

Developments in Business Simulation & Experiential Exercises, Volume 10, 1983

MANSYM III DECISION SUPPORT SYSTEM DEMONSTRATION

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INTRODUCTION

This demonstration will show the decision support system for MANSYM which is being used at East Carolina University. This decision support system is partially available in MANSYM III [2] and the remainder is planned for inclusion in MANSYM IV. While the author does not know of a decision support system that is as extensive and conceptualized in the same way, it is clear that management games have been evolving more elaborate decision support systems (see for example [1] and [3]). The decision to develop a decision support system for MANSYM was motivated by a number of factors. First, the author has been concerned by a movement away from management games. Southern Methodist University has dropped games in favor of IFPS and the University of Maryland is reappraising their commitment to game, possibly in favor of IFPS or a similar package. Second, as the computer becomes more and more an integral part of business, it is important that students become more comfortable and adept at the use of the computer. Management games as commonly used do not require computer-based analysis. Third, this author is not alone in his desire to see management games operate on a simulated real time basis (i.e. in a simulated real time environment, the time clock is always ticking and decisions are made on an exception basis). MANSYM's decision support system coupled with appropriate equipment allows this option. Along the same line, the system allows elimination of IBM cards and all of the attendant mess.

The decision support system for MANSYM includes: 1) diagnostics, 2) performance evaluation, 3) market research, 4) computer generated proforma statement, 5) a decision check run for card input, and 6) multiple regression sales forecasts.

DESCRIPTION OF MANSYM

It is necessary to provide a little background about MANSYM. MANSYM is a management game or simulation designed to provide students with a simulated business environment which they operate as the top level management group for a number of simulated years in competition with other students. The game may have from one to ten firms and from one to three products. The environment depicted is a manufacturing environment which is somewhat analogous to a small electrical kitchen appliance industry. The game output includes all of the statements necessary to understand the internal operation of the firm as well as some summary information on the firm's competitors. Each set of decisions covers a three-month period. The firm makes from ten to thirty-three decisions, depending upon the version of game played and the decisions allowed by the referee. Some decisions are made quarterly and some are made less frequently.

Table 1 indicates the number of decisions made for the one, two, and three product game.

DESCRIPTION OF DECISION SUPPORT SYSTEM

Before proceeding, it is appropriate to clarify what is meant by decision support system (DSS). DSS is a computer-based,

data-based system for aiding in decision making, especially decisions where a combination of quantitative analysis and executive judgment is involved. Decision support systems tend to be interactive and real time based. Thus, access to the DSS should be continuous.

TABLE 1

Decision	One	Two	Three
	Product	Product	Product
Pricing	1	2	3
Promotion	1	1	1
Selling Expenditures	2	2	2
Change in Durability	0 or 1	0 or 2	0 or 3
Product Enhancement	0 or 1	0 or 2	0 or 3
Marketing Effort	0	0 or 2	0 or 3
Raw Materials Ordered	1	2	3
Production 1st Half /Qtr	1	2	3
Production 2nd Half /Qtr	1	2	3
Maintenance Expenditures	2	2	2
Capacity Additions	0 or 2	0 or 2	0 or 2
Cost Savings Equipment	0 or 1	1	2
Changes/Short Term Debt	1	1	1
Changes/Long Term Debt	0 or 1	0 or 1	0 or 1
Purchase/MktResearchData	0 or 2	0 or 2	0 or 2
TOTAL	10-18	15-26	19-33

It should be recognized that DSS is an extension of MIS; consequently, a management game with a DSS must also have an elementary MIS. In some sense, all games include a rudimentary MIS because they have a data base from which all of the statements are generated for the firm.

The MANSYM DSS include six component parts: 1) diagnostics, 2) performance valuation, 3) market research, 4) computer generated proforma statements, 5) a check run for decision cards, and 6) computer generated sales forecasts. For the time being, the forecasts are generated externally, i.e. they are not a part of the MANSYM program. Each of these six component parts will be discussed.

The diagnostic system provides diagnostic statements about: 1) input errors, 2) game play errors, and 3) acknowledgments. Input error diagnostics indicate infeasible decisions, either due to the game environment (such as excess increases in plant) or due to errors resulting from a logical error (such as not allocating 100% of promotion). Input errors are automatically corrected so that play may proceed. Game play errors alert firms to undesirable outcomes such as running out of goods (especially at times other than the beginning and end of the quarter). Acknowledgments indicate acknowledgment of decisions that take effect later or decisions made earlier now taking effect.

