

**Massachusetts Institute of Technology
Sloan School of Management
System Dynamics II: Applications of System Dynamics**

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The “Standard Method”¹

What is the “standard method”? The standard method is the sequence of activities (or the process) most teams will follow in doing their projects. Each week you will receive a handout describing the particular step of the standard method that you should be working on with your client.

We encourage you to stay as close to the standard method as you can. Of course, your project is *your* project, so you (in consultation with your client) should feel free to depart from the standard method as desired. However, we ask that when you try something new or different, you think of it as an experiment that you can tell us all about. Jot down what you’re doing differently and why. What do you hope to accomplish? How did it turn out and why?

Why do we call it the “standard method”? Most top system dynamics practitioners follow processes that are similar to what we do in class. On the other hand, all practitioners have their own modifications. We were in a quandary. If we called this the “Jim Hines Method”, everyone would say, “That’s not the Jim Hines Method, that’s the process that *everyone* follows. *I’ve* been doing it for years. It’s standard!” Of course by calling it the “standard method”, everyone will now say, “That’s not the standard method, it’s just Hines’ method. What *I* do is the standard method, and it’s *totally* different”. We finally decided to go forward with the “standard method”, because it seemed less self-aggrandizing than the “Jim Hines method”.

Steps in the standard method. The steps of the standard method will probably seem familiar to you after taking after having taken *System Dynamics for Business Policy* or *System Dynamics: Managing Complexity* (or, perhaps, a course equivalent to either of these). The steps are:

- 1) Problem definition
 - a) List of variables
 - b) Reference modes
 - c) Problem statement
- 2) Momentum policies
- 3) Dynamic hypotheses (i.e. causal loops)
- 4) Model first loop
- 5) Analyze first loop
- 6) Model second loop

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- 7) Analyze second loop
- 8) Etc.

Conclusions and insights should emerge at every step and may emerge at any minute during the standard method. Be sure to record these conclusions and insights when they occur.

Quick example of the standard method. In this example, we'll end up building a classic diffusion model. But, let's pretend that we don't know what a diffusion model is. (If you *don't* know what a diffusion model is, this little exercise will show you).

Our first meeting with the client begins in a conference room with the vice president of the automated products division, and his direct reports (marketing, manufacturing, research and development). The VP provides some introductions and context.

“Our Automated Fly Swatter is a great product. But, we need to understand the key drivers in the fly market, so I've hired these very smart folks from MIT. Let me just turn it over to them so they can tell us what those key drivers are.”

At this point everyone turns to you and expects you to say something brilliant. That's too hard, so instead you stand up and say “We don't really don't know anything about fly swatters or even much about flies and very little about your culture, your values, the way you do business. One thing I do know, though, is if I were this were *my* problem, I wouldn't turn it over to anyone less than the most knowledgeable people on the planet – and that's you guys. The reason I *think* you probably really need us is not because you know too little about the technology, your own company and the market, but because you know too much. You know thousands of things and thousands of ways that they're all interconnected.”

At this point you stop to look meaningfully into the eyes of a few of the managers around the table. “What you probably *need*,” you continue, “is some help in talking about what you know and structuring all that knowledge in a way powerful enough so that you can see what the key things are you really ought to do.” You pause again just to make sure that the reason managers are nodding is that they agree with you and not because they're all about to drift off to sleep.

Once you're reassured you continue, “If that's what you need, then we're in good shape because what we have to offer is exactly that: A structured process for talking and thinking and for arranging what you know in a way that makes it easier to figure out what to do. Fortunately, you don't have to take my word for it. The process contains a number of steps and the first step is easier to do than to talk about. So, what do you say? Should we start?”

What can they say, except, “Well...sure, let's just dig in”. So, you tell them that you want to begin by simply listing important variables”. Slowly at first and then with

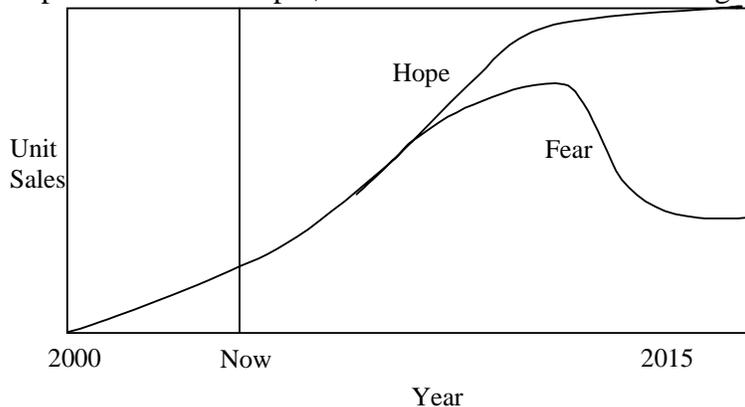
increasing speed the managers call out variables while you write them on a flip chart. You record:

