

EFFECTING STRATEGY CHANGE WITH SYSTEM DYNAMICS

Effecting Strategy Change With System Dynamics

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SUMMARY

Abstract

A System Dynamics project for a corporate client generally has three objectives: creation of an analytical tool, transfer of a new analysis technology into the client organization, and managerial development. In many ways, the first two objectives are means toward the third. Development of new -- and shared -- perspectives, attitudes, and behaviors among the senior executives can be the most significant benefit from a System Dynamics project. This paper discusses how the process of System Dynamics has been used to draw out diverse points of view, to test and evaluate the differences, to build a consensus regarding key assumptions, to create confidence in the analytical tool which was developed, and, ultimately, to forge a managerial commitment to a new business strategy. The author draws upon several recent applications in the United States and Europe to illustrate the role of System Dynamics in effecting strategy change, and comments on how the process is affected by differences in organizational "culture."

A System Dynamics project for one of our corporate clients generally has three objectives: creation of an analytical tool, transfer of a new analysis technology into the client organization, and managerial development. In many ways, the first two objectives are means toward the third. Development of new -- and shared -- perspectives, attitudes, and behavior among the senior executives can be the most significant benefit from a System Dynamics project.

Developing consensus among senior managers about a corporate strategy and implementation plan requires agreement on a number of important dimensions:

- o Trends in the technological, competitive, economic, and regulatory environment;
- o The implications of assumed external trends and prospective internal changes for organization performance, both in the short- and long-run; and
- o How changes in strategy will be implemented.

Experience has shown that a model is extremely useful in strategy refinement, testing, and consensus-building because it forces explicitness and consistency in the statement of assumptions, and because it precisely calculates the short- and long-term implications of these assumptions. The process of constructing a model is essentially one of stating explicitly

assumptions about what makes the business perform as it does. The process of testing a model is one of checking the consistency and validity of these assumptions: Do the assumptions produce behavior which is reasonable, and is it consistent with the organization's performance in the recent past? If so, one can have confidence in his view of the business. If not, questionable assumptions can easily be changed, to see if alternatives produce more plausible behavior.

The model becomes the focal point for achieving consensus on the nature and implications of a proposed strategy. In constructing the model, we seek inputs from many people. We discuss their hypotheses about how the business works and about important future trends. We organize and synthesize these hypotheses into an explicit, consistent framework. Assumptions are there for everyone to see and question. Where people disagree on assumptions, we test the implications of the alternatives.

Once a model is constructed that is consistent with the organization's historical performance, we can engage in a series of highly disciplined and deterministic projections of the future: disciplined in the sense that all of the assumptions are explicit and clear; deterministic in that the assumptions produced the projections through paths that are visible to all. The strategy can then be refined by altering it, and the sequence of changes required for its implementation, until everyone is satisfied with the projected results. The strategy can be further tested with the model by subjecting it to alternative assumptions. A consensus on the strategy emerges from a consensus about assumptions and their implications. The model is an integral part of the consensus-building process.

There are several features common to all of our work of this type:

1. Use of a project Task Force, including key senior managers who must accept and support any recommended strategy changes;
2. Emphasis, from the outset, of the client managers' responsibility for selecting and implementing a business strategy, and hence the importance of their playing a leading role in the analysis;
3. Recognition that differences in beliefs, perspectives, and assumptions exist, and have to be dealt with before agreement on a strategy can be achieved;
4. Use of the model development process to force explicit definition and testing of assumptions about how the business "works", the causes of problems, how the organization has been affected by the external environment, and likely future scenarios;
5. An iterative approach to modeling, in which a relatively simple initial model is created quickly, tested, evaluated, used for preliminary analyses, and then expanded and refined in several subsequent phases of work;
6. Concern not only with strategy design but also with problems of strategy implementation, and use of the model to explore implementation issues; and
7. Recognition of the need for an on-going process of "strategy management", that is, regular review, re-evaluation, and revision of whatever strategy is adopted.

