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M E M O R A N D U M

TO: Mr. S.S. Reisman April 20, 1972.

FROM: A.R. Dobell

RE: Long-Range Planning and the Role of "Systems Dynamics"

Since the Department of Finance is establishing a small group to have some responsibility for monitoring long-term issues in economic or social policy, members of the Department may be asked to comment upon the recent flood of "doomsday projections" or claims for novel and powerful methods for analyzing such issues. I have therefore thought it worthwhile to prepare and attach a brief review of this debate, with some comments upon the likely usefulness of further work in this area. In particular, I have expressed strong skepticism that commissioning major studies of system dynamics by external - particularly foreign - consultants can yield any useful results on concrete problems of long-range policy.

The main points of this survey can be summarized briefly:

(a) There have been several recent reports on questions of continued economic growth and its consequences:

- "A Blueprint for Survival", The Ecologist,
- Jay W. Forrester, World Dynamics, Wright-Allen Press, Cambridge, Mass., 1970,
- Dennis Meadows et al, The Limits to Growth, Potomac Associates, Washington, D.C., 1972,

The conclusions of these documents might be summarized generally in the words of the Club of Rome project team:

"1. If present growth trends...continue unchanged, the limits to growth will be reached sometime within the next one hundred years....

2. It is possible to alter these growth trends and to establish a condition of ecological and economic stability that is sustainable far into the future....

3. If the world's people decide to strive for this second outcome rather than the first, the sooner they begin working to attain it, the greater will be their chances of success."*/

Obviously these results are hardly unique. As the authors recognize, most people who have looked at the issue have reached similar conclusions. It is deciding what to do next that presents problems. Quarrels arise in discussion of the nature and extent of intervention required to guide the system.

(b) One approach being intensively promoted as an appropriate tool for analysis of policy problems in these areas is the so-called "systems dynamics" technique. After the traditional fashion of consultants differentiating their product, this method is variously described as "a body of expertise uniquely suited to the research demands", "the only formal model in existence that is truly global in scope", "a new tool for the analysis of complex socio-economic systems", and so on.

In fact the procedure is nothing more than the description of a dynamic system by a set of straightforward difference equations (stock balances or accounting relations, involving little or no price behaviour), with the use of a computer program to update and plot the results. Such work is described in a number of documents cited in Appendix 1 to the following report, and, apart from the computer program ("Dynamo") itself, is nothing new to economists.

(c) Not surprisingly, social scientists have responded unenthusiastically to the claims of the engineers that this machinery yields great new insights into policy problems before us. While recognizing that the wonders of exponential growth and compound interest are important in the general nature of the Malthusian dilemma - and, indeed, that it is an important service to focus attention

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* Meadows, Limits to Growth, p. 23

on these issues - the social scientist generally has denied that so aggregate and abstract (indeed non-operational in the philosophical sense, so broad are its categories) a model can have value in analysis of real questions of economic or social policy. Four reviews of this work are attached as Appendix 2. Other (and more favourable) reviews are cited in Appendix 1 and available upon request.

(d) Notwithstanding the above reservations, we could do this kind of work within the Department if Ministers, the Prime Minister's Office, or the Privy Council Office, considered it essential. Probably we should expect to use these general techniques of analysis in study of more specific and concrete policy problems, and I propose to maintain the capability of this unit to carry out such work. One illustrative exercise along these lines has already been undertaken in the Quantitative Analysis Course, and I propose also to organize, as part of the next round of the Course, a presentation on these matters for interested officials. Appendix 3 provides a list of "Systems Dynamics" models presently available for use in this advisory unit.

(e) In fact, however, experience with these models suggests that commissioning from outside consultants more such work at this level of aggregation is unlikely to be useful in concrete applications. The reasons behind this conclusion are:

(i) A model which is to be useful in real questions of public policy must reflect specific policy issues; a highly aggregated, very general model can display only a superficial picture of policy options.

(ii) A model adequate to concrete policy problems must reflect relevant detailed data; it is nonsense to assert that specific policy conclusions can be completely (or even moderately) independent of the actual numbers describing the issues under study.

(iii) A model appropriate to specific issues of policy must itself evolve from the concrete features of the particular problem; general tools in search of problems to be solved rarely capture the right problems.

(iv) Present work of the "Systems Dynamics" type, while highlighting possible consequences and crucial problems arising from present exponential trends,

> fails to reflect many natural adjustment mechanisms in the economy, and thus fails to reveal the appropriate channels and extent of government intervention required to deal with these problems. Thus, while the work to date has served some purpose, more detailed analysis may require different tools, or application of "systems dynamics" techniques in different ways.

We conclude that the debate is not about the existence of Malthusian problems; it is about the extent to which some self-regulating adjustment mechanisms already exist in the economic system, and the extent or nature of government intervention required to deal with emerging problems. Undoubtedly very active policies are required in dealing with management of common property resources or questions of environmental degradation and the quality of life. But on these questions of concrete policy the systems dynamics models available off the shelf or from external consultants are silent, and cannot be otherwise. If work of this kind is going to be useful, it must be undertaken where it will be used, either internally or with the active and direct participation of government personnel.

Thus, nobody argues that the questions raised and the conclusions reached by the proponents in this debate are unimportant, or challenges the possibility that their prophecies may be realized. But, having once demonstrated that present exponential trends cannot continue, these models have for the moment reached the limits of their contribution. Useful policy analysis must follow other paths: even where difference equation representations of the problem might be helpful, they must be at a more detailed, concrete and operational level if they are to be useful for more than armchair conjectures. In the contest for the minds of men, both "big think" based on sweeping speculation, and "little think" based on empirical slogging, have their place. But just as "little think" may drift into myopia, so "big think" may drift into dreams. And in policy analysis, dreams without facts may turn into nightmares.

ARD/md

Attached: "Systems Dynamics in Perspective"