IMPLEMENTATION ISSUES

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Summary

System dynamicists have always been concerned with having an impact -- with working on important problems and having their work lead to organizational change. Having an impact almost always starts with implementing specific decisions or actions. This requires working on an important problem, developing a comprehensive, validated model, and using an effective process with significant client involvement. But system dynamicists have an impact in other ways as well. In addition to implementing specific decisions or actions, their work can lead to implementation of insights which improve manager’s mental models, to continued use of an existing model, and/or to the development of an internal expertise in system dynamics modeling. All require commitment and effort on the part of the client, and an on-going relationship with the system dynamics experts.

1. Introduction -- The Implementation Challenge

“Implementation, n."to carry out, accomplish, especially, to give practical effect to and ensure of actual fulfillment by concrete measures” [Webster's New Collegiate Dictionary, Springfield, MA: G. & C. Merriam Company, 1974]

Since its beginnings in the 1950s, system dynamics modelers have tried to have an impact. Jay Forrester, the founder of the field, insisted that his students work on important practical problems. He would observe that solutions to the important issues

are no more difficult to find than solutions to the unimportant. By this, Forrester did not mean that finding solutions to important problems would be easy; only that for the same effort, the payoff would be far greater. Indeed, Forrester's early work [Industrial Dynamics (1961), Urban Dynamics (1969) – *For a summary see: Urban Dynamics*] suggested that finding leverage points in a system was difficult, requiring about a year of intense intellectual effort. Nevertheless, if you are going to spend the time, Forrester reasoned, why not be spending that time on problems which would make or break an organization?

While there is no doubt that Forrester's work found real solutions to important problems, a further difficulty was quickly discovered: managers were often resistant to implement the proposed solutions. Because current policies were based on existing mental models, it should not have been surprising that managers would resist adopting the counter-intuitive policies that go against those mental models! Of course implementation was not a problem that only plagued system dynamics. Every approach to quantitative decision-making was encountering implementation difficulties of one form or another. And this was particularly true for those approaches that were meant to improve or substitute for management decisions (for example, by providing specific decisions or by designing alternative ways of making decisions), rather than just automate existing processes. Perhaps what is remarkable in retrospect is that the early System Dynamics practitioners were surprised by the problem. The field had been founded on the idea that managers themselves should be able to understand system dynamics models because those models should correspond to manager's mental models. The early view was that once managers *understood*, implementation would follow almost effortlessly. Subsequent experience has indicated that managerial understanding is in fact key; but, getting managers to understand an "understandable model" is itself not effortless and additional hurdles – from conflicting agendas to unwillingness to suffer short-term costs for long term benefits – arise even after understanding has been achieved.

Early in the application of system dynamics (and other modeling approaches), it became clear that doing good technical modeling work alone did not always produce successful change. Something more was needed. Thirty or forty years ago models were viewed as a means of putting science into management. Conventional wisdom at the time was that following the scientific method was all that was required to achieve improvement in organizations. The expert scientists (modelers) would analyze the situation, build a model, "validate" that model, and come up with recommendations to improve the situation (the infamous report) for management to implement. The results were sold based on the authority of the results: taking these actions would improve profits by X%. Yet this rarely worked effectively.

Roberts (1977) cites a long list of modeling failures, and notes "Organizational changes (or decisions or policies) do not instantly flow from evidence, deductive logic and mathematical optimization." "Scientifically" designed policies do not often sell, and the scientific method alone does not produce organizational change. The difficulty in implementing these wonderful approaches was unforeseen. By the sixties, the problem of implementing models was a topic of discussion and research within management science.

Research suggests that there are two reasons why scientifically designed policies are difficult to sell. First, most policies, that is, the basis for making decisions, do not normally arise by scientific design, but from a more organic process based on tradition, folklore, mimicking, and trial and error improvement [Hines and House, 2001]. Scientifically designed policies are unusual, and we resist the unusual. And second, people are resistant to changes, especially those that they do not completely understand the basis for, or do not participate in developing. Resistance to change can arise for any number of reasons [Roberts 1977, Sterman 2000]:

- Lack of any perceived need to change;
- Misunderstandings of what is intended;
- Disbelief that the change will make things better rather than worse for the individual (reflecting the reasonable belief that their own welfare is rarely the object of changes initiated by others, that is, the goals and reward structure for the individual are different than for those driving the change);
- Personal animosity from traditional sources of advice and information that have been supplanted by the drivers of change (usually external consultants); and
- Unwillingness to suffer the likely short-term costs for less certain potential long-term benefits.

