Growing Ownership and Instilling Confidence for a Decision Support Approach at the Stakeholder Level

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Abstract

In a globally operating company, when a country management team base their opposition to the global product marketing strategy on a System Dynamics simulation tool, the model is definitely to support communication across the management layers in a bottom-up way. To reach out to stakeholders and global management at the HQ, neither of them being familiar with the System Dynamics approach, it's not sufficient to provide a technically convincing simulation tool. This paper describes a bottom-up model building initiative and its vital educational component. Building the model with the client had to both grow ownership at the country level, overcome "black-box" attitudes and establish a shared understanding for the approach at the stakeholder level in order to structure the discussion about critical issues beyond trailing market dynamics or covering up by fanciful statistics.

Keywords: Black box, Stakeholder, Ownership

Introduction

System Dynamics is a well established methodology to provide managers with insights about market behavior when launching new products (cf. Homer, Lyneis, Sterman). Determining how much to invest in product quality or product attractiveness, when to introduce a new product, how much to spend on marketing, and how to price the product are all critical management decisions affecting success or failure. Using system dynamics can help managers to test different strategies in a risk-free environment and then chose the strategy with the highest likelihood for success.

Even though system dynamics is an established management tool in many firms and organizations, there is still a lot to do for the system dynamics community before reaping the benefits of a level of awareness or acceptance of their tools that other communities have enjoyed with management tools such as linear programming. Thus, to share understanding by applying system dynamics often requires an educational component as people had never before been exposed to system dynamics methods. As soon as a common understanding is established people begin to see potential applications and gain interest in the method. In addition, they may be inclined to apply system dynamics in areas they know best.

This paper is about the challenging task for a country manager to convince senior management at the headquarters early on that their global strategy for the launch of a new pharmaceutical might not succeed in the local market. It appeared easy to convince the country manager that a system dynamics model can provide valuable insights into the market dynamics and help derive policy options during the launch of the product. However, the hard part proved to make the case before the stakeholders. Neither local management nor people at the headquarters were familiar with system dynamics methodology. Therefore, applying system dynamics to the case with people never before exposed to the method required stressing an educational component to establish a common understanding of the approach.

Market Conditions

Launching a new product in a competitive market is a complex and challenging task for a decision-maker; time pressure, incomplete information, organizational context and selfish motivation can strongly influence a decision. As a result, many decisions can turn out to be incorrect. Managers are faced with complex and highly unstructured conditions and the implications of a desired launch strategy cannot be known with any degree of certainty at the time a decision is made.

The goal for the project discussed in this paper was twofold: to help the client with the creation of a viable strategy for launching an innovative pharmaceutical, and to provide evidence as to why the global strategy might not achieve the desired objectives. For confidentiality, we do not provide the company or product name in this paper. Furthermore, some of the specific details in the model have been altered, but the overall structure and framework described in this paper are accurate.

Not so long ago pharmaceutical companies invested hundreds of millions of dollars in developing a new medicine and allocated virtually unlimited funds to marketing. Most new drugs were improvements on their predecessors, so selling the product was relatively simple – have your sales force tell doctors about the new product, refer to the merits of its predecessor, and the doctors will prescribe it. In fact, almost proportionally, the more sales reps contacted doctors, the more they would prescribe. Via frequent visits to virtually every doctor in the country, the sales force became, not surprisingly, the main communication tool for the industry. This marketing approach has changed due to an increasing pressure from government to lower healthcare costs. Accordingly, market forces have changed the way doctors see prescribing drugs. Doctors have been given financial responsibility for their practices. Like any other service provider, they are now to consider improving the service they offer to their patients or risk losing them (and the income) to some competitor. At the same time, pharmaceutical companies have become an easy target for politics in a bid to cut overall healthcare costs.

The increasing cost pressure, the trend towards better informed patients demanding quality service, and the rising competition among doctors resulted in a changing market approach when launching a new drug. First, some pharmaceutical companies have shifted their focus to approach the patients directly by marketing campaigns similar to those of fast moving consumer goods companies. The assumption underlying a direct-to-consumer approach (within the legal boundaries as they apply to advertising of prescription drugs) is to establish brand preference. Patients with a brand preference then could presumably persuade the doctor to write the brand name of choice on their prescription.