Our experience also has revealed significant differences in organizational "culture" between the U.S. and European companies, that affect the process of strategy change. In the European organizations where we have worked, it has usually taken a much longer time to get differences in perspectives, assumptions, and goals "out on the table" for discussion. Lower-level managers often are reluctant to speak up in meetings with more senior people, particularly when they disagree. We have encountered more defensiveness regarding managerial competence and professionalism in the European companies. These differences mean that the process of building shared perspectives on the business, consensus about a new strategy, and commitment to its implementation in a European organization may take more

patience on the part of the consultants and more investment by the client.

This suggests a series of projects, with periodic evaluations of progress and payoff.

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## I. INTRODUCTION

A change in corporate strategy entails significant costs and risks. Large investments in R&D, product development, facilities, bringing in new people, and market penetration may be involved. In any organization, implementing new policies, systems, or structure (all possible components of a new strategy) costs considerable sums out-of-pocket, plus the inevitable disruption.

The primary risks are corporate and personal failure. Despite the effort that goes into its formulation, a new strategy may be basically flawed. It may be negated by unanticipated technological, competitive, economic, or regulatory developments, or it may encounter serious implementation problems. Of course, not changing also may entail significant risks.

In evaluating a potential strategy, the key questions are:

- o At what cost?
- o With what problems?
- o To what longer-term end?

It is important that a new strategy be carefully designed to reflect the uncertainties in external trends, and carefully implemented to avoid creating needless additional problems. With so much at stake and so many critical questions in the air, it is little wonder that managers are hesitant and often seek the help of outside consultants.

My firm has been retained by many of its corporate clients when they were considering (indeed, debating was frequently a more accurate word) major changes in strategy. What did we offer that attracted them to us?

We could assist them to analyze strategic issues in a comprehensive and systematic manner. We could help them to develop a new and lasting capability for strategy management.\* One aspect of this capability is a strategic planning model, to provide both more intellectual discipline and more computational efficiency to the process. A second aspect -- a by-product of developing the first -- is an enhanced ability of senior managers to share a broad, integrated view of the business. We accomplish these ends with System Dynamics.

A System Dynamics project for one of our corporate clients generally has three objectives: creation of an analytical tool, transfer of a new analysis technology into the client organization, and managerial development. In many ways, the first two objectives are means toward the third. Development of new -- and shared -- perspectives, attitudes, and behaviors among the senior executives can be the most significant benefit from a System Dynamics project.

This paper discusses how the process of System Dynamics has been used to draw out diverse points of view, to test and evaluate the differences, to build a consensus regarding key assumptions, to create confidence in the analytical tool which was developed, and, ultimately, to forge a managerial commitment to a new business strategy. The paper draws upon two recent applications (one in the United States and one in Europe) to illustrate the role of System Dynamics in effecting strategy change, and to comment on how the process is influenced by differences in organizational "culture."

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\* "Strategy Management Using System Dynamics" by H. B. Weil and J. M. Lyneis. Paper presented at the 1980 International Conference on Cybernetics and Society (Oct. 9, 1980), Cambridge, Massachusetts.

## II. THE NEED FOR STRUCTURED ANALYSIS

Developing consensus among senior managers about a corporate strategy and implementation plan requires agreement on a number of important dimensions:

- o Trends in the technological, competitive, economic, and regulatory environment;
- o The implications of assumed external trends and prospective internal changes for organizational performance, both in the short- and long-run; and
- o How changes in strategy will be implemented.

It is not easy to achieve agreement along these lines. Various groups of managers start with different perspectives, different assumptions, different information available to them, and different short-term objectives. Achievement of a consensus, therefore, involves dealing with these differences.

Information must be shared; assumptions must be made explicit, scrutinized, and tested. Ultimately an assessment must be made of the implications of potential changes in strategy for the organization's performance. Without this, the whole discussion is unreal. Change is costly in terms of disruption, money, and risk. One needs to project the benefits from change in order to weigh them against the costs. Disagreements often disappear when that is done.

