

# Developments in Business Simulation & Experiential Exercises, Volume 15, 1988

## AN EVOLUTIONARY CLASSROOM EXPERIENTIAL AND COMPUTER SIMULATION MODEL OF A CORPORATE STRATEGIC PLANNING SYSTEM

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### ABSTRACT

A decision support model for a student-designed strategic planning system for a complex conglomerate is described. This model involves both computer implementation and human processes. Each year the model is modified to match the real-life dynamics of the conglomerate it represents, which have been considerable. Also, each year the model further "evolves" as students alter, improve, or add to it,

businesses: cigarettes, beer, wine, soft drinks, real estate, and a variety of industrial products. The class project assignment was not to do a traditional policy/strategy case analysis but to design a strategic planning system for Philip Morris that would generate and evaluate alternative strategies and provide for implementation of chosen strategies. The planning system design was also to include procedures for implementing the planning system itself.

### INTRODUCTION

Business policy and strategy courses at the senior and masters levels have been the spawning grounds for important developments in simulation gaming and experiential learning. In most degree programs these are "terminal" courses, i. e. they not only conclude and summarize a prior curriculum but also have no sequel course. However in a curriculum aimed at specialized masters- and doctoral-level studies, business policy and strategy courses sometimes serve as the prerequisite or leveling point of entry into a program of study. Additional courses beyond the usual policy/strategy course can comprise a program of advanced study in the general field of policy and strategy. In one such program, a course titled "Design of Strategic Planning Systems" was placed in the catalog without much prior thought to what it would be.

#### The Pedagogical Challenge

Given that an advanced graduate course in the field of policy and strategy dealing with designing strategic planning systems was to be taught, pedagogical questions such as these arose: Should it use experiential methods? Should it use simulation gaming? (These two methodologies would, of course, build on students' prior experiences in the "terminal" policy/strategy course.) Would nongaming computer simulation models be appropriate? What substantive content should there be? How should the course differ in point of view from the "terminal" course?

The guiding answer to these questions was: the students should design a strategic planning system as a class project. Readings and cases were selected to focus on this class project. Cases chosen were not the usual policy/strategy cases, but were cases in the actual design and implementation of strategic, planning systems in real organizations, mostly large corporations. The readings paralleled the cases. As the organization for which the students were to design a strategic planning system, a large corporate conglomerate was desired in order to focus strategic planning at several organizational levels. The firm selected was Philip Morris Inc. The original reasons for selecting Philip Morris were that a written case was available, it was currently being used in the policy/strategy course, and it was an international conglomerate with a history of acquisitions and divestitures. At the time of selection (1983) Philip Morris was engaged in the following

### COURSE HISTORY

1983, the Design of Strategic Planning Systems course has been taught seven times. Planning system design cases and readings have been changed and new topical materials introduced, but the class project and its target company, Philip Morris, have remained the same with one exception. The first time the course was taught, students had to design a strategic planning system from a zero start. Thereafter, the class project has been to take the system left in place by the prior class and modify, improve, or otherwise build on it. Hence, the designed strategic planning system for Philip Morris has become evolutionary in nature (which, incidentally, is the prescription of one of the reading's authors for implementing such a system in real organizations). The choice of Philip Morris was fortuitous because in the ensuing five years Philip Morris has itself evolved by divesting its soft drinks and industrial products businesses, by buying General Foods, by being Included in the Dow Jones list of 30 industrial stocks, and, most recently, by reorganizing. Hence, each term, the students have had some real-life changes in their target company to cope with, which not only enhanced the evolutionary nature of the course strategic planning project but also gave the project a dynamic history for review each term.

#### A Strategic Decision Support System

It is perhaps inconceivable today that any formal strategic planning system would exist without computer support. From the first, students were instructed to develop necessary and pertinent computer models and programs for their proposed planning system. Commercial mainframe software was available that seemed custom-made for this project. This software is called, appropriately, MODEL (Lloyd Bush & Associates, 1981). MODEL is a spreadsheet oriented computer program generator that talks English." There are none of the row-column-cell statements of microcomputer spreadsheet software. In MODEL, one says, for example, "Profits - Revenues - Costs" and the generated program does it for all columns without further detailing in this statement the rows, columns, or cells (the equivalent of subscribing in FORTRAN) Of course, in this example, there must be a Revenues row and a Costs row in order to give a Profits row. Models written in MODEL are readable by managers.