Second, pharmaceutical companies have positioned themselves to market across borders to take advantage of economies of scale, and their strategies reflect that move. Rather then having localized strategies to launch a new drug, companies go for global or at least pan-European strategies, which local markets have to adopt. The market launch strategy which was proposed by our client's head office suggested focusing on a direct-to-consumer approach, without enough budget left to support targeting of and medical marketing to the doctors. The dilemma of our client was to convince the company's head office that, for the particular market, the proposed global strategy may not yield the desired results and should be replaced by a localized strategy even before trying the global one.

Creating Ownership

Lane (2000) concludes that "clients' ideas must not just be in a model, they must be seen to be in a model", which means that involving the client throughout all stages of the model building process creates ownership. Building system dynamics models with client groups has a long tradition in our field and is well documented (cf. Morecroft and Sterman 1994; Richardson and Andersen 1995; Vennix 1996; Andersen et al. 1997). In the literature, several approaches to group model building are discussed (cf. Richardson and Pugh 1981; Roberts et al. 1983; Vennix 1994) with varying numbers and arrangements of stages and conceptual activities in the process of developing a computer simulation model.

Richardson and Pugh (1981) define seven stages in building a system dynamics model: problem identification and definition, system conceptualization, model formulation, analysis of model behavior, model evaluation, policy analysis, and model use or implementation. Roberts et al. (1983) suggest a similar approach to constructing a simulation model. With our client, we followed an approach similar to Richardson and Pugh in conceptualizing a simulation model. However, we were not able to get people from the client's head office involved in the process in order to foster ownership of the model there.

Often it is senior management who call in consultants to help solve a particular problem. However, in this case, a line-manager took the initiative to call for external help. Thus, in this bottom-up approach, our first task was to convince the country manager that system dynamics is the right tool to solve his problem. We organized a workshop with project team and country manager where we introduced system dynamics in broader terms and illustrated this method with some practical examples. In our discussion with the client we stressed the fact that we do not see ourselves as “teachers” but facilitators. It was also important to clarify that we would not build a simulation model behind closed doors but together with the team. We also emphasized that the result of this project may only help the team to know better what they know already, but at the same time would reveal the underlying dynamics of what they do not know. The compelling reasons for the county manager to approve the project were to have a scientific method to support his arguments against the global strategy and that we as consultants would not be disconnected but integrated in the project.

Model Conceptualization

In following the established framework to build a model with a client team, as noted above, we first discussed problem definition and boundary issues for the model. The focus of our modeling project was to address the following questions in order to study the market dynamics under different strategies:

- What is the likely percentage of customers that will switch to the new product?
- How does the sales force affect prescription behavior of doctors and ordering cycle times?
- How do pre-marketing activities enhance word-of-mouth with opinion leaders?
- How do marketing activities influence diffusion of the new product among the target audience?
- What is the market value of the new product over time?

The sector map in figure 1 provides a high-level view of the modeling project with the endogenous and exogenous key variables that influence the diffusion of the new product. While the sector map only shows the high level variables, the simulation model consisted of a more detailed view on the attributes that determine the diffusion rate. However, as previously stated, we omit some details of the model to focus on issues such as creating ownership and instilling confidence at the stakeholder level.