The same holds true regarding assumptions about the external environment and about strategy implementation. In some cases, the exact assumption may have little impact on projected performance. Other assumptions will be critical. But, once again, it is difficult to know

which are which, and where disagreements over assumptions are important. A final barrier to consensus is the complexity of the organization as a business "system." The paths of cause and effect through which changes have their ultimate impacts are very hard to follow. It is therefore unclear what would happen if various changes were made. Under these circumstances, disagreements may reflect different degrees of willingness to plunge into unknown territory.

Experience has shown that a model is extremely useful in strategy refinement, testing, and consensus-building because it forces explicitness and consistency in the statement of assumptions, and because it precisely calculates the short- and long-term implications of these assumptions. The process of constructing a model is essentially one of stating explicitly assumptions about what makes the business perform as it does. The process of testing a model is one of checking the consistency and validity of these assumptions: Do the assumptions produce behavior which is reasonable, and is it consistent with the organization's performance in the recent past? If so, one can have confidence in his view of the business. If not, questionable assumptions can easily be changed, to see if alternatives produce more plausible behavior.

The model becomes the focal point for achieving consensus on the nature and implications of a proposed strategy. In constructing the model, we seek inputs from many people. We discuss their hypotheses about how the business works and about important future trends. We organize and synthesize these hypotheses into an explicit, consistent framework. Assumptions are there for everyone to see and question. Where people disagree on assumptions, we test the implications of the alternatives.



Once a model is constructed that is consistent with the organization's historical performance, we can engage in a series of highly disciplined and deterministic projections of the future: disciplined in the sense that all of the assumptions are explicit and clear; deterministic in that the assumptions produced the projections through paths that are visible to all. The strategy can then be refined by altering it, and the sequence of changes required for its implementation, until everyone is satisfied with the projected results. The strategy can be further tested with the model by subjecting it to alternative assumptions. A consensus on the strategy emerges from a consensus about assumptions and their implications. The model is an integral part of the consensus-building process.

### III. EFFECTING STRATEGY CHANGE

#### A. Example No. 1: A Diversified U.S. Financial Services Company

##### 1. Objectives of the Project

This project began in the spring of 1980. It was the culmination of a process of strategy development and evaluation that had been underway throughout 1979 and had reached a significant plateau with the preparation of a draft strategy document in January 1980.

In general terms, the objective of the project was to clarify, test, and refine the 1/80 strategy. To be somewhat more specific, our goals were:

- (a) To more precisely define the elements of the 1/80 strategy, e.g., growth targets, the number of people involved in each change, the cost and productivity impacts expected from each change, the timing of changes;
- (b) To develop and test a set of explicit assumptions about the functioning of the company as a business "system," e.g., the impacts of inflation on costs and sales productivity, the sensitivity of sales personnel (in terms of recruitment, retention, and time allocation) to compensation, product competitiveness, and their own morale, the effect of personnel growth and turnover on sales productivity;
- (c) To develop and test various assumptions about the external environment, e.g., the competitive position of each of the company's major products in each market where it might be sold (in terms of price, service, and features), future economic trends (inflation rates and business cycles), the maximum profit margin sustainable on each major product (given competitive and economic conditions);
- (d) To project the impacts of the 1/80 strategy, and many other possible changes, on the company's financial performance (earnings, sales, and costs) and on its personnel (as indicated by compensation, morale, and turnover);
- (e) To refine the 1/80 strategy wherever possible, taking into account the risks posed by adverse conditions, e.g., lower

than expected product competitiveness, higher than expected inflation; and

- (f) To forge a consensus among senior managers about the strategy and its implementation.

To all of those involved in the project, the last objective was paramount. The organization and conduct of the project were carefully designed to bring people with different points of view toward consensus. Much time and effort were expended along the way, but it is fair to say considerable progress was achieved.

## 2. Steps in Accomplishing the Project

The project moved forward in three distinct phases. The first phase, which ended about June 1st, involved extensive information gathering. Several interviews were conducted with almost every senior manager of the company. Their purpose was to identify problems, key assumptions, opinions regarding the 1/80 strategy, areas of agreement and disagreement, and concerns about the possible negative impacts of various changes. In the course of these interviews, we obtained rich verbal descriptions of how the company functions as a business "system" -- the personnel dynamics of each part of the organization, the determinants of sales, the company's financial structure, the process of planning and control, and how all of these things interrelate. A considerable quantity of relevant articles, reports, and numerical data also were assembled.

