Message from Global Models about an Interdependent World

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Global Interdependence: A Fact of Life

Most human beings have never heard of global models, let alone seen one. But periodically, major catastrophes, made vivid by media attention, remind us that we are small, fragile elements in a tightly linked, interdependent system – 1986 provided two examples. A chemical fire and spill in Basel, Switzerland poisoned 185 miles of the Rhine River, destroyed ten years of ecological restorative work, and threatened public water supplies. The long-term consequences are a matter of debate and speculation. A nuclear reactor explosion at Chernobyl produced measurable increases in radiation in far distant places. In the immediate region of the reactor, agricultural fields were contaminated. In some European countries, crops were contaminated and precautionary measures were initiated. The long-term consequences of this even are also a matter of debate and speculation.

Most examples of global interdependence lack this vivid quality. But their impact may be no less important in both ecological and human terms. Consider the following cases:

Cassava Farmers in Thailand. Fifteen years ago, cassava farmers in Thailand belonged to the lowest-income farm families. Protectionist agricultural policies in the European Economic Community (EEC) that set high support prices for grains and restricted imports have improved their lot

considerably. Cassava, in the form of tapioca, is not covered by EEC import restrictions and has proved to be a highly competitive substitute for feed grains.

In 1985, Thailand shipped 7.5 million metric tons of tapioca to Western Europe. This export has boosted foreign-exchange revenues considerably. Competition from tapioca, coupled with high import duties, have reduced grain imports to Western Europe resulting in considerable surpluses and also causing fiscal and financial problems in the American farm economy. But the story may not have a happy ending in Thailand. Continuous growing of cassava in poor soils heavily reduces soil fertility if nutrients are not replaced.

Cuisse de Grenouilles (Frog's Legs) from India. Frog's legs constitute more than 10 percent of India's marine exports and provide a substantial source of foreign exchange. Indians kill an estimated 100 million frogs each year to satisfy foreign palates. Western Europe is a major importer, but frog's legs are also shipped to Canada, Saudi Arabia, the United Arab Emirates, and Japan.

Unfortunately, frogs serve a useful function in the Indian ecosystem. The Indian bullfrog (Rana tigrina) eats its own weight in insect pests every day. Thus, thousands of tons of mosquitoes and other pests are surviving in India that would otherwise be consumed by frogs. This has resulted in a substantially greater local market for insecticides. Two of the most effective and wisely used insecticides for mosquito eradication and crop pest control are Sevin and Temik. Before it was shut down, the Union Carbide plant in Bhopal, India, produced 2,500 tons of these substances each year. (1)

Common Messages from Global Models

Work with global models was initiated nearly twenty years ago, in April 1968, when a small group of Western European industrialists and scientists created the Club of Rome. This "invisible college," as it is termed by its members, became a forum for ideas concerning the syndrome of problems facing humankind, or the problematique, as termed by its charismatic first president, Aurelio Peccei (2)

The syndrome of problems had a common cause: the unrecognized, unplanned, and unanticipated consequences of global interdependence. Population growth, economic expansion, and technological innovation had, within a few decades, transformed our world into one, tightly coupled system. In this system, problems were interrelated; apparent solutions to one problem aggravated or interfered with others. Addressing the problematique would require a global perspective and radically new analytical, planning, and decision-making tools that incorporated a planetary view.

Global computer simulation models were chosen as the tools that incorporated a planetary view. Global computer simulation models were chosen as the tools that could meet this requirement.

Thirteen major global models were developed during the period from 1970 through 1984. They were build in many parts of the world, and for varied purposes. They differed in level of aggression, methodology, key variables, time horizon, and output. The smallest model treated the world as a single, aggregated unit. The largest disaggregated the world into more than one hundred nations.

Modeling groups made different choices about what to put in and what to leave out. Only three models contain any mention of resources and environment. Only one says anything about war or politics. Some models were specifically built to refute others. One model was built for the purpose of emulating other models and contrasting their worldviews.

"Population growth, economic expansion, and technological innovation had, within a few decades, transformed our world into one, tightly coupled system."