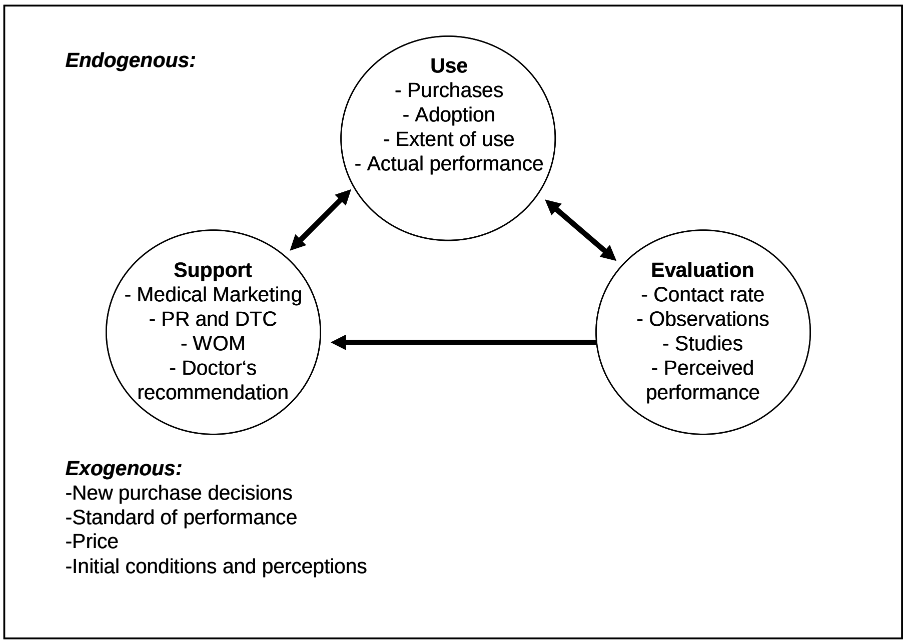


***Figure 1: Key-Variables and Boundary of Model*[1]**

In our first meeting with the client we listed variables and parameters, which we felt influence the diffusion of the new product. Next, we identified key-variables and visualized how these variables depend on each other. The high-level map, as shown in figure 1, determined also the boundary and basic structure of the model. After the management team agreed on the structural view of the market environment and project boundaries, we conceptualized the simulation model in collaboration with the client.

The model structure shown in figure 2 depicts the flow and accumulation of doctors, who would evaluate, prescribe, and recommend the new product and thus influence the adoption rate. We disaggregated the population of doctors into sub-segments to measure the rate at which the different segments adopt the new product. This part of the model structure was shown to the client to get agreement on the level of the detail for capturing the relevant sub-segments in this therapeutic area.

[1] Adopted from Homer, J. B. (1987). "A Diffusion Model with Application to Evolving Medical Technologies." Technological Forecasting and Social Change 31(3): 197-218.

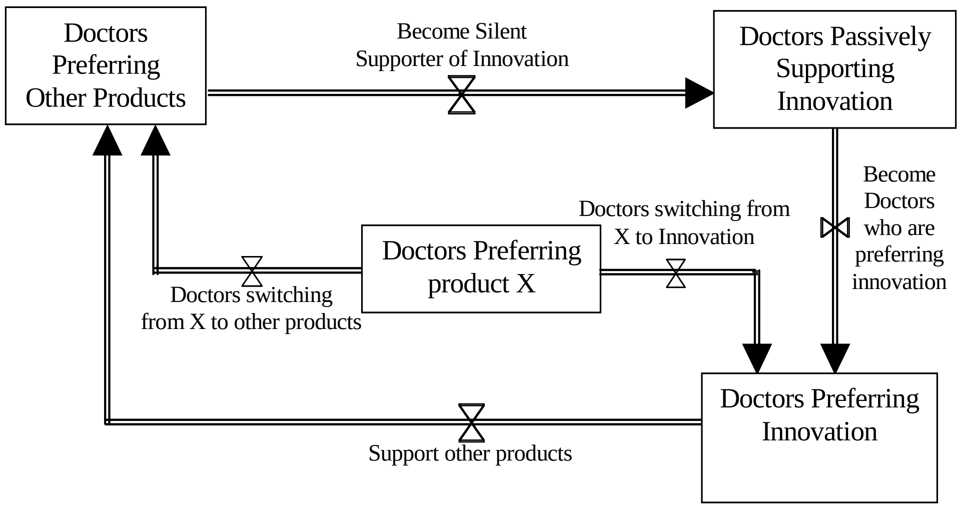


Figure 2: Stock-and-Flow Structure of Doctors influencing diffusion of new product

While the model's representation of the doctors appears highly aggregated it nevertheless closely reflects an important insight into the local market: it's exclusively the doctors that prescribe, or control access to the medicine, for that matter. Therefore, the rate at which the new product will be adopted must be formulated on the basis of a stock of doctors preferring our client's innovative product over others.

In order to model the adoption rate among patients, we added a stock-and-flow structure, shown in figure 3, to keep track of the number of people who are using the different treatments available in the market segment.