Variables List:

- Fly population
- Revenues
- Unit Sales
- Annoyance at flies
- Market saturation
- Manufacturing costs
- Price
- Cost of batteries
- Word of mouth about our product
- Product recalls
- Health problems with our products
- ...etc.

Eventually, your managers run out of steam. You call a break, and ask that during the break people mark what they think are the five most important variables.

Reference Modes: Returning from the break, you explain that you want to graph the behavior of some of the variables. Identifying the half dozen variables that received the most “votes”, you lead the group through a reference mode exercise drawing each one on a flip chart. For example, one of the reference modes might be



(Looking at the graph some one in the group says, “You know, for a long time we won’t be able to tell which trajectory we’re on”. You immediately find a fresh flip chart, title it “Insights” and right that baby down.)

Problem statement: One or more of your reference modes almost certainly will contain the true concern of the clients. You phrase it to the group, but you don’t write it down, after all a picture is worth a thousand words. You just point to the curve and say:

We hope that the initial growth trend of AFS sales continues and that the product ultimately becomes a stable, high-volume seller. But we're worried that sales, after appearing to be on track, might take a nosedive leaving us with mediocre or low sales, and way too much capacity. If we are successful in our project here we will increase the likelihood of the curve labeled "hope" and decrease the likelihood of the curve labeled "fear".

Momentum policies. *Momentum policies* (i.e. solutions) are what the client would implement now to solve the problem, if they had no further time to collect information or ponder. Once you have a problem focus, you are in a position to collect momentum policies.

Continuing with our example, you point out to your client that the system dynamics process has already added something by crystallizing the problem. You explain, though, that you would like to be able to gauge at the end of the process, whether anything beyond this additional specificity has come out of the project. Consequently you'd like to record what the client would do *now* about the problem, if decisions had to be made *immediately*.

You record ideas like:

“We need to do a market study”

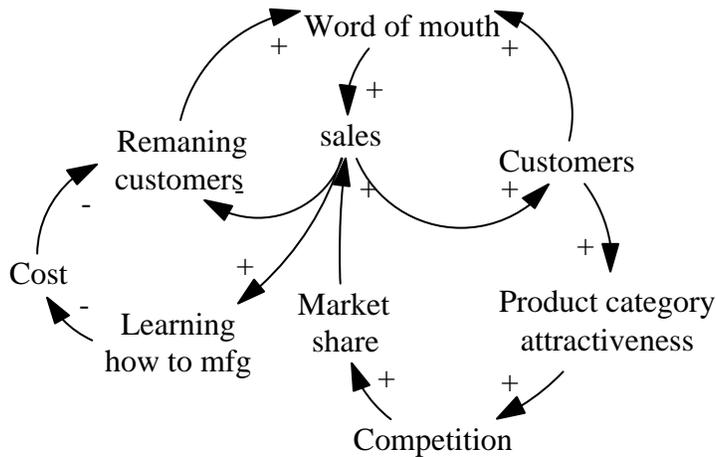
“We should start a competitor intelligence unit”

“We need to get data on the drivers of the market”

“We've got to get better forecasts from the Economics Group”.

Note that these policies are not all well thought out, and some are not even policies. No problem, simply record them. Store them away. You might want to use them to suggest tests or directions of inquiry, but at least (and in most cases at most) you will pull them out ten weeks from now to say, “look how far we've come”.

Causal loop diagram. With variables, reference modes, and a problem-focus, you will be in position to start coming up with dynamic hypotheses; that is, loops that describe feedback processes capable of generating the patterns in your reference modes. Coming up with a diagram will take several weeks, and will likely result in a number of insights and good ideas.