It became recognized that the process of individual and organizational change was complex and difficult. Behavioral theory now describes the change process in terms of unfreezing, moving, then refreezing, of individuals and the organization. This process requires a great deal of personal interaction between the consultants/modelers and the client, in order to build trust with individuals, and gain their confidence in the cause of the problem, the reason things need to change, and the needed change. The "political" situation in the organization and the power/influence centers need to be understood and brought on board. This process requires a lot of on-site work and a set of skills that are different from, and often incompatible with, the skills needed for effective modeling. Effective change management requires skills such as communication, listening, facilitation, and selling; effective technical modeling requires skills such as an ability to think abstractly, to analyze many complex interactions, to focus on details, and so on.

The many difficulties and failures of consulting as science gradually led to a shift toward consulting as change management. The ideas of systems thinking and organizational learning, popularized by Peter Senge in *The Fifth Discipline*, all focus heavily on the consulting process [Senge, 1990]. The pendulum has swung, and conventional wisdom today is that the process is what's important, that group modeling is the best way to do system dynamics, and by itself takes care of implementation problems.

However, it seems to us that focusing solely on process runs a serious risk of erring in the other direction. While the results are perhaps more likely to be implemented, the quality of those results, especially where no formal modeling is done, is in many cases questionable. Without following the scientific method, there is considerable risk that the models will yield erroneous conclusions [Homer 1996, 1997]. We fear that the pendulum has swung too much in the process direction.

In our view, successful implementation requires both process effectiveness and product integrity. As discussed below, the right mix is governed by a number of different factors. However, perhaps most important from a system dynamics perspective is that the right mix depends most on the answer to the question: "What are we implementing?" When today's system dynamics practitioners think of implementation, they typically mean one or more of the following four possibilities:

1. Putting into practice specific policies or decisions ("traditional implementation");
2. Internalizing insights that can be used in unforeseen ways to make faster and better decisions in the future ("learning," that is, improved mental models of dynamics);
3. On-going enhancement and use of a system dynamics model in managing an organization ("institutionalizing a model"); and
4. Acquiring skills and capabilities needed to use the system dynamics approach internally without continual need for outside support ("institutionalizing system dynamics")

Generally speaking, implementation would tend to follow chronologically in the above order. One would first implement specific policies from *a* model, before then moving on to institutionalize a model and the modeling process. Implementation of insights can occur all along. In the remainder of this paper, we will discuss product and process approaches to implementation from the viewpoint of what is being implemented. We write this from the perspective of an external consultant. However, most of the comments apply to internal consultants as well. Further, the focus of our discussion is on organizations with a limited number of decision-makers who can effect change, primarily businesses.

2. Putting into Practice Specific Policies or Decisions ("Traditional Implementation")

The first and probably still dominant use of system dynamics models has been the development of specific decisions and/or policies to improve organizational performance. A model is developed to understand how the structure of the organization and its environment interact to create the organization's problems. (For examples see *the application articles in theme 6.63*). Then, the model is used to determine specific changes in structure, for example, policies for adding capacity ("increase capacity by 5% two years after the peak of orders") or specific actions (build this size production facility now), that will improve performance. Successful change requires a compelling reason for the change (problem), a compelling solution (product), and a process which accomplishes the required change.

2.1. Defining an Appropriate Problem

While it should go without saying, selection of the problem is the first critical decision on a project. While great emphasis is placed in system dynamics on problem selection from a technical standpoint (particularly the need for dynamic behavior modes), problem selection is also critical to implementation. Given that anything important is

likely to require significant organizational change, disruption, and/or investment, it has to be worth the effort. Moreover, the problem must be important in order to achieve the necessary process participation from the client. Therefore, the model needs to focus on a problem that is important to the client in that the results address a significant concern with large financial consequences. In the extreme, there is nothing like a crisis to make organizations receptive to change.

If implementation is your objective, beware of clients who are looking for a "corporate model." While it may be interesting and challenging to develop a new model in an exciting industry, not much is likely to come of it. On a number of occasions we have undertaken projects where having a model was really more the objective of the client than solving a specific problem. While there often seemed to be an issue or focus for the modeling, that focus was not always of great importance to the client. As a result, the client often lost interest as the project progressed. While generally a few insights were gleaned and the effort was considered worthwhile, true implementation of specific actions did not occur.