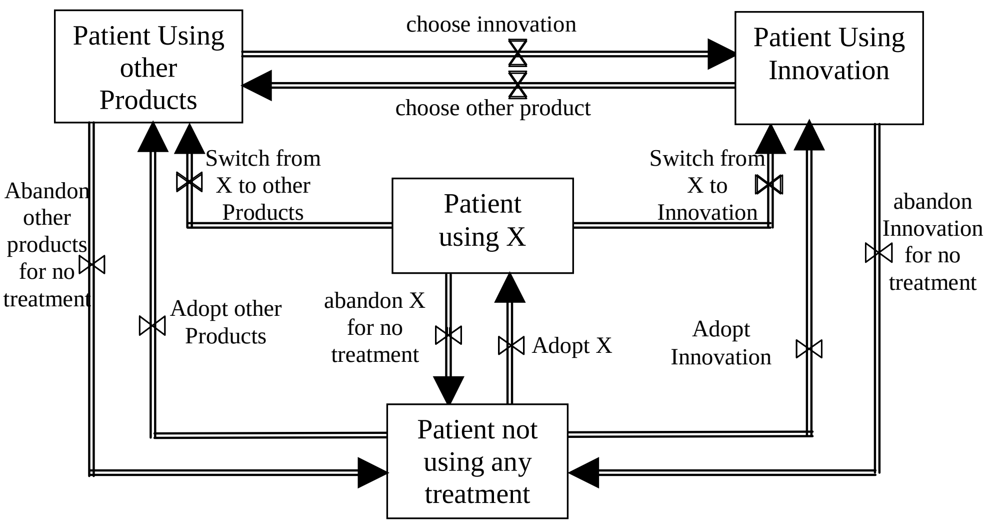


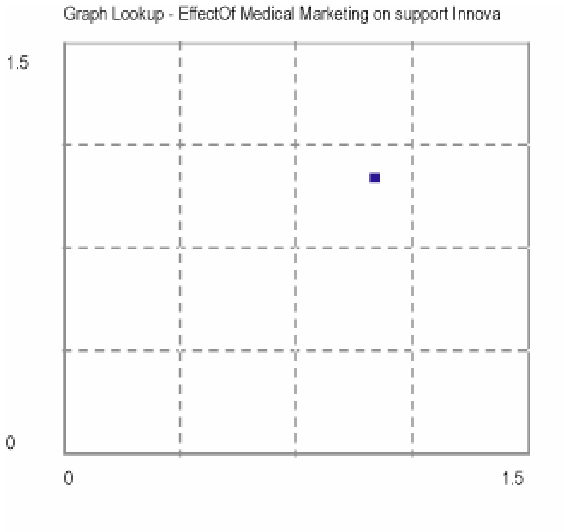
Figure 3: Stock-and-flow Structure of Patients using Different Treatments

The structure in this part of the model, as shown in figure 3, focuses on the flow of patients between stocks of users of a product to capture the shifting market share when launching the new product. The structure is near-symmetric with respect to users of the more comparable products “Innovation” and “other Products”, whereas users of “X” had to be dealt with differently as X’s brand recognition, available body of knowledge, customer retention strategies and other factors differ substantially from those of “Innovation” and “other Products”. The rate equations for the patient flows use a standard fractional rate formulation with modifying factors “Product Attractiveness” and “Doctors’ Recommendation”, as well as product availability.

We used a symmetric structure for attractiveness of competitors’ vs. attractiveness of the client’s product. In discussion with our client, we identified variables which constitute product attractiveness, such as convenience, reliability, safety, and novelty of product. Price was not considered a factor influencing product attractiveness because of inelasticity in this segment of the pharmaceutical market. For some of these variables we were able to use data from existing market research and clinical trials to set initial values.

Surveys and other sources of quantitative data were also available to set initial values and guide model development. Other attributes and underlying choice preferences influencing the adoption rate of the innovation were identified through secondary research and in discussion with the management team. However, there is considerable uncertainty about the effect of marketing on either patients or doctors, and we therefore assumed a normal effect with mean and standard deviation derived from interview data with product managers from pharmaceutical companies. Furthermore, we assumed that operating conditions for stochastic variables are bounded by acceptable attribute levels, i.e. we determined thresholds for soft variables where an increase in an attribute level would take the model outside of its operating conditions so that the resulting model behavior would not be feasible.

