SD and Prospective: A marriage of convenience

Fabián H. Szulanski
Master Candidate in System Dynamics, University of Bergen
S. de Bustamante 1731 5 A, Buenos Aires, Argentina
Tel/Fax 54 11 4826 0861
fabiansz@consultant.com

It will be suggested a conceptual intersection between the System Dynamics methodology and the Prospective approach, one of the future studies applied methodologies.
This interaction could be useful for both methodologies.
Depending on the purpose of the System Dynamics study, the two methodologies might match in the three basic principles of Prospective: appropriation, anticipation and action.
Prospective usually goes through a series of steps, which are: structural analysis, actor strategy analysis, expert methods for scenario proposal, multicriteria analysis for strategy and policy assessment.
There are specific tools for each of these steps.
After presenting both approaches, the above mentioned conceptual intersection will be explained from two viewpoints: when enriching a System Dynamics study with some of the tools that offers the Prospective approach, and viceversa.

The broom: Prospective

Prospective is a way of thinking which throws light on present action by looking at possible futures.
It is based in three principles, which constitute the so-called Greek triangle: appropriation, anticipation and action. (Godet, M., 1994).

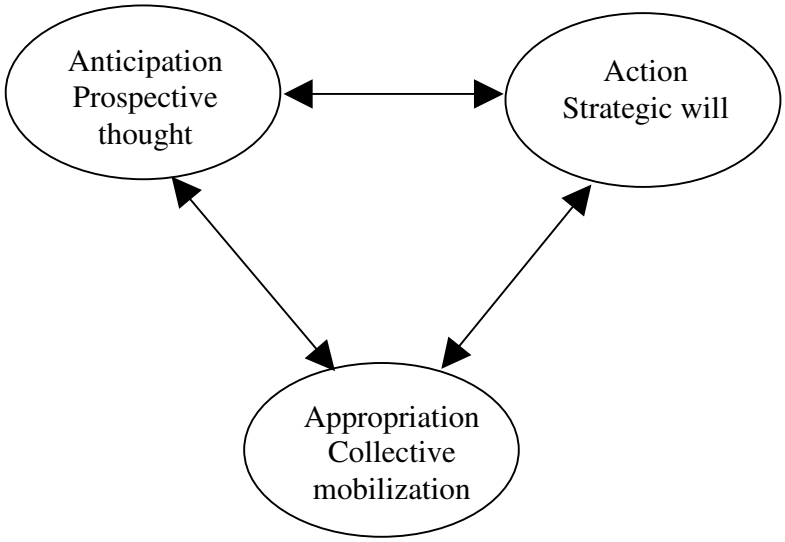


Figure 1: The Greek Triangle of Prospective

Within this approach, prospective gives content and direction to collective mobilization. Instead of trying to predict the future based on past events, what is sought is to define courses of action in order to arrive to desired or most probable futures.
There has to be collective mobilization within the 'owners' of the issue which is being studied, so all the stakeholders are aligned in their vision.
Then there has to be a clear sense about which is the desired reality that they would like to experience in the future, or which is the most probable to be expected to happen.
Standing in the current reality and having in mind the desired or expected future, a course of action is defined, with the goal of arriving to that desired or expected future.

Having clarified this conceptual foundation, what has to be added is that there are substantial differences between prospective and forecasting, basically the same differences that could be found in (Sterman, J. 1991) when clarifying differences between System Dynamics and Econometric models.