The performance evaluation option evaluates performance on overall measures of performance (e.g. ROI) and internal indices of the effectiveness of decisions within each of the functional areas. Two overall measures of performance and two measures of performance for marketing and finance, plus three measures of performance for production are generated. The instructor weights each measure, thus the team may receive constant feedback relative to the bases on which its performance

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will be in part evaluated. These measures are shown both for the quarter of play and cumulatively. Both an absolute grade and a curved grade are shown. The instructor may elect to use or not use this option. The instructor may elect to provide the results to the teams or keep the results to himself.

The market research option provides market research data on sales (demand versus sales) and/or marketing data (promotion, selling expenses, marketing effort, and customer loyalty rating) by firm and by product (where applicable).

The computer generated proforma statement generates a proforma: raw material inventory statement, finished goods inventory statement, production capacity statement, balance sheet and cash flow statement. Such statements can be generated for one to four quarters in advance. An unlimited number of statements can be generated. However, the firm must indicate the expected level of demand for each good produced and expected raw material prices for each raw material plus all the firm's normal decisions. Proforma statements may be obtained at a terminal or by batch. Equipment restrictions at East Carolina University limit the option to the batch mode. Proforma option may be used at any point during play of the game. The proforma option retains all diagnostics. This allows the firm to avoid the usual input errors and game play errors. If the proforma option is used and if the team's demand estimates are correct, then the proforma outcome and actual play outcome are the same. Access to each firm's data is password protected. A decision check run is a program that merely prints the decisions made and key punched by the firm, thus allowing the firm to check or verify its decision cards. It is more an implementation aid than a decision aid, since it merely insures that the planned decision is the one that the computer program attempts to carry out. It is intended for use where batch runs are made using IBM cards.

The computer-generated regression forecasts of demand is, at the moment, an external program which we plan to add to the package. The author uses SAS to generate such forecasts. Because of the cost, such forecast equations are generated only twice during play of the game - after six quarters or play and after eight quarters of play. Three alternative forecast equations for industry demand and three alternative equations for market share are provided each firm. Since the above six forecast equations are necessary for each product, the number of equations shown is six times the number of products. Along with the forecast equations are data used to judge the value of the equations shown (i.e. R^2 , level of significance, and standard error). However, the equations shown are the three best forecast equations using two independent variables. In addition, a summary of the data used to generate the forecast is provided.

EXPERIENCE WITH PERFORMANCE EVALUATION AND MARKET RESEARCH OPTIONS

Some parts of the DSS are voluntary and some are not. The diagnostics are mandatory. The performance evaluation option can be used to evaluate all, part or none of game play. The instructor may elect to use the performance evaluation routine only as feedback and not for evaluation. Clearly, its use has had some influence on the behavior of firms. What it tends to do is to emphasize some often overlooked vehicles minimizing the cost of satisfying the level of demand generated by the firms marketing decisions. In particular, it helps firms obtain a proper balance in the use of maintenance expenditures and level of cash to keep on hand. It also focuses attention on the difference between the quantity demanded and the quantity sold. It further helps focus attention on the need to balance promotion and selling

expenditures. If the evaluation of the production or finance function is unsatisfactory, corrective action is easier to identify and to take. Thus, the most dramatic influences occur with respect to improved production and cash management. I also believe (without actual data) a much better balance of marketing expenditures and fewer stock outs occur when the performance evaluation option is used. Finally, and perhaps most importantly, I also believe that there is a lower spread in ROI when the evaluation is being used than when it is not. It is my belief that the poorer firms benefit more significantly from the evaluation than do the better firms.

Market research data may be distributed mandatorily to all firms (free or for an assessed fee) or may be available for purchase or may not be used. Since IL normally make it available on a purchase basis, coupled with the use of the performance evaluation option, it is hard to tell its influence. However, my observation, based on limited experience, is that when it is distributed to all firms, that the spread in ROI tends to be lower than would otherwise be true. Further, I believe the stock outs tend to be less when it is distributed to all firms. What is perhaps surprising is that it does not seem to take a very high cost to discourage some firms (generally the worst firms) from purchasing the market research data. Our experience with computer-generated proforma option and computer-generated demand forecasts are too few and too recent for us to speculate on their influence.