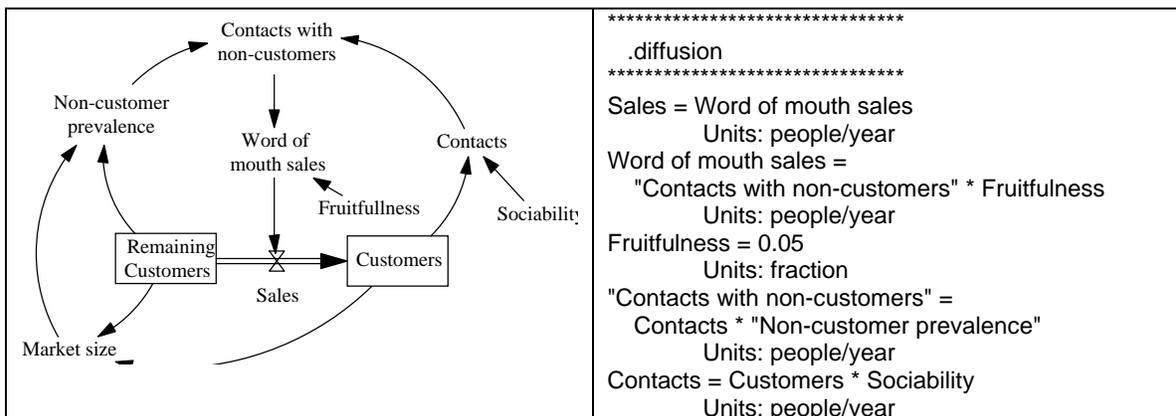


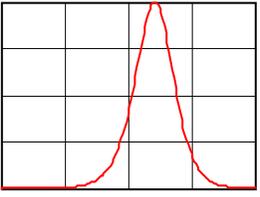
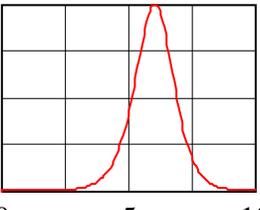
Again remember to record insights as they come up. For example: “The learning loop counteracts the running-out-of customers loop” and “We can strengthen the word-of-mouth loop with a sign-up-a-friend promotion”.

Modeling. Finally, at about the mid point in the semester, you will be ready to model. By this time, your clients realize that the model is not the actual objective, rather the process is. The modeling is simply the next step in the process, it may help people refine some of the insights you’ve already recorded, it will probably result in additional insights, but it probably won’t contradict any of the insights you’ve already had.

Here’s what you’ll do: You will choose a loop, model it, simulate, analyze, and work with your client to develop insights and ideas. Then you’ll choose another loop, add it to your growing model, simulate, analyze again, and work on further developing new or existing ideas.

You will probably only have time to model two or three loops. As always you’ll record insights and conclusions as you go along. For example, “Strengthening the positive word-of-mouth loop creates a faster rise and a deeper collapse.” and “Replacement sales may lessen the severity of the down-turn in sales”.



<p>Current </p> <p>Sales </p> <p>Word of mouth sales </p> <p>Time (year)</p>	<pre> Sociability = 40 Units: people/(year*person) Customers = INTEG(Sales , 1) Units: people "Non-customer prevalence" = Remaining Customers / Market size Units: fraction Remaining Customers = INTEG(- Sales , 100000) Units: people Market size = Customers + Remaining Customers Units: people ***** . Control ***** FINAL TIME = 10 Units: year INITIAL TIME = 0 Units: year SAVEPER = TIME STEP Units: year TIME STEP = 0.0625 Units: year </pre>
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You may find that the modeling leads to the best insights. Or you may find in retrospect that the causal loops, or even the reference modes, was the source of the most important insights and conclusions. You may find that some people involved in the process liked the modeling best and others liked causal looping or something else best. The important lesson from this is that the model is *not* the goal of the engagement. The goal is to use the entire process to help the client. Modeling is just one piece – in any particular situation it might provide the brightest illumination, but in another situation a different part of the process might turn out to be the real source of light, and in yet another situation, the entire process may shine with a uniform brilliance.

Final presentation. The final presentation is not really part of the standard method. But for completeness, here's a brief description. Your final presentation will summarize your project, stressing what you and/or the client learned in the process and how the project has made a practical difference somewhere. There are many different kinds of things that can be learned from the process and many ways to have made a difference. You will have been preparing for the final presentation throughout the term by keeping track of what you and the client are learning and how that has changed or will change what your and/or the client (may) do.

The final presentations are always wonderful – full of insight, humor, and importance. We'd like you to invite your client to the final presentations (now is not too early). Your client may wonder if she really wants to display the project in public. Reassure your client that you won't present anything that the client considers sensitive. These projects are rich and so there is never any shortage of things to present.