All of this information served as inputs for designing and programming a computer simulation model. The reasons for taking a simulation modeling approach are discussed below in Section 4. The Phase I model was relatively simple. The amount of detail regarding products and markets, new distribution systems, and financial structure was deliberately kept

low, so as to pose no barrier to comprehending how the model worked, and why. The model's design and the numerical assumptions imbedded in it were reviewed and discussed at several lengthy meetings of the project Task Force (whose role is more fully described in Section 3).

Once the Phase I model was operational, it was extensively tested to show its historical validity, the most critical assumptions, and needed refinements. For these tests, the model simulated company decisions and performance over the period 1970-1990. Even at this early stage, the model's historical behavior was judged to be quite reasonable and was within 10-20% of the actual data. This demonstrated ability of the model to "reproduce past history" contributed significantly to the Task Force's confidence in it.

The second phase of the project occurred over the months of June and July. The Phase I model was significantly expanded to obtain the detail required to represent elements of a new strategy. Competitive position and sales were now calculated separately for six important groups of products. Sales performance was made dependent on which markets the company emphasized. The capability was added to represent many alternative distribution systems. Another round of tests were performed to establish the historical validity of the model at a more detailed level and, once again, the importance of various assumptions.

The third, and final, phase has involved the evaluation of possible elements of a company strategy. A large range of experiments (numbering well over one hundred) were performed with alternative distribution system modifications, product and market emphasis, product competitiveness (including price changes), sales growth and expense targets, and planning and

control policies. These elements were tested singly and in many combinations, under a range of assumptions regarding external conditions (inflation, etc.). During the final phase, much effort was invested in reviewing and refining the model's financial structure. This was necessary to ensure that comparisons of projected financial performance from one experiment to the next were valid.

The results were discussed in considerable detail at several meetings of the project Task Force. They formed the basis of the conclusions and recommendations presented in the project.

### 3. Role of the Project Task Force

It is most important that the reader understand the organization and philosophy of this project. The philosophy, from the beginning, was one of the company's managers developing a strategy with the help of outside consultants. It distinctly was not a philosophy of having consultants analyse the situation and then tell the client what to do. In an exercise of this type, the outside consultants can contribute techniques, experience, and objectivity. But in the end, the client "owns" the problem and must implement the solution.

The project was organized to engage many senior managers in the process of defining assumptions, designing a computer simulation model of the company (more about this below), evaluating the model, specifying policy and sensitivity experiments to be performed, interpreting the results, and formulating a recommended strategy. These managers formed a project Task Force.

Throughout the project, the Task Force served as a source of detailed information about the company, its markets, and its competitors.

Every two to three weeks, the Task Force meet to review and discuss aspects of the project. These meetings typically lasted for the better part of a day (4-6 hours). In addition, most members of the Task Force were individually interviewed several times during the first phase of the project.

As the project progressed, several Task Force meetings were devoted to a very detailed review of the computer model's structure and the detailed assumptions that went into it. Many significant additions and refinements came from those meetings. At other meetings of the Task Force, the results of simulation experiments were analyzed. Such meetings generally would begin with a discussion of experiments made a day or two before. The impacts on company performance (in terms of sales, operating earnings, ratio of actual to standard expense, sales force productivity, average compensation for different types of people, and other indicators selected by the Task Force) over the period 1980 to 1990 would be reviewed for each experiment, along with the model relationships and assumptions most responsible for the results. The Task Force would then request additional refinements to the model and, based on these, further simulation experiments. On one occasion, a computer terminal was used in a Task Force meeting to obtain on-the-spot results from several experiments.