Table 1

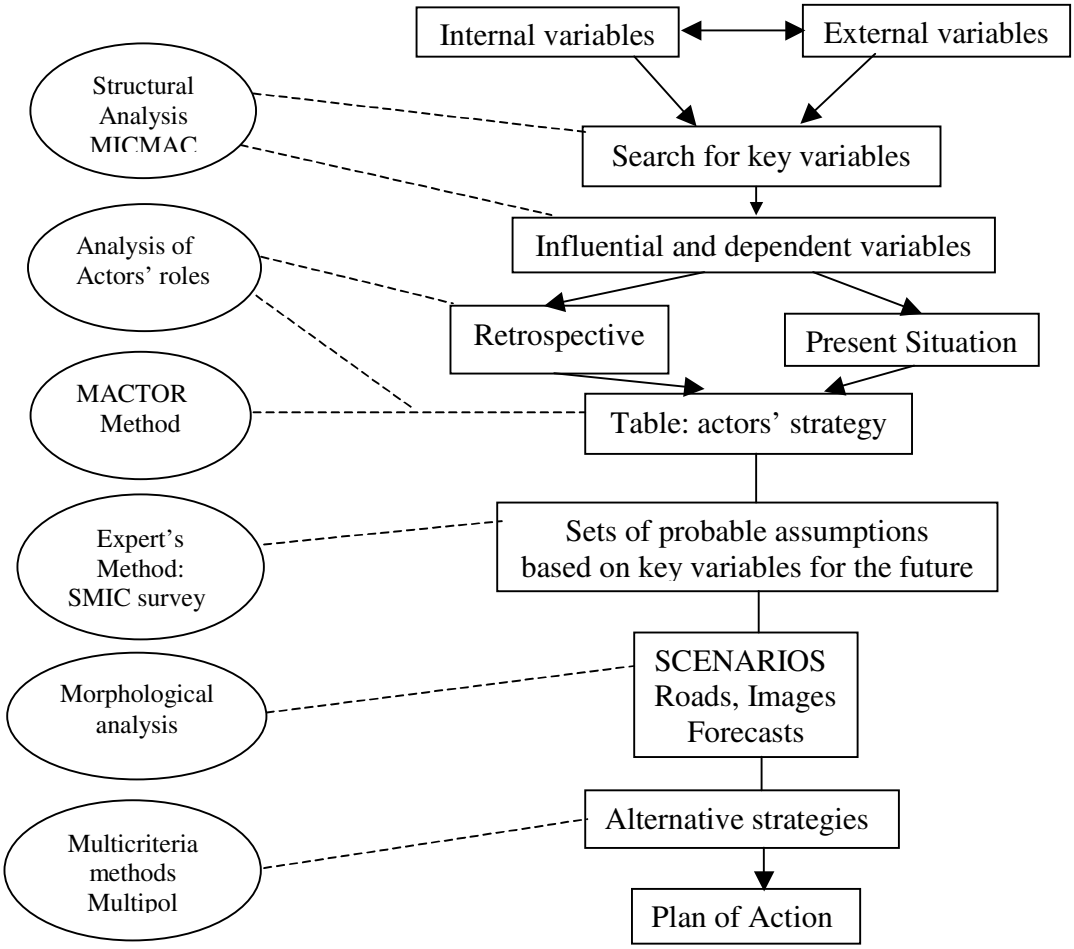
	Classical Forecasting	Prospective approach
Viewpoint	Piecemeal 'Everything else being equal'	Overall approach 'Nothing else being equal'
Variables	Quantitative, objective and known	Qualitative, not necessarily quantitative, subjective, known or hidden.
Relationships	Static, fixed structures	Dynamic, evolving Structures
Explanation	The past explains the future	The future is the *raison d'etre* of the present
Future	Single and certain	Multiple and uncertain
Method	Deterministic and quantitative models (econometric, mathematical)	Intentional analysis; qualitative (structural analysis) and stochastic (cross-impacts) models
Attitude to the future	Passive or adaptive (future *comes* about)	Active and creative (future *brought* about)

Some examples of the objectives that prospective analysis can serve include:
Strategic objectives: Guidance of present action in the light of possible and desirable futures, for example, by aiming for maximum flexibility in the face of uncertainty
Tactical objective: Testing a hypothesis or theory, for example, in order to justify a decision and forestall possible criticism.

There is an array of tools that are used in the prospective analysis in order to build scenarios and design strategies, all of them being described in (Godet M., 1994)

For structural analysis: Identifying key variables: MIC MAC method, Influence-Dependence chart
For actor strategy analysis: MACTOR
Expert methods for scenario proposal: Delphi, cross-impacts
Multicriteria analysis for strategy and policy assessment: Multipol

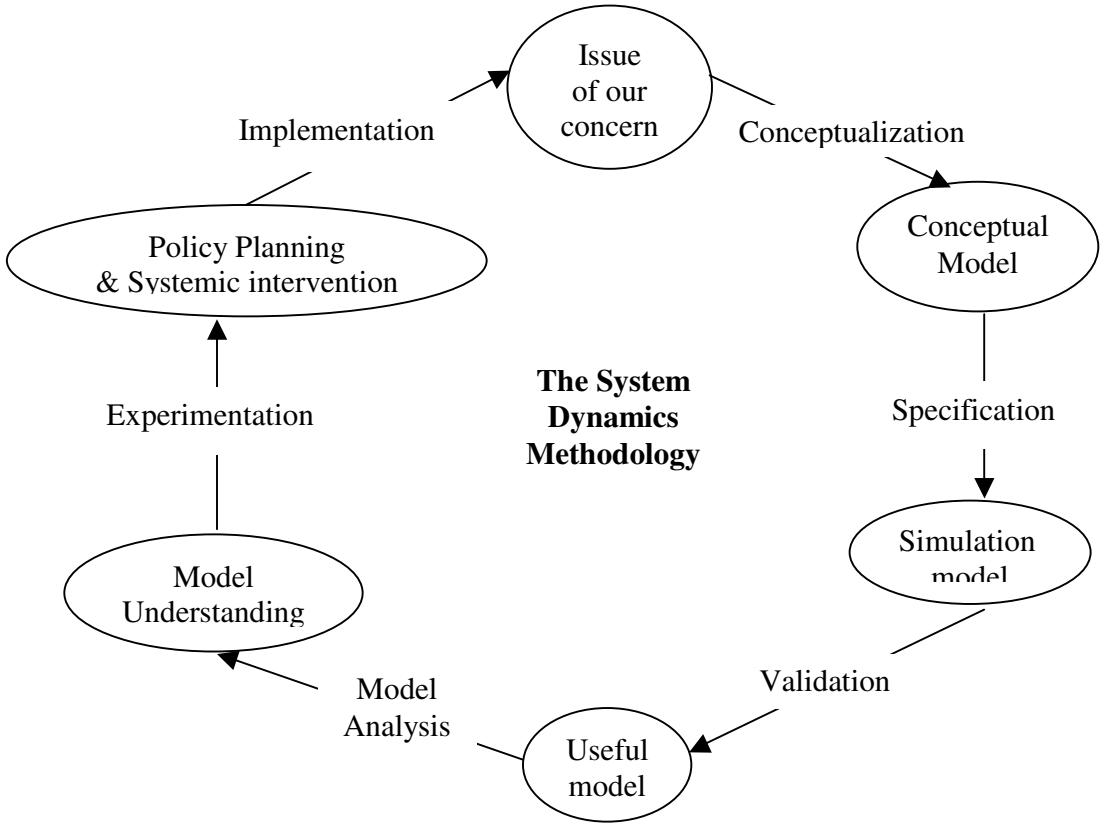
How all these tools are used within a prospective study is shown in Figure 2 (adapted from (Godet M., 1994).