An important part of the conceptualization phase was to elicit information from the client about, and achieve agreement on the shape and the boundary values of the table functions representing effects such as by medical marketing or direct-to-consumer marketing. In a workshop with the client team, we first explained how a table function models a nonlinear influence on a flow rate. Then we introduced them to the familiar multiplicative formulation of “standard rate times effect of …” and asked for reasonable assumptions on the upper and lower boundary values of the effects. Next, we had every member of the team individually sketch their best estimate of the shape and limits of the table function around a designated neutral operating point in a prepared lookup table diagram as shown in figure 4a.



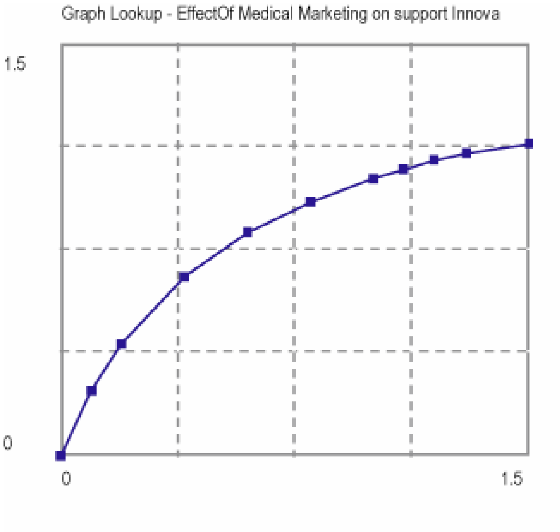


Figure 4a & b: Non-Linear Functions, elicit from Client

We proceeded convening the team for a moderated discussion among them where the members would present their individual sketches to each other along with reasoning before they would settle on a common shape as shown in figure 4b.

Eventually, we would also confront them with our mental model of the lookup table to provide them ample opportunity for sharpening their reasoning skills and deepen their understanding of the effect under consideration.

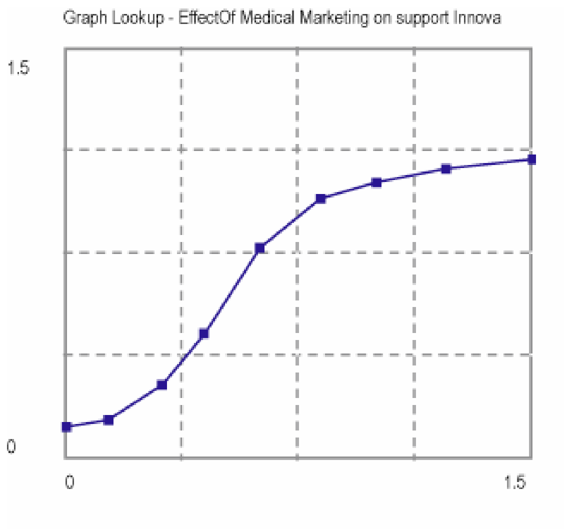


Figure 5: Table Function for Effect of Medical Marketing

This exercise helped establish a firm understanding of the nonlinear interrelationships represented in the model and also clarified some of the uncertainties about the effect of marketing on the diffusion rate. Furthermore, we also got the client involved in some technical conceptualization and thus created ownership in the model at an early stage. After we completed the model, we wrapped up development by thoroughly discussing the structure with the client team using an enlarged plot of the Vensim model diagram.

Model Validation

At the beginning of the project, the management team was somewhat skeptical that this methodology might provide valuable insights. Therefore, a transparent and explicit validation process was to help build confidence in the model. We have sought since to put to use any remaining skepticism to achieve a deeper understanding, widen the view, and discuss more thoroughly potential applications. In the process, we explained how we calibrated the simulation model, using historic market data, so our clients bought into the structural and behavioral consistency of the model.

Sterman (2000), Richardson and Pugh (1981), and Forrester (1961) argued that no simulation model can be validated because every model represents a simplification of reality and, therefore, will differ from reality. However, the goal of model validation in system dynamics is to determine whether a model is appropriate for its purpose and whether model users can have confidence in the model. This is accomplished through model testing and calibration.

Forrester and Senge (1980) describe 17 tests for building confidence in a system dynamics model, while Sterman (2000) lists 12 tests for developing confidence in a model. Sterman’s twelve tests examine models on both structural and behavioral grounds, and other tests focus on collaborative model building projects that include modelers and model users. Richardson and Pugh categorize these tests for building confidence in a system dynamics model into those that test for suitability and those that test for consistency.