After a major global modeling conference held in 1978, Donella Meadows, Gerhart Bruckmann, and I compiled a list of important conclusions from the seven models that were presented. Surprisingly, we discovered in each model similar qualitative conclusions about the current state of the world and possible scenarios for the future. Of course the modelers did not agree on everything and their numerical projections were quite different. But on the broadest level, there were consistent messages. Subsequent global modeling work has affirmed these messages and none has contradicted them.

The basic messages are:

1. 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.

2. Population and physical (material) capital cannot grow forever on a finite planet.

3. There is no reliable, 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.

4. 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, environmental destruction, and worsening economic conditions for most people.

5. Because of these difficulties, continuing current trends is not a likely future course. Over the next three decades the world 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.

6. 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.

7. 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 far advanced to be solved.

8. 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 about a desirable future. Restructuring social, economic, and political systems was much more effective.

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9. 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 intuitively, and probably also impossible to predict with computer models.

10. Because of these interdependencies, 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.

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

12. 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. (1)

Following the Ninth International Institute for Applied Systems Analysis (IIASA) global modeling conference, and after listening to the present-

ations from twenty projects (including the original seven), Donella Meadows identified eight additional areas of consensus. These eight areas are:

13. The structure of our socioeconomic system does not inherently produce a can produce either growth or decline, and the historical pattern has been cycles, first of growth, then decline, then low-level stagnation, then new growth. To produce a sustainable system with high quality of life requires both an explicit social goal of sustainability and a conscious structural redesign.

14. Food aid, and indeed, almost any direct commodity transfer from the rich to the poor, is counterproductive, except in times of emergency. It sets up a pattern of dependence rather than of self-reliance, it discourages the forces of self-help, innovation, and leadership already present in the cultures of the poor.

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15. Removing all government intervention in world trade is neither the panacea its advocates claim nor the disaster foretold by others. Freeing trade has very complex results, favoring some nations and industries and hurting others. Those helped and hurt cannot easily be classified into groups. The major change free trade induces is increased specialization-and hence increased efficiency, with increased vulnerability of each special part to a failure in other parts.

16. The Lima and Third Development Decade targets for economic growth in the Third World are so imprecisely defined they are difficult to measure or model; insofar as they are defined, they are not achievable, and they are so aggregate that, even if met, they may not imply any improvement in the state of the poor.

17. Exotic new technologies such as synthetic food and fusion power are not necessary to solve world problems and are probably too expensive to implement.

18. Macroeconomic growth rates, as measured by GNP or GNP per capita will probably be lower in all regions than simple extrapolations would suggest-and that news is not particularly upsetting, since GNP is not a useful measure of human welfare or progress.

19. Just about any good-hearted change in the system intended to help the poor manages to get twisted to help the rich instead. The system is rife with negative feedback loops readjusting any change back into the same patterns of distribution.

20. The vital arena to understand in order to work on almost any global problem is that of values, goals, individual, social, and political will-why people are what they are, make the decisions they make, and especially how such things can be changed. (3)

Global models tell us we live in an interdependent world; that change in the status quo is certain; that improvement in the state of the world is by no means impossible and by no means guaranteed. We are a long way from knowing all we need to know, but we know enough about where we want to go and how to get there to begin the journey. In fact, we have already begun the journey, whether we like it or not.

In one sense these broad, qualitative messages about the world are not surprising; all of us know about them at some level. Yet in another sense, they are revolutionary; if everyone internalized them and acted upon them, the world would be in a different place.

The Impact of Global Modelinng

Sweeping statements about the impact of global modeling would be presumptuous. But it is possible to point to specific examples of heightened global awareness. Future-oriented "twenty-first century studies" and the growth of grass-roots movements, emphasizing a global perspective, can be traced to the process of consciousness raising, regarding global interdependence, in which global modeling has played a part.

Twenty-First Century Studies. Government and privately sponsored twenty-first century studies are a major and highly visible activity that has been motivated by global modeling. The United States government's Global 2000 report was first. Since Global 2000, more than twenty national, regional, and world level studies have been initiated.

