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A NEW GENERATION IN BUSINESS SIMULATION

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ABSTRACT

This paper presents a case study in the development of a business simulation designed around the currently available Business Management Laboratory (BML). The paper explores the background of using BML, discusses systems modifications required and describes the results obtained so far from transforming BML into a new generation model.

INTRODUCTION

With so many new generations of computers, why not develop a new generation of business simulations? The new generation should reflect and utilize the greatly expanded capabilities of the contemporary computer as well as the impressive reduction in computing costs. Its emphasis should be on people rather than on hardware. The intricacies and machinations of computer processing should be of no concern to the participants in the simulation. Their focus should be on good decision making rather than on accurate keypunching.

ORIGINAL VERSION OF BML

The Business Management Laboratory (BML) [1] is a computer simulation of a manufacturing industry. In its original form, BML simulates a two-product, two-area industry of eight or less firms engaged in the manufacture and distribution of stainless steel consumer goods. With suitable parameter changes, different industries may be simulated. Each firm makes quarterly decisions regarding production, plant capacity, marketing, shipping and financing. The complete decision set contains fifty-six variables, which adds a note of realism to the simulation.

The economic environment is controlled by the game administrator. Each firm receives quarterly statements regarding the industry and the firm's operations. Competitors are aware of product prices, net incomes, the number and distribution of sales reps, new construction and major financing activities of each firm in the industry. Year-end reports provide comparative data regarding sales, income, dividends and major balance sheet items. Each firm has the option to purchase more detailed information regarding the competitive position of firms in the industry.

In its original form, BML provides a rich and integrative experience appropriate to senior-level students in business. Courtney [2;3, pp. 496-509] has added a new dimension to BML by designing a computerized data base for the game, and a simulation programming language to enable students to access relevant parts of the data base and to generate appropriate reports.

USING BML

Picture a capstone course with ten sections of twenty-five graduating seniors who participate in an interactive business simulation, such as BML. Each student has taken the required courses in each functional area of Business, has demonstrated appropriate analytical skills and has taken at least one course in computers. Give these students an introduction to BML, divide them into firms and industries and start the simulation. Quite aside from the main task of making intelligent decisions, these students now have the burden of preparing machine-readable input and meeting processing deadlines. Somehow priorities become confused.

For the 250 students enrolled in the capstone course, an average of two runs per week consumes about 1200 decision cards, each with 12 data fields. Imagine the number of keypunch errors this process can generate. With a fat budget and a talented support staff, the problems of data preparation become less apparent, but the typical budget situation requires that students punch their own cards. Consequently, too much of their attention is placed on the mechanics of data entry rather than on the fundamentals of decision-making.

Game administration is cumbersome and generally less creative in the card-oriented batch processing environment of the computers in existence when most of our current business games were created. Parameters are difficult to change, turnaround time becomes excessive, and the main problem seems to be the avoidance of reruns rather than on the simulation per se.

UPGRADING BML

At CSU, Chico a major upgrade in computer hardware provided the incentive to transform BML and to add the bells and whistles desired. No more cards. No more keypunch errors. Fast, smooth, error-free runs. These were the hopes underlying the conversion process.

Several conferences with the faculty teaching the capstone course served to identify areas needing attention in the conversion process. As it was generally agreed that the original BML simulation was adequate in providing a sound, integrative experience, attention turned toward creating a people-oriented environment for the BML simulation. Specific objectives for the conversion included improving efficiency in data entry and processing, facilitating parameter changes and providing the capability for modeling decision outcomes outside of the normal processing cycle. The objectives could be implemented by designing a data base and a set of programs to interface with the BML model.

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IMPLEMENTING THE CONVERSION PROCESS

The conversion process was planned in two phases. The first phase would emphasize ease of system modification so that wide latitude would be provided for experimentation. In the second phase, effort would be directed toward improving internal efficiency and system portability. Interface programs were structured specifically for high speed CRT terminals and were designed with the presumption that users had no prior knowledge about computers, except how to sign on, when to press the 'return' key, and how to log off the system. All other instructions were to be presented as menus and prompts within the programs.

