

TOWARD GLOBAL EQUILIBRIUM: Collected Papers

Edited by
Dennis L. Meadows and
Donella H. Meadows

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Collected Papers Meadows / Meadows

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Toward Global Equilibrium:
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Preface

This book presents a series of papers written by members of the System Dynamics Group in the Alfred P. Sloan School of Management at the Massachusetts Institute of Technology to explore the nature and implications of physical growth on a finite planet. Using systems analysis tools developed under Professor Jay W. Forrester at M.I.T., it has been our objective to identify the various feasible modes of long-term social evolution and to determine how society might best move from its current dependence on growth toward a stable accommodation within the finite resources and environment of the earth. Obviously, no one group and no single methodology can fully satisfy that objective. Our work is reported here not as a final answer but as a contribution to better understanding and a foundation upon which the work of others may be based.

Over the past two years our research at M.I.T. has been sponsored by The Club of Rome and the Volkswagen Foundation. The Club of Rome is comprised of about seventy individuals from twenty-six countries who are united by a deep concern for the future of the world. Their objective is to sponsor research that will address global problems from an interdisciplinary, transnational, and long-term perspective. The Club of Rome was attracted to system dynamics and the research team developed under Professor Jay W. Forrester. Using system dynamics, Professor Forrester had constructed a model of global population growth and economic development.¹ Because the model provided a tentative explanation for many relevant problems, the Club decided in July 1970 to sponsor a project at M.I.T. to test and extend the model to provide more detailed analyses of the technological and economic forces that are leading to social stresses. I assembled a group of scientists and students in the System Dynamics Laboratory for that purpose and directed them in an eighteen-month study. The results of our work are summarized in three volumes.

¹Professor Forrester's preliminary model, World2, is described in Jay W. Forrester, *World Dynamics* (Cambridge, Mass.: Wright-Allen Press, 1971).

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The first volume, *The Limits to Growth*,² is a general, nontechnical report of our research, written to apprise policy makers and the public of the project's general objectives and conclusions. That report was released through Universe Books and Potomac Associates in early March 1972.

This book is the second volume of the project report. It incorporates thirteen of the papers written by the research team to introduce or enlarge upon various detailed aspects of the world modeling project.

In Part One of this volume, two introductory papers describe the general approach of system dynamics and the objectives of The Club of Rome's program. Seven detailed reports on the project's technical substudies are presented in Part Two. Each of these reports describes a complete simulation model constructed to determine the dynamic characteristics and implications of important relationships within one or more of the five global model subsectors: population, pollution, agriculture, nonrenewable resources, and capital equipment. Part Three contains four papers that were written to examine the economic, political, and ethical implications of the project findings.

Each paper in this volume deals with causes or consequences of growth in the globe's population or material output. Each of the thirteen papers was originally prepared and disseminated as an individual statement. They are published here to provide in one place a collection of the more important, shorter documents from the project. The papers retain essentially the form in which they first appeared. Only a few sections in several of the interpretive papers have been removed to decrease redundancy. Each paper is accompanied by a brief summary of the circumstances that led to its preparation and by a description of its contribution to the total program of research.

The third volume to be released in conjunction with the M.I.T. effort is a technical presentation of World3, the refined global simulation model constructed by the project team. That book, *The Dynamics of Growth in a Finite World*, will describe the revised global model, equation by equation, present and discuss the data underlying each assumption, indicate the relative strengths and weaknesses of various sectors in the model, and point to important future extensions of the work.

With the release of the third volume, the research at M.I.T. will no longer be supported by The Club of Rome. However, members of the M.I.T. system dynamics team will continue to study issues raised by the initial research and to cooperate with university groups interested in the transition to global equilibrium. Groups in at least five countries have already begun to carry the goals and methods of our work into studies of long-term problems related to population and material growth in their own countries.

While the proliferation of this research is encouraging, the effort directed toward issues posed by a transition to global equilibrium must clearly be enlarged

much beyond its current scope if any significant change is to be brought about in short-term policy making.

None of the papers included in this volume maps the path toward material and population equilibrium in detail. However, we believe that each sheds a little light on the general direction that must be followed, the questions that must be raised and answered, and the long-term, holistic philosophy that must be the basis of the many decisions along the way. We earnestly hope that the issues raised by our own preliminary efforts will stimulate the formation of other groups with a long time perspective, a global horizon, and the resources to begin interdisciplinary inquiry into the prospect and promise of global equilibrium.

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² Donella H. Meadows, Dennis L. Meadows, Jørgen Randers, and William W. Behrens III, *The Limits to Growth* (New York: Universe Books, for Potomac Associates, 1972).

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Part One Introductory Papers

An important part of the work at the M.I.T. System Dynamics Laboratory has been the dissemination of information on the methodology and the research results of the various projects undertaken in the System Dynamics Laboratory. The following two papers were written to apprise those outside M.I.T. of the progress of work on the Club of Rome project. They describe the history of the field, the components of the computer-based approach, and indicate the nature of the research undertaken.