The presence of the performance evaluation and market research options do pose some educational dilemmas. Clearly, knowledge is power. Without the DSS, the more aggressive, more dedicated, and brighter groups fare better (by significant amounts). The decision support system composed of diagnostics, performance evaluation, and mandated market research, gives a broader spectrum of firms access to knowledge and reduces the edge available to some firms. It remains to be seen what effect the proforma option and demand forecast option will have on the behavior and performance of the firms.

THE USE OF DEMAND FORECAST OPTION

This option, more than the others, requires adequate instruction, regarding proper use of multiple linear regression used for forecasting demand. In this regard both a six-page handout and a video tape is available to firms electing to use the techniques. Students are given a form which shows the three best forecast equations (with two independent variables) in descending order of statistical importance (i.e. highest R^2). Only those equations which are logically consistent are shown. For example, a forecast equation with a positive coefficient on price means an increase in price decreases demand. Since this is logically inconsistent, such an equation is not shown.

In addition to the forecast equation, the R^2 value, level of significance, and standard error are shown. As indicated earlier, both market share and industry demand equations are shown.

The forecasts obtained from such equations are not actual forecasts of industry demand, since demand used to obtain them is actual demand adjusted for influences not under the control (or influence) of the industry. Thus, forecasts must be adjusted for external economic factors and time series factors. Before adjusting for time series and economic factors, the firm must estimate the value of the independent variable. The firm will have more confidence in some than others. Thus,

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the firm will have three forecasts of industry demand and two bases (a level of significance and confidence in forecast values of independent variables) on which to decide which forecast to use. Typically, the firms eliminate those with low levels of confidence and take an average or weighted average of the remainder.

This same process is repeated for estimates of market share. Once the forecast of market share is made, it is multiplied times the forecast of industry demand to obtain the forecast of demand for the firm. The standard errors may be used to estimate a reasonable range of forecast demand.

USE OF PROFORMA OPTION

The proforma option is only as good as the firm's ability to forecast demand and raw material prices given the decision submitted by the firm. Thus, not only must demand be forecast, but it must be demand resulting from the marketing decisions made by the firm. Since the firm may obtain an unlimited number of pro-forma statements, the firm may conduct a sensitivity analysis by obtaining proforma results for extremes on the level of demand. For example, assume a firm in a two-product industry expected demand for good one to be 40,000 with a σ of 5,000 and demand for good two to be 10,000 with a σ of 2,000. The following table might indicate the different trials.

TABLE 2

Trial	Description	Demand for Good 1	Demand for Good 2
1	Expected Demand	40,000	10,000
2	Worst Possible Case	30,000	6,000
3	Best Possible Case	50,000	14,000
4	Bad Outcome	35,000	8,000
5	Good Outcome	45,000	12,000
6	Good Outcome - Good 1 Bad Outcome - Good 2	45,000	8,000
7	Bad Outcome - Good 1 Good Outcome - Good 2	35,000	12,000

Further, a good forecast of raw material prices is essential to accurate proforma statements two or more periods in advance. Raw material prices are set one quarter in advance, thus the raw material price submitted is for the quarter following. The raw materials used in MANSYM are in limited supply and the industry is a significant user of the raw material. Other raw material users are very stable. Thus, as MANSYM goes, so goes the price. Since the demand for the industry's product is expanding, prices are generally increasing. However, MANSYM's demand tends to be seasonal, thus creating a tight market and high prices in some quarters and vice versa. This makes forecasting raw material prices difficult. The major impact of errors in raw materials prices is that cash needs and profits may be over or under stated depending upon the direction of the error.

DEMONSTRATION

During the demonstration, xerox and transparencies will show the experiences of two firms using the decision support system.

CONCLUDING COMMENT

While the decision support system aids the decision maker, it does not make decisions nor can it in any way substitute for intelligent analysis and synthesis. The better, more dedicated, more intelligent student will still perform better. The elements of the decision support system operational in MANSYM III seem to please the instructors and students. The proforma option has obvious benefits. The regression

option may require so much work to be useful that it will prove of value only to the dedicated. It may result in a wider spread in ROI values.

REFERENCES

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