Improving Data Entry

By switching from cards to terminal entry, it is possible to utilize a screening program which prompts the user through the data entry process and screens out bad data. This step alone has greatly reduced the need for reruns. Files have been designed for interactive use so that participants can edit, display or print copies of their current decision file rather than enter a completely new decision set for each quarter's run.

In the data entry phase, a sequence of prompts is used to display, change and re-display decisions in sequence so that in each sequence the user remains in a display/edit loop until confirming that no further changes are desired. After stepping through the decision set, an editing program screens for illegal entries and displays appropriate messages when they are encountered.

For each firm the decision file remains active and awaits further modification in the course of making new decisions. Some decisions are reset to zero with each new quarterly run. These include those decisions which cause incremental changes, such as new construction, sales rep compensation, etc.

The interactive data entry and editing programs have virtually eliminated the usual problems of misplaced decimals and other keypunch errors. Modifying a decision file, rather than entering a new one for each quarter's run frees up the students' time for more important aspects of the simulation.

Improving Processing Efficiency

As in the data entry phase, all administrative processing is accomplished with menu-driven programs designed specifically for CRT terminals. The administrator is presented a list of options which provide for display/print and editing any of the numerous files associated with the system.

Normal processing time, including changes and data editing, is under ten minutes per industry. A normal run begins by selecting an option which prevents further access from student accounts. This is necessary in order to adhere to the decision deadline. Appropriate parameter changes are made and the processing sequence begins. Key data are displayed and require confirmation before continuing with the processing. This assures that the proper files are in order. The processing sequence provides opportunity to impose administrative charges, pickup or bypass firms' decision files and provides an opportunity to introduce simulated strike options

The Strike Option

The strike option has broader implications than the term implies. For example, this option allows the administrator to introduce variance between scheduled and actual production and/or between scheduled or actual shipping. In each case a scaler is used, having a value between 0 and 1. Using a scaler of .98 redefines production so that it is normally distributed about 98% of scheduled production, within the range of 93-102% of the schedule. A scaler with a lower value, e.g. .67, is used to reflect a one-month work stoppage or an equivalent interruption in shipping. It is left to the reader's imagination to develop scenarios to support such reduction in production or shipping

Production or shipping may be scaled down selectively by product or area, or a uniform scaler may be applied.

Report Generation

After processing, files are updated and reports are released for review by the administrator and by the firms. A copy of the administrator's report is printed, and a news release is prepared and copied to the firm files.

The administrator's report contains a formatted data dump, useful in settling processing disputes. It also contains a copy of all reports distributed to the firms, plus special reports to facilitate game evaluation. Two additional reports are included. One displays firm rankings based on means and growth rates, cumulative to date. The other is a processing instruction sheet designed to clarify processing requirements for the next run.

Firm Reports

Firm reports include a copy of the latest news release, the industry report and the firm's quarterly report, plus selected special reports either in response to the firm's request or as a byproduct of the firms' performance. Reports may be displayed at the terminal or queued to the printer.

Each firm obtains copies of its quarterly reports by selecting an appropriate option from the menu screen. This eliminates any necessity for administrator to deliver reports.

File Maintenance

Four quarters of history, decision and parameter files are maintained so that the administrator may rerun from the current or any of three prior quarters. With each computer run the file updating process drops the oldest files and retains those for the most recent four quarters. History files are readily identified by the unique value of accounts payable for firm 1. If a rerun is required, the appropriate history files are copied to the current files. This starts a new history file chain from the date of the rerun.

In its current form, the new system is a blend of FORTRAN and extended basic programs. Provision has been made to chain or link between programs and to read or write files in either programming language.

Parameter Changes

Most parameter changes require a balanced change in one or more other parameters. One feature of the new system is the clustering of certain key parameter changes. For example, if the Bill Rate is raised to

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appropriate current levels, weird things happen unless other parameters are changed. By defining these as functions of the Bill Rate, the appropriate cluster of parameters is changed by invoking a change in the Bill Rate.

While the original BML model has over 100 parameters, the new system has added many more. Most of the additional parameters affect the data input rather than interact in the model. For example, the system provides for the imposition of financing constraints to limit excessive debt, the continuous use of short term financing, abnormal transactions in treasury stock, etc. These constraints are implemented in the data screening phase of the data entry programs. Decisions which do not conform to the constraints are nullified in the data screening process.