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Bibliography

Forrester J. W. (1961). *Industrial Dynamics*, 464 pp. Cambridge, MA.: The M.I.T. Press. [The seminal first book describing the field now called system dynamics].

Forrester J. W. (1969). *Urban Dynamics*, 285 pp. Cambridge, MA.: The M.I.T. Press. [The first published application of system dynamics outside of a business setting].

Hines J.H. and D.W. Johnson (1994). Launching System Dynamics. *Proceedings of the 1994 International System Dynamics Conference, Business Decision-Making*, Stirling, Scotland. [Paper describing one perspective on consulting with system dynamics and establishing an internal capability].

Hines J. H. and J. D. House (2001). The source of poor policy: controlling learning drift and premature consensus in human organization. *System Dynamics Review* **17**(1), 3-32. [This paper describes the process by which decision rules are developed in organizations and illustrates with genetically-based algorithms for learning].

Homer J.B. (1996). "Why We Iterate: Scientific Modeling In Theory and Practice", *System Dynamics Review* **12**(1), 1-19. [This paper discusses the use of data in system dynamics modeling and illustrates its importance with three case examples].

Homer J.B. (1997). "Structure, Data, and Compelling Conclusions: Notes from the Field", *System Dynamics Review*, **13**(4), 293-309. [This paper builds on and generalizes the work described in the prior paper].

Lyneis J. M. (1999). System Dynamics for Business Strategy: A Phased Approach. *System Dynamics Review* **15**(1), 1-34. [This paper discusses a four-phased approach for business consulting using system dynamics, and illustrates the value of the approach with two case examples].

Lyneis J. M. (2000). System Dynamics for Market Forecasting and Structural Analysis. *System Dynamics Review* **16**(1), 3-25. [This paper discusses the use of system dynamics for forecasting and shows how a structural model can be used to learn about changes in system structure].

Richardson G. P. and D.F. Andersen (1995). Teamwork in Group Model Building. *System Dynamics Review* **11**(2), 113-138. [This paper discusses the various roles necessary to effectively implement a group model building exercise].

Richmond B. (1997). The Strategic Forum: Aligning Objectives, Strategy and Process. *System Dynamics Review* **13**(2), 131-148. [This paper presents another view of the consulting process using system dynamics].

Roberts E. B. (1977). Strategies for the Effective Implementation of Complex Corporate Models. *Interfaces* **8**(1), 26-33. [The first published work in system dynamics to discuss the implementation challenge and to lay out a list of actions to be taken to enhance the chances of success.]

Senge P.M. (1990). *The Fifth Discipline: The Art and Practice of The Learning Organization*, 424pp. New York: Doubleday. [This best-selling management book introduces the skills needed to improve learning within an organization].

Sterman J. D. (2000). *Business Dynamics: Systems Thinking and Modeling for a Complex World*, 982 pp. Chicago: Irwin/McGraw-Hill. [This textbook defines the current state-of-the-art in system dynamics].

Vennix J. A. M. (1996). *Group Model Building: Facilitating Team Learning Using System Dynamics Field*, 312 pp. Chichester, UK: John Wiley & Sons. [This book provides a comprehensive discussion of the theory and process of building models with a management team].

Winch G. W. (1993). Consensus Building In the Planning Process: Benefits From a "Hard" Modeling Approach. *System Dynamics Review* **9**(3), 287-300. [This paper presents another view on the consulting process using system dynamics].

Biographical Sketch

Dr. **James Lyneis** is a Professor of Practice in the Social Science and Policy Studies Department at Worcester Polytechnic Institute, where he teaches system dynamics and economics. He is also a Senior Lecturer at MIT, where he teaches System Dynamics and System and Project Management. Prior to joining the WPI faculty, Dr. Lyneis worked for 25 years in the Business Dynamics Practice of PA Consulting Group (formerly known as Pugh-Roberts Associates). He was General Manager for Pugh-Robert's European office from 1988 - 1990. At Pugh-Roberts, he specialized in the application of system dynamics techniques to business strategy, market analysis, project management, and management training, and worked in the telecommunications, electric utility, aerospace, and financial services industries. Prior to consulting, he was an Assistant Professor at MIT's Sloan School of Management. He is author of the book Corporate Planning and Policy Design: A System Dynamics Approach, as well as numerous journal articles. Dr. Lyneis has a Ph.D. in Business Administration from the University of Michigan and undergraduate degrees in Electrical Engineering and Industrial Management from MIT.