great Wall PC* and on Microvax equipment in developing a very interesting database-cum-modelling-cum-mapping system for a province near Beijing that ran on the PC, using Chinese DOS, Chinese dBase etc. With this, it is possible to select one aspect, such as Urban Population, to ask for projections forward for any particular number of years, and then to receive the results, with the age-groups aggregated into policy-oriented groups, such as Pre school, Primary School ages, Secondary school ages, Military service ages, Working population, retirees, etc. It was when looking at these results that I was struck the strong effects of the Chinese population control policy: the lowest age groups were just over one-half the size of the age group 15 years above them! What this would mean in terms of the dependency ratio in thirty to forty years can be imagined.

Because of SRI's involvement in Geographic Information Systems, I visited some laboratories that did computer mapping, including the Institute for Remote Sensing Applications of the Academia. Here I found enthusiasm and some sophisticated applications on *Great Wall PCs* as well as imported micro Vax and special purpose U.S. mainframes. There seems to be very little chauvinism in China in relation to computer hardware. Our readers are probably aware of the extensive use of American Satellite Imagery in China but what interested me even more was a fascinating, useful River-flood control emergency information system built on the *Great Wall PC*. This again combined mapping of the river path (at different scales) and cross sections of the river bed, with a data base on the nature of the river

bank at different points, the locations of stores of flood-control materials, all vulnerable points such as rail bridges, etc. It was designed for real-time use.

The Conference on Economic Information Systems was conducted very competently, with simultaneous translation over portable headphones, and a remarkable lack of "show" on the part of the Chinese dignitaries. *Prof Zhang Shou*, Vice Chairman of the State Planning Commission (and a Deputy Minister of the People's Republic), who is in charge of the State Economic Information Centre, not only attended at the sessions of the week-long Conference, but carried his own bags, *Dr Hongren Zhou*, Deputy Director of the Centre, *Prof Wu Jia-Pei*, Chief Economist and *Prof Wang Tong* Director of the Department of Economic Forecasting, were some of the prominent economists and modellers who participated.

The Centre has several IBM mainframe computers in Beijing and one in each of the 20 provincial capitals. They are being linked as fast as telecom facilities allow. Each state unit of the centre has a large number of data entry and query terminals as well as a large sized laser printer. PC's and minis are used at district level.

At Beijing they use the TROLL modelling and economic time series system from MIT, which was installed about 3-4 years ago. Using this *Prof Wang* and his group have constructed several short term and long term national models for policy analysis. Their plan is to articulate these models with provincial models, using energy and some few commodities as the links. This has not been achieved yet. However, the enthusiasm and skill of the persons I met, the quality of the tools they have chosen, and the support they receive from the government augurs well.

One person I met at the Conference was *Dr Weiwen Gu* of Shanghai, who had attended ICDM's Singapore Workshop. Apart from discussing the possibility of a workshop at Shanghai, she mentioned that her next major project was to be a China-Japan-US trade model. □

If you have anything to do with policymaking...

International Workshop on Models in Policy Making

Day One : 21 Nov
 Presidential Address
Dr Hiten Bhaya
 Plenary Address
Prof. P N Rastogi
Prof. Hartmut Bossel
 Panel Discussion -
"Experiences With Using Models"

Day Two : 22 Nov
 Modelling the Dynamics Of Rural Poverty
Prof. P N Rastogi
 Modelling Agricultural Systems
Prof. Hartmut Bossel
 Lab Session

Day Three : 23 Nov
 Modelling for Urban and Regional Planning
Mr. Calvin Hamilton
 Modelling Global Socioeconomic-Political Linkages - GLOBUS :
Prof. Wolf Eberwein
 Lab Session
 Informal Work Groups

Day Four : 24 Nov
 Presentation of India Models
 Exhibition of Running Models

Venue
 India International Centre, New Delhi

Invitation
 There is **no charge** for participation, but participation on days 2-4 is restricted to 30 persons .

