IN REVIEW

Modeling for Learning Organizations

reviewed by W. Brian Kreutzer

Using causal loop diagrams or systems archetypes to explore a significant organizational problem can be an eye-opening experience. As a team works through the diagrams, its members gradually come to the realization that the chronic behavior they have been wrestling with may, in fact, be produced by the very structure of the system. With this knowledge comes the realization that by changing the structure, they can finally free themselves and their company from the shackles of a persistent problem. In their excitement, the team members frequently want to act on their new insights right away. Unfortunately, this can often turn out to be the worst possible response.

Drawbacks to Causal Loops

Causal loop diagrams (CLDs) and systems archetypes can be extremely effective for surfacing mental models and discussing potential solutions. However, they cannot effectively analyze the dynamic *consequences* of those solutions. As MIT professor John Sterman points out, CLDs and archetypes are working hypotheses about the interconnections in the real system, but they are not precise enough representations to be used for predicting the outcomes of decisions.

How, then, can managers examine the possible consequences of their actions and make better informed decisions? In order to vigorously test hypotheses, we must translate CLDs and archetypes into mathematical simulations. But for a non-modeler, this can be a daunting process. What resources are required? What does a typical modeling project look like? What can be learned from other companies' experiences? Fortunately, a recent publication addresses these questions.

Modeling for Learning Organizations, edited by John Morecroft and John Sterman, is a collection of 18 essays by leading practitioners and theoreticians in the field of system dynamics. It provides practical tips, techniques, and case studies that demonstrate how modeling can be used to support learning in organizations (see "What's Inside"). This unique volume not only provides the reader with an in-depth look at the tools of system dynamics, but it also discusses several critical modeling processes that can be used to test causal hypotheses. The varied essays included in this volume are grouped into four main sections: an overview of the model-building process, summaries of business applications, methods for sharing insights from the modeling process, and descriptions of software and modeling tools. In addition, real-world illustrations that show how system dynamics has been used effectively in a variety of corporate settings are sprinkled throughout the book.

Model-Building Process

Simulation models can greatly aid decision-making by providing a way to assess the dynamic consequences of a set of potential policies. Once managers have mapped policies of the system into mathematical equations, the computer model can show the outcome of that particular set of assumptions. The results of these simulations often illustrate the counter-intuitive nature of complex systems, which is not usually apparent in the CLDs or archetypes. By providing a way to assess the dynamic implications of various alternatives, simulation models can enhance managers' effectiveness in designing policies and decisions that create genuine, long-term solutions.

The first part of the book explores the process of model building through essays such as John Morecroft's "Executive Knowledge, Models, and Learning." In this chapter, Morecroft explains how models can be used to capture, filter, and organize knowledge, and discusses how they can be used by managers to facilitate experimentation and learning.

In "Policies, Decisions, and Information Sources for Modeling," founder of system dynamics Jay W. Forrester goes one step further to explain how models can be developed to enhance actual decision-making. Forrester defines decision-making as the process of converting information into action, and breaks it down into three distinct stages: determining the actual condition, determining the desired condition, and developing a plan to achieve the desired condition. Because such plans are generally based on specific policies, Forrester argues that if managers gain a better understanding of the dynamic consequences of their policies, they will be able to make better decisions.

Real-World Applications

The test of a good model or methodology is whether it can help make real improvements in organizational performance. In part two of the book, the editors provide a collection of case studies that describe how system dynamics modeling was used to help managers gain a better understanding of how to create high-leverage change in the sys-

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tems in which they operate (see "Modeling in Action: Case Studies from the Field").

One of my favorite selections here is "Systems Thinking and Organizational Learning: Acting Locally and Thinking Globally in the Organization of the Future," by Peter Senge and John Sterman. This chapter describes how the Hanover Insurance Company used a learning laboratory to help its managers come to the realization that "external" problems—such as an increasing number of claims requiring litigation—were actually the result of *internal* policies and decisions.

Hanover Insurance's experience began with a desire to use the tools of system dynamics to explore issues involved in claims management. First, a model was created by a team of claims managers (facilitated by outside consultants) to map the managers' mental models of the claims management system. This model was then incorporated into a management flight simulator that could be used by a non-technical audience to conduct their own exploration of the issues. Eventually, the flight simulator was incorporated into a workshop that allowed groups of claims managers to come together and explore the dynamics that affected their performance as an organization.