There are three features of MODEL that are especially pertinent to this course and its class project. These features are:

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1. “What if” examination of modeled consequences of hypothetical strategy alternatives.
2. Hierarchical consolidation of proforma financial statements and other spreadsheet information.
3. Monte Carlo simulation.

### “What If” Analysis

Once a MODEL model is built, many aspects of it and of the data it uses can be controlled from the interactive computer terminal without changing the program. For someone familiar with the chores of programming, compiling, executing, then reprogramming and so on, this aspect of MODEL is truly amazing. In its WHATIF mode (one word in capitals following MODEL’s convention), MODEL can by terminal command perform any of multiple preprogrammed sets of instructions, get any of multiple sets of data, change any data using MODEL’s extremely convenient data generation techniques (for example, altering a row by a constant or growing percent) display whole spreadsheets or single rows, send reports to the printer, save whole spreadsheets or sets of data, express the spreadsheet as ratios, and call subroutines from mathematical, financial, statistical, forecasting, and hierarchical consolidation libraries. For example, with a goal seeking feature built into a set of instructions, from the terminal a row of hypothetical profit results may be entered and the revenues required to generate these profits may be computed, displayed, saved, and the process repeated as many times as desired.

### Hierarchical Consolidation

The consolidation library allows models to be written that perform under WHATIF interactive terminal control consolidation of spreadsheets representing departments, divisions, business units, subsidiaries, headquarters services, potential acquisitions and divestitures, or reorganized configurations of any of these. Consolidation may be performed from any organizational level, to any higher level. Consolidations are controlled by hierarchy files. Each hierarchy file is a statement of an organization structure showing parent entities with children that in turn may be parents to children for as many levels as desired. At the bottom levels are entities for which initial data is provided in a separate data base. Data for the intermediate entities is created by consolidation or supplied directly from files or by data generation techniques, then stored in a data base. Consolidated entities may own varying percentages of children. The amazing thing for simulation modeling is that consolidation to any level can be performed interactively from the terminal using any one of multiple hierarchy files and any one of multiple data bases, each of which may be altered from the terminal—all, without reprogramming, recompiling, or separately manipulating data.

### Monte Carlo Simulation

MODEL provides elaborate capability for Monte Carlo simulation. Within any spreadsheet loaded from a data base, any variable value or any row of values may be represented by a library probability distribution (uniform, triangular, normal, lognormal, exponential, gamma, beta, poisson, or historical) with parameters set interactively from the terminal. Parameters may grow or shrink over columns (years). Multiple or identical sequences of random numbers are available through seed number control. The number of

Monte Carlo passes (trials per variable) may be controlled from the terminal. Statistics collected from Monte Carlo runs may include minimum, maximum, mean, standard deviation, skewness, kurtosis, a normal approximation, a frequency distribution with percentages greater and less than class boundaries, and a histogram. Finally, the spreadsheet is filled with median values for terminal display or printing.

The rationale for Monte Carlo simulation is to learn the effects of interacting random variables on derived variables of interest when the resulting distributions cannot be inferred directly by analysis (Barton, 1970). For example, if a business unit’s revenues are assumed to vary for each year of say ten years as a normal distribution with means and standard deviations different for each year, labor costs are assumed to vary uniformly within a range that moves upward each year, and interest rates are assumed to follow a bimodal historical frequency distribution, then for each of the ten years MODEL Monte Carlo simulation can create a bottom line profits distribution giving the implications of the modeled risk and uncertainty. In this example, if the number of passes (i. e., trials) was set to 1000, MODEL would have created 1000 spreadsheets, drawing from the hypothesized distributions for each year (column) for the revenues row, the labor costs row, and the interest rate row using the parameters set for each year for these distributions. Then with each drawn random variate in place, MODEL would compute the entire spreadsheet and pass off the bottom line profits for each of the ten years to ten files. Each file would contain 1,000 different possible profit figures from which statistics would be computed and reported. Finally, median values for the random variables would be entered and a new spreadsheet computed. The process can be repeated with different parameters, seed numbers, and number of trials as often as desired from the terminal in interactive WHATIF mode. To change the distributions for any variable or row, a different set of instructions must be programmed and compiled or these instructions may be preprogrammed and available under interactive WHATIF control.