The Global 2000 report to President Jimmy Carter (1979) echoed concerns that had been expressed by the Club of Rome and some of the early global models. These concerns were now given the additional visibility and weight attached to an "official" government study:

> If present trends continue, the world in 2000 will be more crowded, more polluted, less stable ecologically, and more vulnerable to disruption than the world we live in now. Serious stresses involving population, resources, and environment are clearly visible ahead. Despite greater material output, the world's people will be poorer in many ways than they are today... unless the nations of the world act decisively to alter current trends. (4)

The massive China 2000 has been one of the more successful studies. The project had the enthusiastic support of Premier Zhao Ziyang and the ambitious second phase is being conducted at his request. (A draft of the second phase is reported to be thirteen volumes in length.) A recent visitor to China was repeatedly told that the China 2000 study had a considerable impact on China's top leaders and on the final draft of the seventh five-year plan (I986 through 199O). (5)

Many twenty-first century studies, including Global 2000, have had a

relatively narrow environmental focus. However, there is a trend toward examining interrelationships among environment, development, and war and peace issues. This return to the breadth of concern expressed in early statements of the Club of Rome's problematique is exemplified by "Common Future, The Report of the World Commission on Environment and Development. Work on the report was initiated in 1983; it will be presented to the UN General Assembly in 1987.

Major themes of the reportwere recently discussed by Commission Chair and Norwegian Prime Minister Gro Harlem Brundtland. Her statement echoed concerns expressed in more than a decade of global modeling:

> We share a world economy; a world environment, which is the basis for the present and future world economy; and a stake in world development and a decent and dignified human condition of life.
>
> We must learn to think globally and in a long-term persepctive. The world is shrinking rapidly. No single region or nation can isolate itself from the rest of the world. They share the responsibility for a common future. We need to dig deep into our political consciouseness and make the environment and sustainable development a prefit, not a retrofit. We must change our perceptions so that sustainable development and the conservation of our planetary heritage come to the forefront.
>
> We must come to see that many of our current approaches add up to a sort of piracy against our children that a truly civilized world can no longer tolerate. (6)

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Grass-Roots Organizations

A great number of nongovernmental organizations concern themselves with international development issues. Not long ago I compled a list of these as part of a sourcebook on just one global issue — world hunger. The list was longer than the book itself. Therefore, instead I chose to only list directories of organization. Seventeen directories were identified, printed in ten countries (including India, Nigeria, and Mexico), listing thousands of organizations. (7)

Lists focusing on other dimensionbs of the problematique would be similarly large. And there is considerable overlap. Organizations that focus on development are increasingly concerned with environmental and war and peace issues. Many organizations have been raising consiousness about environmental issues of "nuclear winter."

I believe it can be said that in less than two decades, the initial goals of the Club of Rome and the Global Modelers have been achieved. Issues of long-term global development are becoming a matter of public discussion. But new ways of htinking required for national policies to be shaped by global perspective have not yet become part of public consciousness.

Ways of Thinking That Are Inconsistent with Global Interdependence

While I have not done a comprehensive surey of the more recent twenty-first century studies, nonme that I have examined contradict the twenty basic messages we need to respond to. Most of the messages sound like common sense. But a list of the broad assumptions on which public policy is based in many nations (including my own) would read quite differently. This list would include statements such as the following:

1. Growth in physical capital and material output can and should continue indifinitely.
2. All problems of scarcity will be handled in a timely manner by national-level market mechanisms without significant social or economic costs.
3. It is better to postpone changes in social and technological systmes until the necessity for change is demonstrated by a major crisis.
4. Most major global problems have technological solutions. The more costly, complex, and centralized the technology, the more likely it is to be used successfully.
5. The actions, successes, and failures of one nation or transnational economic institution are bassically independent from those of others.
6. The future is predetermined by forces that rae beyond the control of individuals.
7. Most human beings are basically selfish and narrowly focused; they are inconcerned about the future, about the environment, or about other human beings on the planet.
8. There isn't enough of anything to go around; each nation and group should protect what it has rather than sharing.
9. The most important priority for any nation is to protect itself from potential adversaries by building up its military power.
10. Competition between nations is the only viable formm of international behavior. (8)

During the past twelve years I have spokent about the messages of global modeling to citizens and public officials throughout the world. Across cultures, walks of life, and classes, the majority of reactions I hear are the same. There is broad agreement with the basic messages, but there is also the belief that only a small minority shares that agreement. There is a

feeling of powerlessness, whether the individual speaking is peasant, corporate executibve, or cabinet minister. There is a velief that constraints imposed by social, political, and economic institutions prevent people from acting in accordance with the messages of the global models. The assumptions which shape present policies are unexamined, but taken for granted as true.