Suitability tests determine whether the model is appropriate for the problem it ad-dresses, while consistency tests examine whether the model is consistent with the slice of reality it attempts to capture (Richardson and Pugh 1981). Besides testing the sensitivity of the model by changing some of the assumptions in constants over a range of values and examining the resulting output for change in values, we calibrated the model against market data.

While these tests established confidence within the core team of our client, we also needed to convince the country manager about the validity of the model. Furthermore, it was important to provide the local management team with a set of measures to support communication with stakeholders. To cope with the problem that most of the stakeholders and the country manager were familiar with traditional analytical tools but not non-linear methods, we used a mixture of two approaches to convey confidence in the model.

The first approach as noted above was to calibrate the model against historic market data. Because the focal point of the model is to test management policy for the launch of a new product, we needed a crystal ball to look into the future. We assumed that if the model behaves the same way as a traditional analytical forecast tool, it will help to improve confidence in the model. Thus, the second approach was to calibrate the model against an analytical forecast tool. We used SPSS Decision Time to forecast the therapeutic market in which the new product will be launched. Figure 6 shows the graph from SPSS Decision Time, which depicts the data range of historic and forecast revenues for the total market (see appendix for detailed statistical information).

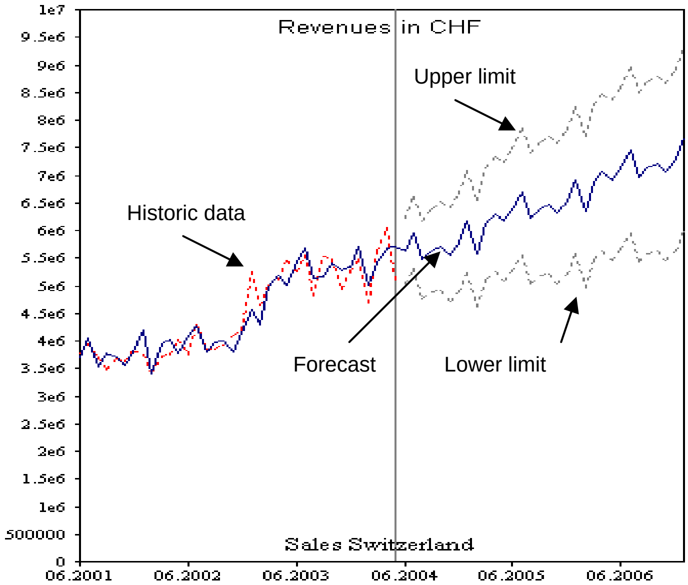


Figure 6: Market Forecast from SPSS Decision Time

As noted above, we calibrated the model against the forecast data from SPSS Decision Time. The graph in figure 6 shows actual market data from 6/2004 until 12/2004 and then forecast data from the analytical tool against the data from our simulation model.