### “What If” Hierarchical Consolidation and Monte Carlo Simulation

Monte Carlo instruction sections have been included in the Philip Morris model developed evolutionarily by student project groups. Variables assumed to be uncertain have been domestic sales for various business units, research and development for the beer business, mortgage rates for the real estate unit, foreign exchange rates for the international cigarettes unit, tobacco costs for domestic cigarettes, tax rates for corporate headquarters, and others. These simulations have been for particular business units, for divisions, or for corporate headquarters. The effects of these uncertainties can be studied for each entity and a median report can be saved in a data base.

The implications of the above uncertainties for the entire consolidated corporation (the top of the hierarchy) can be partially seen by consolidation of median reports. Unfortunately, MODEL does not supply compounding of the uncertainties modeled for each entity or business unit in the consolidated spreadsheet. In other words, distributions of values are not consolidated upward. (Of course, this could be accommodated by putting the entire organization into a single spreadsheet, which is feasible but unwieldy, possibly using MODEL’s ability to process three-dimensional spreadsheets. Alternatively, distributions for rows of the highest consolidated entity can be assumed and Monte Carlo simulation done directly on it, and this has been done.)

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Again, all this can be accomplished under interactive WHATIF control at the terminal (assuming sufficient anticipatory preprogramming of instruction sections). From the terminal, all data is accessible and hierarchy files may be added, deleted or altered. The MODEL model evolved for Philip Morris by the cumulative efforts of five years of student projects can now explore the financial and other data implications for the total corporation of strategic portfolio changes such as acquisitions and divestitures, and of business unit strategies such as hold, grow, or harvest all under conditions of risk and uncertainty at any level in the organization.

### The Philip Morris Computer Model Over the Years

In order to train students in the MODEL decision support system, a printed and online tutorial supplied by the software vendor was used. Students at the terminal, paced themselves through writing MODEL computer programs that demonstrated many of the above features of MODEL. In order to prevent the course from resolving into a computer programming course, after completing the tutorial, students were not asked to write further computer programs. Instead, they were given four programs to use, complete with data. These were a simple "brute force" consolidation program, an illustrative hierarchical consolidation program, the PMET program described below, and the long complex program for Philip Morris (called UCM for uniform consolidation model) left in place by the prior class. Thus, students were able to progress from very simple "toy" models to models that had behind them many person-semesters of development. Students were able to understand what the big Philip Morris UCM model, was doing for the class project without suffering the pain of writing it from scratch. Each student had a computer account and received and ran all of these programs.

Over the years, modifications made in the original Philip Morris UCM MODEL model include:

- Updating the columns for years
- Updating the data files
- Changing organization hierarchy files
- Creating new data files
- Addition of Monte Carlo simulation
- Changing row captions
- Streamlining by eliminating some rows
- Increasing interaction at the terminal by adding additional prompts
- Adding online menu controls (See Figure 1 for recent illustrative menu items)

In addition, a separate program was written to evaluate the strength of a business unit (by use of index scores on competitive position, profit, technological strength, distribution strength, manufacturing skills, investment utilization, and vertical integration) and the attractiveness of its industry (market size, market growth, prices, competitive structure, industry profit, technological characteristics, cyclicity, and energy and inflation vulnerability) for multiple units and plot the results on a General Electric style nine cell grid. This program was called the Philip Morris Evaluation Tool (PMET) and itself has evolved over the past three years. Recent innovations to PMET made it more menu driven, revised the User's Guide and provided online instructions, enhanced its visual output, altered the variables for each dimension, added a third dimension for consolidation attractiveness (index scores on shape of cash flow, size of cash flow, risk of cash flow, and covariance of cash flows), and provided default scoring for business comparisons within a single industry. The PMET output presently stands alone and is not an input to the UCM model, but it is part of the total strategic planning system.

### The Total Philip Morris Strategic Planning System Over the 'fears

The planning system designed by the first class was essentially the three-cycle, three-level system of Vancil and Lorange (1975). Subsequent versions have been variations on the same theme. These variations have included a strategic planning support team that functions during all three cycles, ad hoc task forces, varying specifications for planning steps (number of steps ranging from 11 to 23), expanding to four cycles, adding a fourth level (as Philip Morris actually did when General Foods was acquired), adding gap analysis processes, including a 3 to 5 year threat and opportunity impact index scheme, providing for transitional strategies, and modifying corporate, divisional, business unit, and functional department goal setting methods. An example of one project team's planning cycle system is shown in Figure 2 (for space reasons, only the initial first cycle is shown).