The final phase of the project involved a very wide range of experiments. Many possible elements of a company strategy were tested, under various assumed external conditions. This period was in ways analogous to the passing of the baton in a relay race. During the first months of the project, the initiative was with the consultants. Starting at the end of July, the initiative shifted to the company managers on the Task Force. It was, increasingly, they who specified which refinements and tests to perform next; it was they who debated project's conclusions; and it clearly

was they who would go forward from there to make the final decisions about a new company strategy.

#### 4. Methodology Used

This project has relied very heavily on a computer simulation model of the company. There are several very important reasons why a model was used. First, it forced people to be explicit. The need to specify, initially in flow diagrams and later in mathematical equations, a theory of how the company functions and how its financial performance is determined caused the Task Force to spell out, argue about, and ultimately agree upon dozens of critical assumptions and hypotheses. Any strategy is based on numerous assumptions. Usually they remain poorly articulated, and a consensus about them is never reached. Achieving a consensus about important assumptions is a major step toward a consensus regarding a strategy.

The second reason for using a model was that it allowed for the testing of assumptions. Putting many individual assumptions together in an explicit mathematical framework is a powerful test of their consistency with one another. Furthermore, attempts to simulate a period of past history (in this case, 1970 to 1980) tests whether a set of assumptions about how the company functions is consistent with actual data. In the process of improving the historical accuracy of the model, many assumptions were re-examined and refined. Finally, a model enables sensitivity testing -- that is, varying assumptions from one's best estimates to see how much difference it makes in the simulation results. This type of testing reveals which assumptions are really most critical. Assumptions that turn out to be especially critical represent sources of business risk,

opportunities to improve the company's performance, and/or subjects about which more information should be gotten.

Third, the model provided a framework to which the whole Task Force could relate. Assumptions were clear for all to see. Alternative hypotheses could easily be tested. And the results of any simulation experiment could be traced back to the assumptions that produced them.

The model also made it possible to be more thorough. In theory, all of the calculations and projections performed by the model could be done manually. As a practical matter, this would have been a vast undertaking. During the project, approximately five hundred simulations were performed, each one involving perhaps a million calculations. By taking advantage of the power of a large computer, we were able to include more important relationships, to test more possible elements of a strategy (singly and in many combinations), and to consider more competitive and economic scenarios than otherwise would have been possible.

Last, but certainly not least, the model developed in this project provide a complete record of assumptions and analyses for later reexamination. Company managers will be able to efficiently review and update their strategy in the future with the help of the model. If conditions change in ways counter to what the Task Force assumed, the strategy can be re-evaluated at any time.



B. Example No. 2: A European Chemical Manufacturer

1. Objectives of the Project

In this case, we were actually involved in a series of projects that began at the end of 1977. All of them focused on one of the company's important product lines. The basic objective was to develop, and then update, a new business strategy for the product line in question. We became involved because senior management recognized several immediate problems, and felt that their future strategy had to contend with an external environment quite unlike the past. The purposes of the initial project were:

- (a) To develop a far clearer and more detailed description of the problems which existed within the product line;
- (b) To provide an in-depth analysis of the causes of these problems (i.e., to what extent were they caused by management's policies, to what extent aggravated or even precipitated by external factors); and
- (c) To define and evaluate alternative responses to these problems and, in particular, to illuminate the risks involved in critical but uncertain assumptions (e.g., the timing of market opportunities for new products) upon which future projections were based.

This effort was completed in September 1978.

Five additional projects followed, over a period of approximately two and one-half years. Their goals were:

- (a) To engage in a thorough review of critical assumptions and, then, to update the projections and recommendations of the original project;
- (b) To install the model on the company's computer system and train one of their people in the technical details of the model;

- (c) To expand the earlier analyses to include strategic issues relating to investment in production capacity;
- (d) To update the assumptions in the model and strategy conclusions from earlier analyses; and
- (e) Once again, to update the strategy conclusions in light of significant technical and financial developments within the company.

Throughout this series of projects, senior management had a further, high-priority objective. They perceived that functional managers (for example in sales, technical support, production, and R&D) were quick to blame one another for the product line's problems, were lacking a shared comprehensive view of the business, and had no agreed-upon strategy for more than one or two years in the future. These senior people hoped the projects would contribute to managerial team building, although this was not a publicly expressed goal.