For more Information Contact:
Mr. Shripad Dharmadhikary,
 Coordinator, Workshop on Models and Policy Making,
 Information Centre For Development Policy Modelling,
 Poona 411037
 ☎ : 420323 Telex : 146 265 JNMP IN

An Event You Just Can't Afford to Miss!

Growing Populations and Policy Inertia

By the middle of the 21st century, India's population may reach 1,591 million people, compared with 1,555 million in China according to the U.S. Census Bureau's Population Profile: 1987.

India's latest birth rate is estimated at 32 per 1,000 population while China's is 20. India's population is increasing at an annual rate of 2.1 per cent against 1.3 per cent for China.

The latest demographic statistics for China as announced by *China Family Planning News* reported a crude birth rate of 21.04 per thousand and a rate of natural increase of 14.39 per thousand.

Population problems do not end with tackling problems of vast increases in the short times. (See relationships of growth rate to doubling time *table 1*).

The population born in a given year is called a cohort. All the cohorts can be represented together in the form of a pyramid (*fig. 1*). This represents the age structure of the population. Each cohort advances ahead in the pyramid every year as it ages and new cohorts add to the pyramid.

As a cohort moves ahead in time it imposes different kinds of pressures on the economy; a large cohort of young people moving into the childbearing age and work force will cause pressures on meeting employment problems and services. As this cohort ages and moves out of the work force pressures will be placed on the services for senior citizens. As can be seen (*Fig. 1*) the age structures of a region where each generation just replaces itself is likely to be uniform, causing

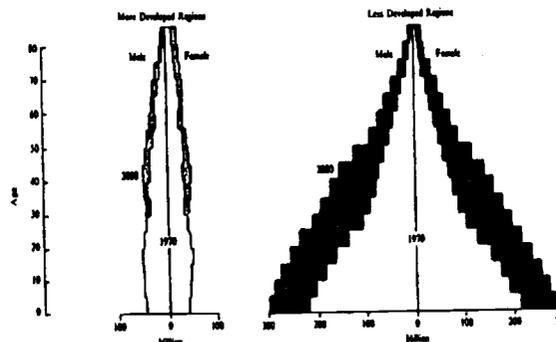


Figure 1.

little problem as cohorts age.

Qifan Wang of Shanghai Institute of Mechanical Engineering and *John Sterman* of MIT have created a disaggregate population model distinguishing 1 year cohorts and urban rural populations, the model serves as a tool to examine issues as shifting balance of children, workers, child bearing and elderly persons, effects of delayed marriage age, incentives for small families and growing disparity between urban and rural fertility. World 3 served as a 'parent' model in the exercise.

In the simulation the effect of inertia in the population is very striking. Though fertility drops below 2 children per family in the mid '80s, population continues to rise till 2020. This is a direct consequence of the large number of children born before 1980 who reach childbearing age between now and 2020. *Fig 2* indicates the age structures projected by the model in 2000 and 2024. □

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Growth rate	Doubling Time (years)
.1	700
.5	140
1	70
2	35
4	18

Table 1.

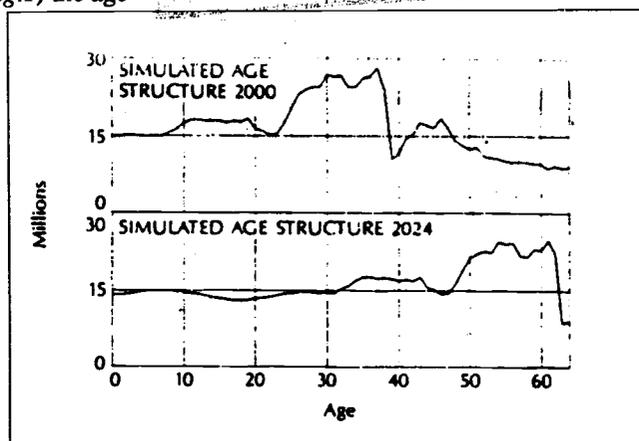


Figure 2.