"The most important message is that changes in human values, modes of thinking, and visions of the future are needed for us to live more sustainably and harmoniously — indeed to survive — in an interdependent world."

Perhaps the most pernicious unexamined assumptions are exemplified by items 7 through 10 above. Such philosophies have become manifest in resource allocation priorities by nations around the world, and are both decried as immoral and accepted as essential. While the Brundtland Commission report may detail our global aspirations, the following sampling of information more accurately reflects what our values and priorities have manifested on the planet:

> The megatonnage in the world's stockpile of nuclear weapons is enough to kill 58 billion people, or to kill every person now living twelve times.
> In the Third World, military spending has increased fivefold since 1960 and the number of countries ruled by military governments has grown from twenty-two to fifty-seven.
>
> The US and USSR, first in military power, rank fourteen and fifty-one among all nations in their infant-mortality rates. The budget of the US Air Force is larger than the total educational budget for 1.2 billion children in Africa, Latin America, and Asia, excluding Japan.
>
> The Soviet Union in one year spends more on military defense than the governments of all the developing countries spend for education and health care for 3.6 billion people.
>
> There is one soldier per 43 people in the world, one physician per 1,030 people. It costs $590,000 a day to operate one aircraft carrier while every day in Africa alone 14,000 children die of hunger or hunger-related causes.
> In a world spending $800 billion a year for military programs, one adult in three cannot read and write; one person in four is hungry. (9)

How can we transform the world we have into the one most of us say we want? Global models do not provide an answer to this question, but they point the direction where the answer may be found. The most important message of global models is not about specific future projections or even

about global interdependence. The most important message is that changes in human values, modes of thinking, and visions of the future are needed for us to live more sustainably and harmoniously - indeed to survive - in an interdependent world.

Towards a New Mode of Thinking

In 1982 Donella Meadows, Gerhart Bruckmann, and I completed a book about the first decade of global modeling. The title of the book, Groping in the Dark, referred to the Sufi fable of the man searching for his front-door key under the lamppost, not because he lost it there, but because the lighting is best there. Our point was that global modelers would prefer more light, but feel they must work where the critical problems lie.

Our book shared not only the technology, but the personal experience of building global models and working with other global modelers. The most important consequence has been a fundamental transformation in our personal worldview. Living in an interdependent world will require greater levels of trust and cooperation. We know this is true, but must be willing to risk acting on this knowledge.

In the conclusion of the book, we tried to share our own experience of transformation and ourviews on the mode ofthinking towardwhich global modeling points. That statement is an appropriate conclusion for this survey as well. (1)

> The most basic message of the global models is not new and should not be surprising.
>
> We do not need a computer model to tell us that:
> we must not destroy the system upon which our sustenance depends.
> poverty is wrong and preventable.
> the exploitation of one person or nation by another degrades both the exploited and the exploiter.
> it is better for individuals and nations to cooperate than to fight.
> the love we have for all humankind and for future generations should be the same as our love for those close to us.
> if we do not embrace these principles and live by them, our system cannot survive.
> our future is in our hands and will be no better or worse than we make it.
>
> These messages have been around for centuries.
> They reemerge periodically in different forms

and now in the outputs of global models.
Anything that persists for so long and comes from such diverse
sources as gurus and input-output matrices must be coming
very close to truth.
The current condition of our globe is intolerable
and we make it so.

It is changing
because of what we decide

It could be beautiful
If we would only
decide to get along together
be open to each other and to new ways of thinking
remember what is really important to us
and what is less so, and
live our lives for that which is important.

As sophisticated, skeptical, scientific Westerners
We always react to statements like that by saying:

It sounds too simple
And is in fact impossible.
How could we ever decide to get along together?
You don't just decide things like that.
And how could we get everyone else to decide it?

(It couldn't be possible that everyone else is just like us
and is saying the same thing)

When everyone is so sophisticated
that they can't believe it could be simple to be honest and
to care, and

Everyone is so smart
that they know they don't count
so they never try

You get the kind of world we've got.

Maybe it's worth thinking another way
as if we cared and we made a difference
even if it's just groping in the dark.

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