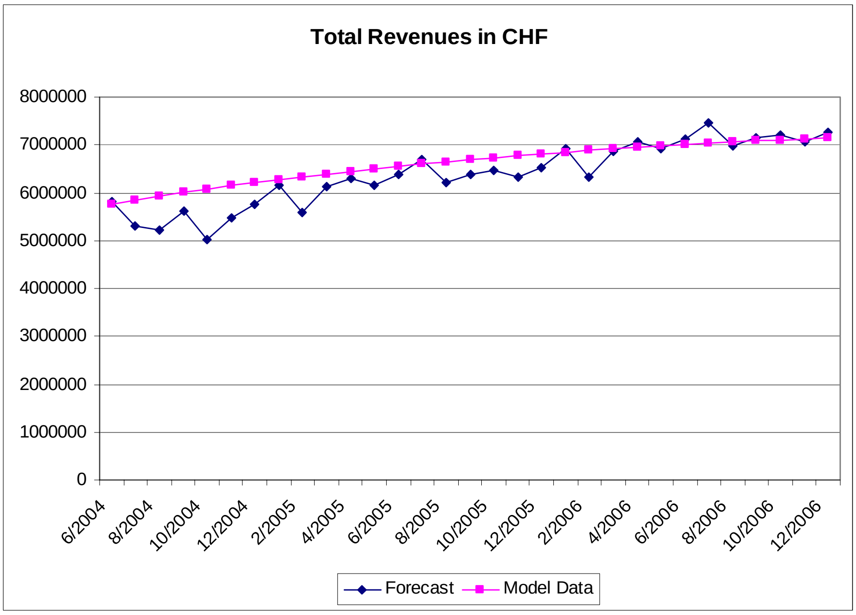


Figure 7: Model Calibration against analytical forecast from SPSS Decision Time

While causal maps and stock-and-flow diagrams were useful in revealing the interdependencies of key variables and thus helped to communicate with the client, the calibration part was important to “sell” the insights gained from the model within the client’s organization. Building the model in close cooperation with the client helps to validate the underlying assumptions captured in the model; calibrating the model against data instilled confidence to support reasoning.

Exercising the Model

In this section we show a number of graphs comparing the proposed strategy from HQ against the strategy, which the client suggests for his particular market. Like a flight simulator is used to let pilots practice their skills in a risk free environment, we built an interface for the management team in order to let them change certain variables and then see how the market response.

While we only present some graphs with number of people in this paper, the model is able to dynamically present all the key variables as shown in figure 1. The model was also used to test a number of resource based policies to optimize sales-rep frequency and medical marketing activities. We do not show these policies tests here because the main task of the model was to support argumentation against the proposed launch strategy from HQ.

The graph in figure 8 compares the expected number of women who will use the client's product under different launch strategies; HQ strategy, which emphasizes a targeted approach towards patients, and client strategy, which is focusing on medical marketing and targeting. The two strategies are based on the same assumptions in terms of spending levels per year but allocate the budget differently.

We conceptualized the model so that effects from investment in medical marketing, direct-to-consumer marketing, and targeting (efforts towards changing preference attitude of doctors for the new product) can be changed to reflect the focal points of the two different strategies.

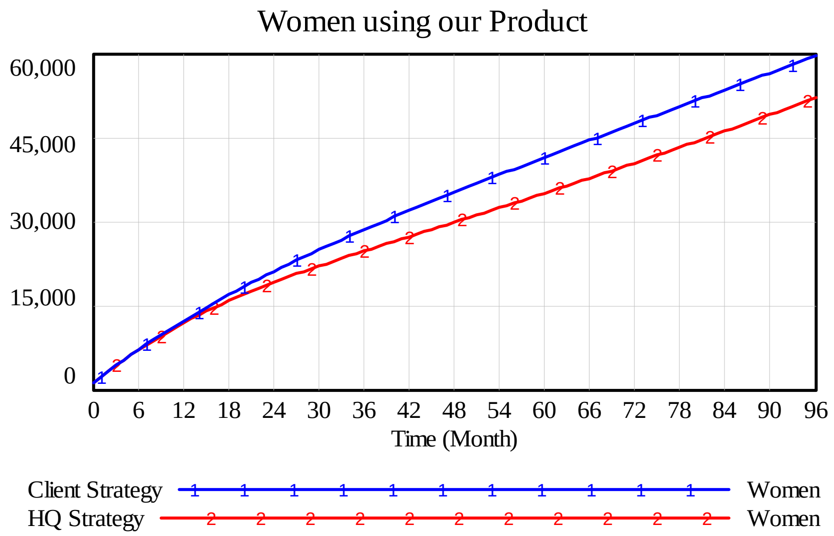


Figure 8: Expected Number of Patients using the new Product

The model does not start with zero on the Y-axis because at the time of market launch there are already a number of patients who use the product as part of a client trial. As can be seen, the client strategy leads to a higher expected number of women who will use the product. While the marketing budget remains the same for launching the new product, the client strategy seems to yield higher returns.

The graphs in figure 9a & b reinforces the previous observation that the proposed launch strategy from HQ does not achieve the same impact as the client's strategy.

