GROUP MODEL-BUILDING

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Keywords: group model-building, group facilitation

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Summary

Over the decades system dynamicists have increasingly involved clients in the process of model construction. Recently researcher from the State University of New York at Albany has coined the label Group Model-Building for this. This is an approach where a group of around ten persons gathers in one or more sessions and is guided by a modeling team in the construction of the model. The goal is to increase insight into the problem, create alignment and develop a robust strategy to improve system performance. So far Group Model-building is not a standard procedure, it knows variations which primarily relate to qualitative and quantitative modeling, the use of preliminary models and whether to conduct sessions within a two day setting or to distribute these over a couple of months.

1. Introduction

In many cases system dynamics models are constructed to analyze the dynamics of a strategic problem of a particular organization. Involving the client in the process of model building becomes necessary for several reasons. The first is to capture the knowledge in the mental models of the client group. Much of the knowledge and information required to construct a system dynamics model resides in the mental models of participants in the system. A second reason, which is closely related to the first, is to enhance the clients' learning process. Studies have revealed that modeling a problem results in considerable learning, provided that one has participated in the process of model construction. Third,

to increase the validity of the model. Last but not least, client involvement becomes necessary, to increase the chances of implementation of model results. Every model, however brilliant its constructor may be, will contain debatable assumptions. If a client or the public is not willing to accept model results, these debatable assumptions become the Achilles' heel of the model, a sure butt for critique and a safe way to reject the entire model and refute its results. Results of models, which are not owned and accepted by a client, will thus generally be rejected. Unfortunately history has shown too many examples of this.

For these reasons, more and more system dynamicists involve client groups when constructing a model. Most modelers use their own idiosyncratic approach and base this approach on intuition and practical experience. Some have developed particular, more or less standard approaches for client involvement. An early example is Jorgen Randers' "Reference Group" approach, which was primarily applied in public policy settings. In the business sector Barry Richmond introduced his Strategic Forum.

2. Group Model-Building in a Nutshell

Simultaneously some researchers started studying the process of working with client groups in more detail. They coined the more generic label Group Model-Building. Group Model-building refers to a system dynamics model-building process in which a client group is deeply involved in the process of model construction. Typically in Group Model-Building a group of (generally somewhere between nine and fifteen) people gather in one or more sessions in order to construct and analyze a model under the guidance of a modeling team.

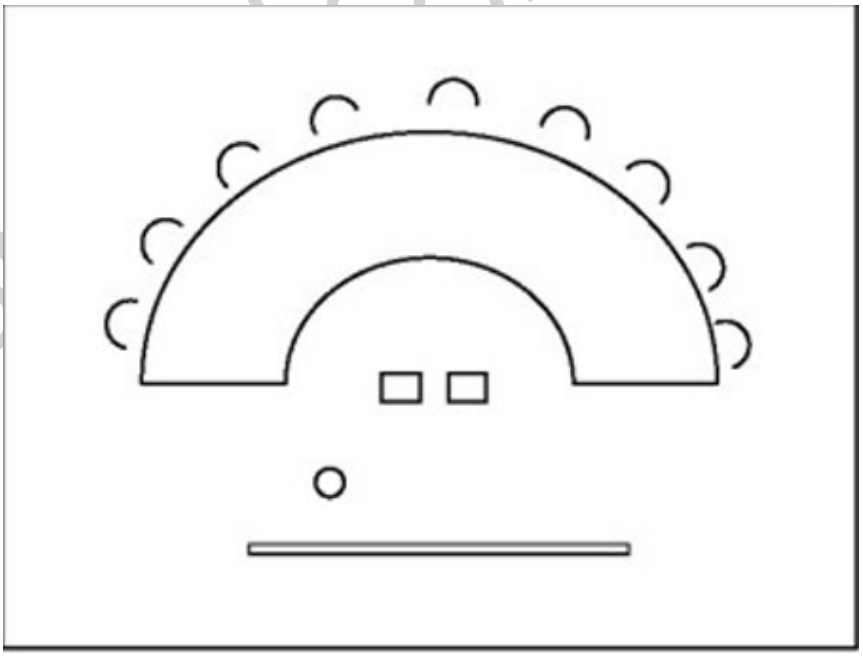

Figure 1. Typical room layout for group model-building with participants seated in a semi-circle, white board and facilitator in front, and computer and overhead projector.

As Figure 1 demonstrates, team members are seated in a semi-circle. In front of the room are a white board and/or projection screen, which serve as the so-called group memory. The white board is used to (a) document knowledge generated by the group; and (b) sketch (parts of) the model's structure, and (c) record any unresolved issues which may surface during the discussions. A projection screen is required in cases when a computer is used with appropriate software (e.g. Vensim, Ithink, and Powersim) to construct and run system dynamics models.

The modeling team, typically a group of two to five persons, including at least a facilitator and a recorder, guides the process. Generally it starts with the identification of the strategic problem. The best starting point for a system dynamics model is to put the problem in terms of a so-called reference mode of behavior: one or more graphs of variables over time which reflect the problematic behavior in the system. Problem definition can be rather straightforward, but, if there is a lot of difference of opinion within the group, it could also turn out that this proves the most difficult stage. This is particularly true when one is confronted with so-called messy problems, and in those cases qualitative modeling (also referred to as "mapping") sometimes serves as a means to clarify thought within the group on whether there is a problem and what its nature may be.

