



## TOOLBOX

Each Toolbox presents a different systems tool using relevant business examples. Readers are encouraged to practice using these tools by applying them to issues of personal interest. See page 12 for a symbol key for the diagrams.

# Software for Understanding Complex Systems

by Daniel H. Kim

"Life is complex," states M. Scott Peck at the beginning of his book, *Further Along the Road Less Traveled*. Unfortunately, that statement goes against the fondest desires of many managers, who wish that life would be simple—or at least, that we could treat it that way. We have long applied simple tools to complex organizational issues only because they were available—and because we knew how to use them. But in a world that is growing increasingly complex, we need to find ways to understand and navigate our way through these complexities, rather than continue to ignore them.

### Structural Modeling

System dynamics-based modeling software represents a new breed of tools that allows us to model complex, dynamic issues more accurately. Unlike other common modeling methodologies, which are primarily statistically based or data driven, system dynamics models focus on mapping the *structure* of interrelationships that create the complex behavior we manage on a day-to-day basis. By its very nature, system dynamics modeling forces us to surface the thinking behind our decisions and to connect our actions with their impact on the larger system.

The chart on page 8 (see "System Dynamics Modeling Software") provides an overview of the basic system dynamics software packages. Although

the list is not exhaustive, it does represent the full range of modeling capabilities that are currently available. To help you decide which package best suits your needs, we provide the following explanation of some of the distinguishing features of these packages:

**User Interface.** The simulation packages offer three basic ways to create a model: (1) represent the relationships in the system through algebraic equations; (2) map out the relationships graphically and have the software prompt you for the formulas; or (3) simply import an existing model into your package. The choice of which method you want to use depends to a large extent on who you think will be involved in the actual model-building process. If you want to build models in real-time with lay managers, the graphical method is highly desirable. If, however, you are building large models with professional model builders, it becomes more an issue of individual preference.

**Authoring.** Authoring capabilities allow you to create run-time versions of your model that you can distribute to other people. They can then run the model themselves without having to purchase the modeling software. (It's like being able to give someone a Read-Only version of a Word document that they can view without having to pay more money to Microsoft.) This feature is important if you need to share models or games with a lot of people. Keep in

mind, however, that these run-time models cannot be modified by the users.

**Gaming.** Some of the software packages enable the user to convert a computer model into an interactive decision-making game. This is an end-user feature that provides a fun and engaging way for those not involved in the model-building process to explore and understand the dynamic structures included in the models. Having people make decisions in this game environment is a powerful way to surface and test their mental models about the world, and it can be useful in building a greater common understanding about a complex issue.

**Arrays.** Arrays allow you to model repetitive structures—such as multiple product attributes, geographic sectors, or customer segments—in a quick and efficient way. For example, if you want to model the impact of five different competitors on your market share, you can create a single array of five dimensions and enter in different parameter values to represent each competitor.

**Documentation and Training.** Documentation and training is very important in making the best use of these tools. Just as you need to understand some statistical theory in order to use statistically based tools, you also need to understand the basic principles of system dynamics to use these structural modeling packages most effectively.

### A Final Tip

Perhaps the most important thing to keep in mind when choosing a software program is this: modeling software can make the process of building a model easier, but it won't make you a better model builder. For that, you'll have to rely on the wisdom of the age-old saying, "Practice makes perfect." ☐

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