## 2. Steps in Accomplishing the Project

The original project consisted of two phases. The first phase was "Problem Definition." We sought to define the system of underlying factors that had produced the problems, and which would affect any attempts to improve the situation. The principal steps in the first phase were:

- (a) Problem Identification. This was accomplished through several rounds of interviews with company personnel, and through review of historical data.
- (b) Diagnosis. Hypotheses were developed regarding the origins, evolution, current consequences, and future implications of problems in the product line.
- (c) Discussion and Refinement. A presentation and follow-up discussion with management occurred for the purpose of reviewing and refining the problem diagnosis.

A report in March 1978 presented the results of the first phase of the study.

The second part of the project was the "Analysis" phase. The principal steps in this second phase of work were:

- (a) Model Development. A computer simulation model of the "system" of factors producing problems in the product line was developed, tested, and documented.
- (b) Review. The model -- and the techniques used to develop it -- was presented, discussed, and refined in meetings with management.
- (c) Policy Analysis. The model was used to evaluate alternative responses to problems in the product line.
- (d) Recommendations. The policy analysis results were thoroughly reviewed and recommendations for future strategies developed.

The second phase of the project was accomplished over a period of five months.

Our firm has a particular philosophy and approach for identifying, structuring, and analyzing business problems. Our objective is to view the client organization as a whole: that is, as a system of interacting and interdependent components. We carefully consider each component and its interaction with the others. We identify how the organizational components affect one another over a period of years, and how they are impacted -- individually and collectively -- by economic, social, and political trends.

In the case of this project, the important organizational components were the groups involved in selling, manufacturing, technical assistance, quality control, and R&D for the product line being studied, plus senior management of the company. For us to define and diagnose the problems of the product line, it was necessary to structure the interactions, over time, of these important groups and how they affected the

company's competitive position, sales performance, and profit performance.

This structuring process involved consideration of:

- (a) The activities performed by each group (e.g., selling, manufacturing, assisting customers, developing new products);
- (b) The formal policies that govern these activities (e.g., policies concerning pricing, inventory levels, product testing);
- (c) Informal behavior, which also influences the effectiveness and/or cost of these activities (e.g., how managers react to technical problems or to variances from financial targets);
- (d) The system for planning and management control (e.g., how financial targets are set, how resources are allocated, how performance is evaluated); and
- (e) The impacts of the external environment (e.g., the consequences of increased customer sophistication, environmental regulations, and nationalism).

The result was a framework of cause-and-effect relationships which described the functioning and performance of the product line.

We believe that this framework was quite useful as an aid for problem definition and diagnosis. It helped the project Task Force (see below) to see the origins and evolution of the existing problems, and to distinguish between the basic causes of these problems and their more obvious symptoms. The framework represented a comprehensive and objective picture of a major piece of the company's business. Such a picture is very difficult for any "insider" in an organization to develop, and is one of the greatest benefits to be gained from an outside consultant. This "system" framework and the conclusions which we developed from it were the products of an iterative process of information gathering and analysis.

### 3. Role of the Project Task Force

As in the first example, we worked with a Task Force of managers. Both the composition and the role of the Task Force changed considerably over this series of projects. In the original project, the Task Force was composed of sales, technical support, R&D, and manufacturing people concerned with the product line, plus the company's industrial marketing manager, his staff assistant, the comptroller, and the president. This group met every six weeks, on average. Important assumptions, aspects of model structure, and simulation results were presented for discussion. A lot of time was spent talking about the external environment (customers, competitors, government regulations, etc.) and how it affected the company. The Task Force was very interested in sets of ten-year projections under different assumptions about external developments. We prepared a series of strategy recommendations, which the Task Force questioned thoroughly.