The bride: System Dynamics

System Dynamics is a methodology that is useful to increase our understanding of complex dynamic nonlinear systems, from a feedback perspective and using computer simulation for overcoming our bounded rationality as policy makers.
The main premise of System Dynamics is that structure generates behavior, as the result of interacting feedback processes.

The process of System Dynamics modeling begins from observing the real system, which has an observed structure and behavior. Then, based on our perception, we construct first a conceptual model, defining the main variables in play, their level of aggregation, the time horizon of the issue we are analyzing and the model boundary.
After that we build a formal model, that which can be simulated, using one of the modeling software tools available in the market.
Then we validate the model, so we consider that we have a useful model.
We begin to analyze the model, so we understand it.
We begin to use the model as a laboratory for policy design, testing our decisions in a safe environment. Eventually we design a systemic change.
We pick one of the alternative strategies, and implement it, feeding back in the real system.
This process is shown in Figure 3, and all of the loop steps may be iterative. (Adapted from Ford, D., 1996)



Why is the reason for this marriage to be convenient?

The purpose of this paper is to provoke thought and suggest that this two methodologies, Prospective and System Dynamics, could interact in a productive and synergistic way.

It will be suggested how some of the tools utilized in the System Dynamics methodology could improve a prospective study, and how some of the tools of Prospective could improve a System Dynamics modeling effort.

The bride in action: How a prospective study could be improved by using some of the tools of System Dynamics?

As it has been observed in (Ritchie-Dunham, J. , 1998), there is great potential in the interaction of different management tools for obtaining leverage in our systemic interventions.

Being System Dynamics a structure-behavior oriented methodology, a system dynamics simulation model could greatly improve the structural analysis phase of a prospective study.
The simulation model could be used for finding the dominant feedback processes, being able even to perform sensitivity analysis in order to identify the leverage points, therefore enriching the structural analysis of a prospective study.
Another contribution of the System Dynamics simulation model is to help in the analysis of actors' roles, identifying if there are seeds of change in the present situation.
That could be made by finding via simulation if some variable that is at a not so visible condition could grow itself or make other variable to change considerably over time.
System Dynamics simulation models could greatly help in the finding of alternative strategies, which would lead to the action plan.
They would serve as a safe environment where alternative strategies could be tested and refined, avoiding risking time and losing real resources.

The broom's turn: How could a System Dynamics study be enhanced by some of the tools of Prospective ?

The MICMAC method could help in the conceptualization phase, helping to identify causal feedback loops between variables in a dynamically complex system.
It has been shown in (Ritchie-Dunham, J. , 1997) that the influence – dependence chart could be a useful tool for enhancing a structural analysis of a System dynamics study.
The analysis of actors' roles and the MACTOR method could enhance the system understanding phase of a System Dynamics study.
If the System Dynamics study is facing different possible scenarios, or different desired situations due to different stakeholders' perspectives, some expert's methodologies used in Prospective studies could be used in the System Dynamics study for validating the different scenarios where policies should be tested.

And finally, the multicriteria methods utilized in Prospective studies could help in finding the alternative strategies, candidates for being implemented in the issue of concern of the System Dynamics study.

Conclusions and suggestions for future research

This paper had the purpose of commenting about the potential for the interaction of System Dynamics and Prospective methodologies when facing a complex issue that may involve different scenarios.
System Dynamics and Prospective could both take advantage by using tools from each other in their respective studies.

Future research that could add value to this paper could include a case study that utilized the System Dynamics methodology as the main approach, adding value and leverage power by using the mentioned Prospective tools.
Another piece of research could be choosing the Prospective approach and enhancing it with some of the tools utilized in the System Dynamics methodology.
This research could try to prove the hypothesis that this marriage is really convenient for both methodologies.

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