Each term, the new project team is given copies of the past four project reports and a cumulatively generated library of materials on Philip Morris. The current team then obtains the most recent annual and quarterly reports and information on developments since the last project report and builds its changes based on this new information. It also adds these materials to the cumulative library. Documentation is prepared on computer program innovations. Finally, each team runs through a strategic planning drill on Philip Morris using its total system including the computerized decision support system as they have modified it. All this is presented in a one hour session and in a bound formal written report.

### REFERENCES

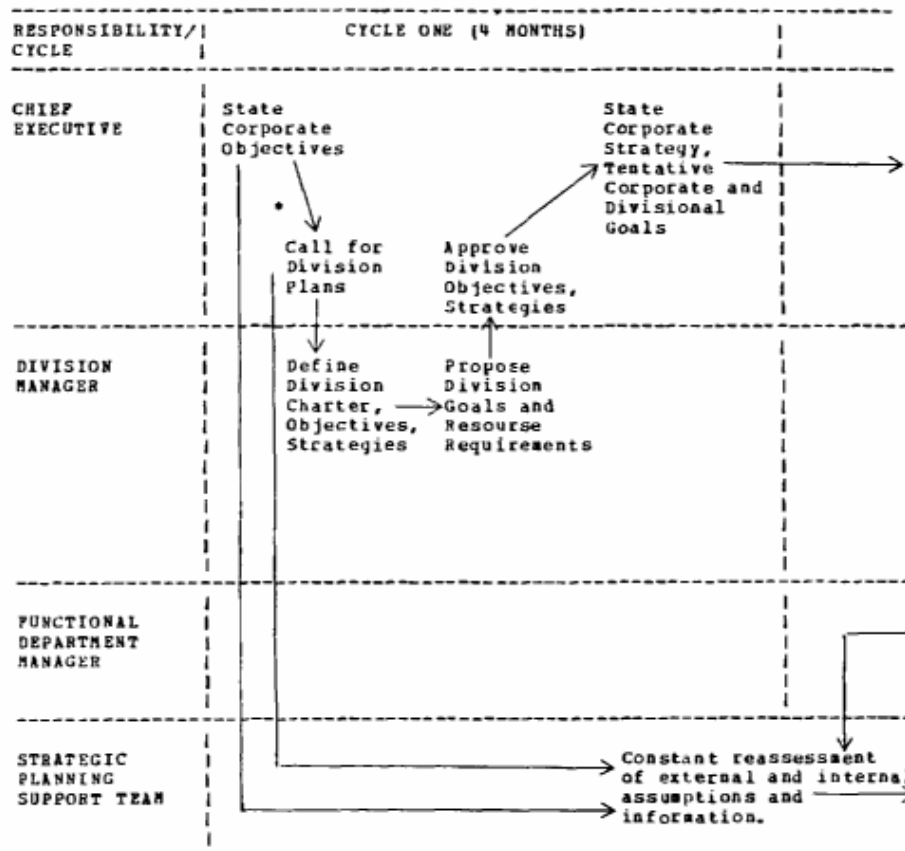
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FIGURE 1  
ILLUSTRATIVE SCREEN DISPLAY MENU ITEMS FOR UCM

CONSOLIDATE CORPORATION  
 CONSOLIDATE A DIVISION  
     PHILIP MORRIS, INC.  
     GENERAL FOODS  
     MILLER BREWING COMPANY  
     PHILIP MORRIS CREDIT CORPORATION  
 CONSOLIDATE A BUSINESS UNIT  
     PHILIP MORRIS USA  
     PHILIP MORRIS INTERNATIONAL  
     GENERAL FOODS CREDIT CORPORATION  
     MISSION VIEJO  
     PROCESSED MEATS  
     US GROCERY BUSINESS  
     WORLDWIDE COFFEE & INTERNATIONAL PRODUCTS  
 PERFORM MONTE CARLO SIMULATION FOR THE CORPORATION  
 PERFORM MONTE CARLO SIMULATION FOR A DIVISION  
 PERFORM MONTE CARLO SIMULATION FOR AN SBU  
 REPORTS MENU  
     STATEMENT OF EARNINGS  
     BALANCE SHEET  
     TREND REPORT  
     CHANGES IN FINANCIAL POSITION  
     RATIO STATEMENT  
     ALL REPORTS  
 ENTER WHATIF MODE  
 EXIT UCM PROGRAM

FIGURE 2  
ILLUSTRATIVE THREE-LEVEL, THREE-CYCLE PLANNING PROCESS  
(INITIAL FIRST CYCLE ONLY)

FIRST YEAR - THREE CYCLE PROCESS



\* Annual Planning Seminar