During the second project, the Task Force really dug into the details of the model. In a session which lasted for three days, they debated (and, in most cases, finally reached agreement) on a large number of quantitative assumptions about how managerial decisions were made, what determined their sales, and the process of developing and introducing new products. Several times each day, we would adjourn the meeting to perform simulations to test the effects of alternative assumptions. By the end of this project, the Task Force (now expanded to include several members of the corporate planning staff, who were designated in-house model users) had internalized much more of a "systems view" of their business, were more explicitly thinking about internal as well as external sources of their problems, and had more confidence in the model-generated strategy recommendations.

As the subsequent projects progressed, the most senior managers withdrew from the Task Force and became a separate, parallel "client" for the work. The Task Force itself sub-divided between one or two staff people who worked very closely with us on the technical details of model refinement, and the rest who continued to formulate key assumptions and discuss results. The role of the most senior managers was particularly important. They had acquired confidence in the model and the overall process of periodic review and update, and were comfortable delegating that to the Task Force. The senior managers requested answers to specific strategic questions as the need arose. They communicated their own confidence in the process, while leaving the people directly responsible for the product line the freedom to explore options, debate assumptions, and work out a strategy with an appropriate amount of "privacy."

#### IV. SOME OBSERVATIONS

The two preceding examples illustrate how we work with corporate clients on strategy analysis projects. There are several features common to both examples, indeed, to all of our work of this type:

1. Use of a project Task Force, including key senior managers who must accept and support any recommended strategy changes;
2. Emphasis, from the outset, of the client managers' responsibility for selecting and implementing a business strategy, and hence the importance of their playing a leading role in the analysis;
3. Recognition that differences in beliefs, perspectives, and assumptions exist, and have to be dealt with before agreement on a strategy can be achieved;
4. Use of the model development process to force explicit definition and testing of assumptions about how the business "works", the causes of problems, how the organization has been affected by the external environment, and likely future scenarios;
5. An iterative approach to modeling, in which a relatively simple initial model is created quickly, tested, evaluated, used for preliminary analyses, and then expanded and refined in several subsequent phases of work;
6. Concern not only with strategy design but also with problems of strategy implementation, and use of the model to explore implementation issues; and
7. Recognition of the need for an on-going process of "strategy management", that is, regular review, re-evaluation, and revision of whatever strategy is adopted.

Of course, the critical questions remain: What did these two projects (and others like them) really achieve? What unique contribution did System Dynamics make? Responding to these questions in order, I believe both projects had substantial impacts on the client organizations. They changed strongly-held views of senior managers about "the right way to run the business." They gave management the confidence to be more

venturesome; in both cases, strategies were adopted that involved higher levels of investment and greater departures from past policies than management had earlier been willing to accept. And they caused managers to internalize a shared, integrated "systems view" of their business that affected how they related to one another and carried out their respective jobs.

Furthermore, I believe that the process of System Dynamics was essential in achieving these results. It provided the intellectual impetus and discipline to be explicit, to test assumptions, to diagnose problems, and to evaluate alternative strategies and scenarios. It also provided the computational efficiency to perform large numbers of simulation experiments; we were able to test many possible elements of a strategy (singly and in combination) under many competitive and economic scenarios. Perhaps most important, it produced a "transparent", full-information, deterministic model to which non-technical senior managers could easily relate. Assumptions were there for all to see and questions. Everything people felt was important could be included, without awkward methodological constraints. The model could be evaluated against all available information concerning the business and its performance. And these results of any simulation could be traced back to the assumptions that produced it. Without these contributions, very little of the rest would have been possible.

The two examples also illustrate significant differences in organizational "culture" between the U.S. and European companies, that affect the process of strategy change. In the European organizations where we have worked, it has usually taken a much longer time to get differences in perspectives, assumptions, and goals "out on the table" for discussion.



Lower-level managers often are reluctant to speak up in meetings with more senior people, particularly when they disagree. We have encountered more defensiveness regarding managerial competence and professionalism in the European companies. These differences mean that the process of building shared perspectives on the business, consensus about a new strategy, and commitment to its implementation in a European organization may take more patience on the part of the consultants and more investment by the client. This suggests a series of projects, as described here, with periodic evaluations of progress and payoff.