

Now, as to simplifying the model so that he can understand these internal workings, this really defeats the purpose of using mathematics for these sort of analyses, because you would want to take advantage of the most advanced mathematical techniques that are necessary for the solution of the problem. If you can't use these, why, you are not making use of the tools which are available to you. Then you're back in the position of doing essentially the normal staff study. So, unless the manager can spend seven or eight years in college, and then some more years in getting experience in using these things, he can't really be expected to know all of the details of a model.

QUESTION: What is your appraisal, Mr. Hare, of the relative effectiveness of the analytical techniques on the one hand and simulation techniques on the other, considering past efforts and future projected efforts to solve real world problems?

MR. HARE: Well, the analytical techniques, because they have to be in a form that a mathematician can handle analytically. Because, equations will necessarily involve a number of simplifications, approximations, and certain simplifying assumptions, so that he will - in many instances - have to ignore a lot of detail in the situation. Now, in certain situations he can get away with this; he will get answers that will give him at least the order of magnitude solutions to his problem.

In the computer simulation the problem has just gotten so involved that he can't, even with a lot of simplification, study the thing; there are too many parts to it. So then, he goes back and goes into a lot of detail. He just sort of puts together all the pieces and lets the computer do all the recording of information.

So, in a simulation you can probably get a good deal more realistic model of the problem. On the other hand, simulation is extremely expensive; it's extremely time-consuming. Some of these programs for computers - for simulation - may take