Ease of parameter changes encourages creativity in the administration of the simulation.

Stagflation and other current economic ills may be modeled with relative ease. Tuning and balancing the parameter set can be done without great effort or delay. Parameters most frequently changed are addressed as separate options on the edit menu, whereas less frequently changed parameters are addressed by parameter number.

Modeling Decision Outcomes

Modeling capability has been added for two purposes: to test parameter changes and to generate pro forma statements for a given decision set. One of the design features of the new system provides for efficient parameter testing without affecting the industries involved. Results for several quarters may be obtained in a relatively short time. This is a valuable tool in testing the effects of parameter changes without adversely affecting the participants in the game.

Being able to compute pro forma statements is a basis for improving the quality of decisions. Students can learn much from analyzing the probable consequences of the decision they are about to make, especially before the decision deadline. With appropriate analysis and with reasonably accurate sales forecasts, they can 'fine-tune' their decisions and improve the competition inherent in the simulation.

The new system provides easy access to history data, which is updated with each quarterly run. Firms may modify their decision file, compute and display/print pro forma statements, and repeat this process until they feel that they have made the best decisions possible. The new system also allows students to model a sequence of decisions over several quarters without affecting the decision files used in processing quarterly reports. This capability is useful in introducing BML prior to beginning the competitive simulation. It is also important as a stimulant to improving long range planning.

EXPERIENCE WITH THE NEW SYSTEM

The new system surrounding the original BML model has been in use for two semesters.

During the first semester of its use, the new BML system was in its early developmental stage. Numerous changes were being introduced, and the inevitable bugs were being worked out. In spite of the lack of time to thoroughly check out the system before actual production runs, the system worked surprisingly well and marked a substantial

improvement over the previous version of BML. By the second semester of operation, the system was functioning smoothly; however occasional changes and fine-tuning continues to date.

Instructors have strongly supported the effort and have continually added new ideas to incorporate in the process. The simulation has shifted focus away from the mechanics of computer processing and more toward the fundamentals of decision making. Processing time, cost and accuracy have improved substantially. The degree of realism introduced through selective parameter changes has added significantly to the quality of the simulation.

One problem area concerns the tradeoff between sophistication and ease of operation. As new options are added, they increase the chances that the wrong option will be selected or that the normal processing cycle will be broken. More sophistication requires additional training for those responsible for processing the simulation. Simplifying the process reduces the flexibility and variety of processing options. Only continued experimentation will evolve a neat balance between processing ease and program sophistication.

The new system encourages experimentation in game administration. Our experience supports Gentry's finding that there is less dissension in smaller groups of two or three [4]. Multiple criteria are used in performance evaluation. In an effort to introduce management by objectives, each team assigns weights to the performance criteria, subject to minimum weights on each. The weights are used to scale the rankings generated by the system so that team's standing depends on achievement of its objectives.

Typically we interrupt the simulation in mid-semester and make appropriate reassignments. In some classes teams remain intact but are assigned a different firm. We have found significant rank correlation in team rankings after the first and second phases of the simulation, even though firm reassignments were made in reverse rank order; with the best teams assigned to the worst firms, etc. Another approach used to make the reassignments was a bidding process in an outcry auction. Each team was allowed to bid for any firm other than the one it managed in the first phase. Funds were provided by giving each team the market value of its firm. Successful bids below that amount resulted in a larger cash account in the acquired firm. Successful bids could be made above available funds, in which case any deficit was financed by having the acquired firm raise new capital.

In other classes peer evaluations were used to reform different teams for the second phase. The new teams were comprised of members with equivalent peer rankings. Groups with the lowest ranks were assigned to the firms which performed best in the first phase. Teams whose members had the highest peer rankings were assigned to firms which had performed poorly in the first phase. Two interesting outcomes are noted. High achievers in the first phase, when regrouped with other high achievers, faced more dissension in the second phase, but generally revised the rankings of the firms. Teams comprised of the lowest achievers in the first phase typically developed more cohesive groups and apparently exerted greater effort in the second phase.

At the outset of the second phase, firms were given an opportunity to sell excess capacity and to submit sealed bids for any additional capacity required.

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Although we have been using some version of BML for several years, we feel that the new system provides an exciting opportunity to improve the educational outcomes of the simulation

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