If problem definition is more or less straightforward, the next step then is to systematically elicit knowledge contained in the mental models of participants, in order to construct the system dynamics model. Model building is an iterative process and one of the ground rules of sound modeling is to go through the various steps (i.e. conceptualization, formalization, quantification, model testing, and policy experiments) as quickly as possible. Rather than first constructing the whole model and then start simulating it, experienced modelers make a small model and simulate it as soon as possible. Then they add structure, simulate again, and so on up to the point where the problem, is considered, modeled adequately. The most straightforward way to proceed in Group Model-Building is thus to start constructing a relatively simple stocks and flow diagram which can then be run to show its dynamics. Running the model, particularly in the beginning, will show deficiencies in the model and structure is gradually added and/or changed to make the model a more valid representation of the problem. This implies that the team will cycle through the stages of model building in an iterative way, from conceptualization to formalization to quantification and simulation, back to conceptualization, and so on. In every cycle the model is gradually improved in the light of the problem that the management team faces. The basic idea is that while construction of the model progresses, the problem will gradually be understood better. Moreover, through simulation of strategic options their potential effects will become clearer. Eventually this will lead to the identification of one or more robust strategies to tackle the problem.

2.1 Goals of Group Model-Building

Group model building can be considered as a subset of a larger group of systems thinking interventions from the realm of soft Operations Research. These include for example Soft Systems Methodology (SSM) and Strategic Options Development and Analysis (SODA). As is the case with most systems thinking interventions, Group Model-Building can serve

a variety of goals, depending on the type of problem the group faces. Typically a system dynamics model is constructed for the purpose of understanding problematic system behavior and to identify robust policies with which to improve the performance of a system. Robust policies are those policies, which produce desirable behavior of the system under various conditions of uncertainty, i.e. uncertainty with regard to changes in the environment of the system and/or with regard to the structure of the system. Hence, in general the goals of system dynamics (and thus Group Model-Building) are at the systemic (or organizational) level. They aim at system process change (things are done differently) or at system outcome change (customers or clients are impacted differently).

These goals however presuppose that there is general consensus on the definition of the problem. In Richmond's Strategic Forum for instance the goal is to "align strategy and business processes with stated objectives." In this case there should be a general agreement on the stated objectives. This is certainly not always the case. Messy problem situations are characterized by a wide divergence of opinions. In some cases opinions differ so widely that people in an organization may actually create a deadlock situation. The primary goal of the intervention then becomes to break this deadlock and create alignment/agreement within the team on (a) the problem definition; and (b) the best option to tackle the problem. In these messy managerial situations the role of the facilitator becomes critical. If the facilitator orchestrates the group interaction process in an appropriate way, then not only can s/he create agreement within the team, but also commitment with the resulting decision. In turn the latter may require a change of insights at the individual level and/or a change of attitude towards a problem situation.

Dealing with messy managerial situations also has consequences for the process of conducting the Group Model-Building sessions. In some cases it is not clear from the outset what the stock and flow structure should look like. Then the facilitator may start the process by having participants brainstorm variables, which may, in the perception of participants, somehow be related to the problem. The next step then involves the construction of a causal loop diagram to identify the causal structure underlying the problem.

In reality most situations are of course a mixture. The client group is facing a situation, which demands both the identification of a robust strategy and commitment to that strategy. In those situations will be most effective. The model will help to assess the robustness of policies, while the facilitator will guide the group process in such a way that alignment and commitment will actually be created.

3. Suitability of System Dynamics and Group Model-building

The type of problem more or less automatically raises the issue of the suitability of system dynamics to tackle strategic problems. As with all methodologies, the interventionist runs the risk of suiting the problem to the method rather than the other way around. That is because problems are frequently not well understood and defined. There is generally more than one way to describe the problem. When it comes to the use of system dynamics a couple of criteria can be applied to determine its suitability. The first is that the problem needs to be dynamically complex, i.e. one should expect the observed behavior to be caused by underlying feedback processes. The most practical

way to define a problem and to determine its suitability is to define it by sketching a so-called reference mode of behavior. A second practical way to check the suitability of system dynamics is to try to draw preliminary stocks and flow or causal loop diagrams.

When it comes to applications of system dynamics and Group Model-building, these cover a wide range of topics. For example: conflict regulation in shipbuilding industry, merchant fleet reduction problems, cost reduction, and waiting lists in health care, inventory control in production, claims settlement in insurance business, financial continuity of housing associations, startup and growth of new organizations, capacity planning in oil industry, and welfare reform etc.

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Vennix J. A. M., Andersen D. F., and Richardson G. P. eds. (1997). *Group Model-Building*. Special issue *System Dynamics Review* **13**(2), 103-204. [Describes the need for more theoretical and empirical research on Group Model-building, and provides papers on scripts for group model-building, Richmond's strategic forum, and an example of a formal assessment study of Group Model-building intervention.]

Biographical Sketch

Jac Vennix received his Ph.D. from Nijmegen University and is currently professor of research methodology at the Faculty of Policy Sciences of Nijmegen University. He has conducted a large number of projects in a variety of organisations in the areas of system dynamics group model-building and (interactive) scenario construction.

In 2000, he served as the president of the System Dynamics society and is also one of the managing editors of System Dynamics Review. He has published a number of articles and books on system

dynamics, group model-building, knowledge elicitation, group facilitation and scenario construction. His latest book 'Group model-building: facilitating team learning using system dynamics', was honored with the Jay W. Forrester Award, for the best work in the field of System Dynamics in the preceding 5 years.

His research interests focus on problem structuring methodology and empirical assessment of problem structuring interventions in organizations. More in particular on how these methodologies (primarily Group Model Building and scenario construction) can assist in increasing the learning potential of organizations.