One counter-intuitive insight that came out of the workshops was that in their efforts to restrain costs by aggressively managing the number of adjusters, the claims managers were inadvertently *raising* their costs. The reason? By not having enough skilled adjusters on hand to assess claims accurately, the level of service quality declined, thus contributing to escalating settlement costs. Senge and Sterman not only discuss Hanover's experience, but also draw some general conclusions from that setting about how others can design effective learning environments.

Learning from Models

As the managers at Hanover Insurance discovered, the model builders themselves learn a great deal about the system under study during the modeling process. But many teams struggle with how to share this experience with a wider group of people. In part three, learning laboratories are explored as a means to transfer learning from the core modeling team to others in the organization. Learning laboratories are a form of simulation-based training workshops in which managers use system dynamics models to help them challenge and improve their mental models. But how effective are they?

"Experimentation in Learning Organizations: A Management Flight Simulator Approach," an essay by Bakken et al., examines how well-suited learning laboratories are for transferring learning, and offers ways to enhance managers' ability to transfer learning

What's Inside

The following is a list of the articles contained in *Modeling for Learning Organizations:*

from the workshop to the workplace. In the study, managers participated in two learning labs—one in which they were responsible for making decisions based on anticipated world demand for oil tanker transportation, the other in which they made decisions based on the anticipated demand for office real estate. The simulators were designed so that, although the two settings were different (oil tankers vs. real estate), the underlying model was essentially the same.

For the most part, managers who had been exposed to one simulator did perform better on the other simulator, indicating that there was some transfer of learning from one setting to the next. More importantly, the more times a player went bankrupt (indicating that he or she used the simulator in a more "exploratory" mode to gain a better understanding of the underlying dynamics), the better they were able to transfer insights from one game to another. This points to a critical value of simulation modeling: participants may take risks in this "safe" environment without having their decisions pose a threat to their organizations, all the while accelerating their learning process so that their decisions back on the job will be better informed from a systems perspective.

Software

Part four includes descriptions of many products available from the major vendors of system dynamics software. It also describes how these products can be used to create models that aid organizational learning. More than just a listing of software, this section provides the beginning modeler with a set of resources for learning more about the modeling process. For example, in "Software for Model Building and Simulation," Steve Peterson illustrates how one software product was designed to help the modeler navigate the various stages of model building—from conceptualization and model construction to model simulation analysis and communication. This section aids managers in identifying the kind of software that will best suit their application needs, while at the same time offering further insights into modeling design and execution.

Over all, *Modeling for Learning Organizations* provides an excellent balance between system dynamics theory and practice. These essays give the systems thinker both an introduction to the academic underpinnings of system dynamics, as well as many illustrations of how this work can be applied in the context of organizational learning.

After reading this book, managers will be better prepared to decide if mathematical modeling can add value to their systems thinking efforts. If so, the annotated bibliography can help them decide where to go next for further study and practice. Though the book is somewhat theoretical and tends toward an academic tone (some of the vocabulary may be challenging for those with no prior introduction to system dynamics modeling), *Modeling for Learning Organizations* is an essential resource for any manager who wants to go further into studying the science behind the learning organization.

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Modeling in Action: Case Studies from the Field

Modeling for Learning Organizations contains many organizational applications of simulation modeling. The following are a few examples of how system dynamics tools have been used in conceptualization, scenario planning, and policy design.

The Health Care Insurance Organization

In this case study, Vennix et al. describe how system dynamics was used to model the rise of healthcare costs in the Netherlands. The authors also survey and evaluate several different techniques—such as a form of the Delphi method—that were used to capture the mental models of healthcare professionals involved in the study. Although this process yielded some benefits, the authors concede that it remains more of an art than a science, and much work needs to be done to formalize the process into a tangible set of variables that can be identified and mapped systemically.

People Express Airlines, and Intecom PBX Market

Graham et al. discuss how a simulation-based exploration of the strategic issues facing these two companies has been used to supplement the traditional case study methodology popular in graduate business schools. The authors also explore how stories about these particular companies can be used to teach effective inquiry and conceptualization skills to managers, and they discuss how the insights gained from these simulators can be transferred to other situations.

Royal Dutch Shell

John Morecroft, a longtime consultant to Shell, and Kees van der Heijden, the former head of Scenario Planning at Shell, describe how a simulation model was developed for Shell's scenario planning process. They outline the entire process, from model conceptualization to its final use among Shell's managers, and explain how the model helped managers assess the effectiveness of several management policies against the challenges of alternative scenarios.