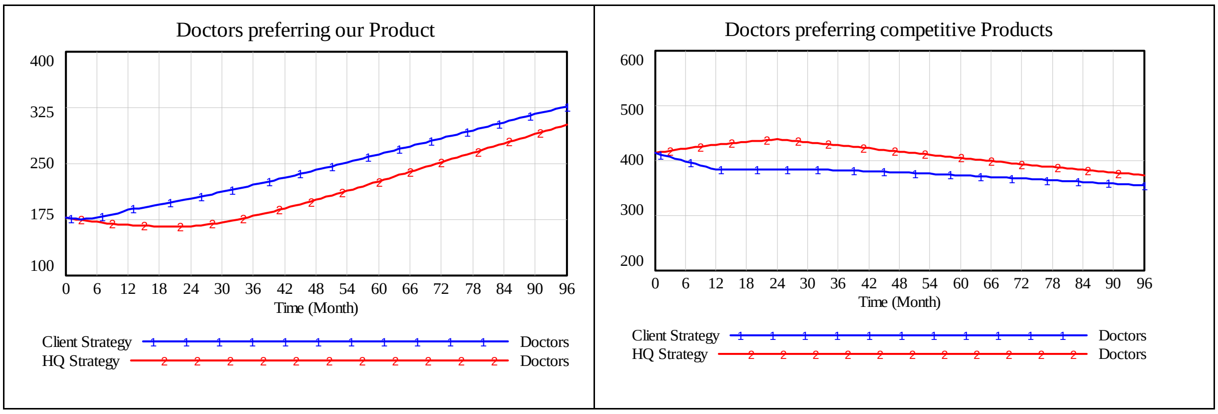


Figure 9a & b: Doctors preferring the new product viz. competitive products

The client strategy, which is focused on medical marketing and targeting yields better results in terms of doctors who prefer the new product as opposed to the suggested strategy from HQ. The results from using the simulation model confirmed our client's assumptions about the need for a localized market approach. While we did not gain any new great insights from the model, the project helped the client to confirm what he already knew.

Motivated by the results of the model and supported with calibration data, the client was able to argue why he thinks the proposed launch strategy from HQ might not achieve the desired objectives.

Discussion

Not every modeling intervention reveals great systemic insights. However, as this case illustrates, conceptualizing and developing an otherwise standard model with the client can substantially improve the client's stature by growing ownership in the model and fostering systematic experimentation. In the process, the client gained a dynamically enhanced understanding of the market feedback relationships and the leverage points for different strategies. Thus, the model not only put on solid experimental ground the client's ideas about why he felt the global strategy may not achieve the desired results but also instilled confidence to argue against the objected strategy.

Arguing against a proposed global strategy in a highly centralized organizational structure is a rather daunting task for a country manager. First of all, he or she needs to get over the “not-invented here syndrome” which suggests that managers tend to neglect an outsider’s propositions. As there are no irrefutable data yet, discussion about the pros and cons of global strategies tends to become very subjective. Seeing is believing; while verbal reasoning alone could eventually lead to similarly strong confidence of the stakeholders in the local manager’s strategy, using model-supported evidence accelerated and elevated the discussion to a different level.

The model conceptualization process in the team-based environment created ownership within the boundaries of the local client, but the model remained a “black box” for the stakeholders. Rather than trying to uncover the “black box” in a series of workshops the stakeholders were not prepared to commit their time to, we used scripts the stakeholders were familiar with. In communication with the stakeholders, the country manager used Excel spreadsheets with graphs showing the results of the model calibration against historic market data and the market forecast data from SPSS Decision Time. This built confidence in that the model’s base line correctly captures market behavior. Next, we used graphs, as displayed in figures 8 and 9 to compare the expected dynamics of the global strategy against the local strategy. These graphs supported the country manager’s argumentation why a local strategy can be trusted to yield better results. Eventually, the country manager convinced the head office to allow for local adjustments of the strategy.

Appendix

Statistical model for market forecast as shown in figure 6

Data Range			
Estimation period: 06.2001 through 05.2004			
Goodness-of-fit Statistics			
Mean squared error		8.621e+010	
Root mean squared error		2.936e+005	
Mean absolute percentage error		4.807	
Mean absolute error		2.194e+005	
Maximum absolute percentage error		13.5	
Maximum absolute error		7.116e+005	
R-Squared		0.8667	
Normalized Bayesian Information Criterion		25.48	
Model Parameters			
	Estimate	***Standard error***	***t-value***
Level	0.4433	0.1518	2.92
Trend	0.003018	0.02469	0.1222
Season	0.001	0.2143	0.004667
Model Statistics			
Error variance	8.621e+010		
Log-likelihood	-502.8		
Number of non-missing residuals	36		
Ljung-Box Statistic(18)	18.88		
P-value of the Ljung-Box Statistic	0.2191		

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