

Developments in Business Simulation & Experiential Exercises, Volume 13, 1986

COMPUTERIZED BUSINESS MANAGEMENT SIMULATIONS FOR TYROS

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ABSTRACT

The purpose of this paper is to provide general information about computerized business management simulations. The paper first provides some introductory comments on the intended audience for the paper and the specific focus of the paper. Second the paper provides some background information and dimensions for classifying computerized business simulations. Next, thoughts on selecting and using computerized simulations are provided. Finally, a bibliography of some of the games currently available is provided.

INTRODUCTION

This paper deals with computerized business management simulations, so called business games. It is directed toward tyros which comes from the Latin and means young soldiers. The word tyros was chosen rather than novice or newcomer because it seems to include both those with no prior exposure to the use of computerized business management games as well as those with a little experience. Thus, this paper is directed toward those who are relatively or completely new to computerized business management games as a form of pedagogy.

There are three types of simulations which the paper will not cover. First, the paper will not deal with non-computerized simulations, even though some of the comments will be applicable to such simulations. Second, the paper will not deal with exercises such as role-play, in-basket, etc. which are frequently considered to be business management simulations [19]. Third, the paper will not deal with computerized packages of a problem-solving nature, such as the package by Harris and Maggard [13] which are designed to teach tools such as linear programming. Rather, it will focus on those computerized business management games which involve decision making and therefore have a management orientation. With this understanding of what is included, the phase business game will be used throughout the paper to refer to computerized business management simulations.

The paper is meant to be an overview of some of the literature and research related to computerized business games. The paper in no way attempts to present all the relevant research and in a number of instances will draw primarily on the experiences of the author. The primary focus of the paper is on selecting and using computerized business games. In addition a bibliography of some of the business games available from publishers is provided. Before turning to these topics, however, I will provide some background information and identify some ways in which computerized business games may be classified.

BACKGROUND

It has now been more than a quarter of a century since the first practical business game was introduced by the American Management Association in 1956 [20]. The

growth in this 25 plus years has been very rapid. Today, there are certainly hundreds and probably thousands of these games available. Horn and Cleaves [15] for example, provide information about over 500 games and list numerous others. In addition, the number of users has increased and the use covers graduates and undergraduates, 4 year and 2 year colleges, large and small educational institutions, business firms and high schools [2]. Finally, the growth is reflected by the fact that as early as 1972 it was estimated that the per year expenditures on business games was in excess of \$100,000,000 [26].

Given this rapid growth one might assume that the educational merits of business games are well established. The fact is, however, that their educational merits have been subject to considerable debate. There are studies which indicate that other forms of pedagogy are just as effective or more effective than business games while other studies find the reverse to be true. As I read the literature, however, it appears to me that the more rigorously constructed studies tend to support the educational merits of business games while the less rigorous studies tend to find business games to be inferior or at best no better than other forms of pedagogy. I also note that the studies uniformly find that students become interested in the simulation they are playing. Since the literature in psychology tends to say that we work harder on things in which we are interested, the interest factor alone may legitimize the use of a business game. Individuals who are interested in reading more about learning in business games should refer to the articles by Keys [17], Greenlaw and Wyman [11], and Wolfe [28] which review the more rigorous of the studies dealing with learning in business games. The Wolfe [28] study is particularly useful since it is a 10 year update of the Greenlaw and Wyman [11] study and therefore makes comparisons to the earlier study. In addition, you should review the proceedings of the Association for Business Simulation and Experiential Learning (ABSEL) which began in 1974. To simplify the review of the ABSEL Proceedings you may wish to order A Comprehensive Guide to ABSELS Conference Proceedings (1974-1981) by Goosen [9]. You should also review the Journal of Experiential Learning and Simulation which was published from 1979 through 1981 and Simulation & Games which began in 1970. These sources will help you identify other journals of interest.

There is no single way to classify business games. For our purpose we will, classify them on a number of dimensions. First, business games may be classified by subject matter as functional or general management. A functional business game is one which is designed to "focus specifically on problems of decision-making as seen in one particular functional area" [7:140]. In contrast, a general management game is "designed to give people experience in making decisions at a top executive level and in which decisions from one functional area interact with those made in other areas of the firm" [7:140]. General management games would be used in courses which are designed to give an overview of business management such as

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the senior or graduate level business policy course or the freshmen level introduction to business course. While this range from freshmen to senior or graduate may seem broad, the fact is that the level of complexity and expectations can be set so that even a single game may be used for diverse audiences.

Second business games may be classified as competitive or non-competitive. In a competitive game, the decisions of the participants influence the results of one another. Thus, if all else is equal and I charge a lower price than my competitors I will sell more than they do. In a non-competitive game, on the other hand, the participants are competing against the computer model or an environment rather than one another. A third classification of business games of interactive or non-interactive refers to how participants interact with the computer. In an interactive game, participants play the game at a computer terminal or, more frequently today at a microcomputer. Participants respond to questions at the terminal, receive an immediate response, and then submit additional decisions. In non-interactive games, decisions are submitted to the game administrator, run through the program, and the results are returned later. A recent combination of interactive and non-interactive has come into being as a result of the advent of microcomputers. A number of games, for example [16,23], now provide for the student to work at a computer terminal or microcomputer with an interactive program to put their decisions on a disk which they turn in to the instructor. The instructor then merges the disks of all participants and runs the simulation in a non-interactive fashion.

A fourth classification of business games is industry or non-industry depending upon whether or not a specific industry is being simulated. In an industry specific game the authors attempt to replicate very closely the actual industry whereas in the non-industry games only general business relationships, such as the downward sloping demand curve are replicated. A fifth dimension along which business games may be classified is whether they are designed to be played by individuals or teams. Sixth, computerized business games can be classified as basically deterministic or stochastic depending upon the extent to which random events occur. Seventh, a relatively new basis for classifying business games is in terms of the type of computer on which the game is to be run. Are we using a mainframe (including minicomputers) or are we using a microcomputer? This category may be further subdivided in the future as researchers compare games which were written directly for the microcomputer versus those which were originally written for mainframe computers and then were adapted to the microcomputer.

Eighth, business games may be classified according to degree of complexity. As has been noted by Keys [18], there are two dimensions of complexity in business games -- game variable complexity and computer model complexity. According to Keys [18:5], the best measure of game complexity is "the number of individual decisions inputs per round of game play (a decision set)." The issue of game variable complexity has been addressed by Raia [21], Wolfe [29], and Butler, Pray, and Strang [6]. An issue closely related to game variable complexity of how much information is needed for effective game play has been addressed by Riggs and Greenlaw [3]. The complexity of the

computer model deals with items such as the program language, number of lines or pages of output, memory required, etc. Thus, this aspect of complexity is more concerned with computer hardware and software issues. A final way in which business games could be classified is according to the time period simulated. Does each decision set cover one day, one week, one quarter of a year, a year, etc? With this background information and dimensions along which business games may be classified we will now turn our attention to selecting the simulation.

SELECTING THE SIMULATION

In selecting a business game the user must first identify the learning objectives for the course involved and decide whether a business game would help to meet the objectives. What is it you wish to accomplish? If your stated objective in the business policy course is to expose the student to a variety of industries, leadership styles, decision making styles, and managerial problems then a set of case studies should be used rather than a business game. If, on the other hand, your objective is to provide the students with an opportunity to make decisions in a dynamic environment in which they will be required to use previously learned tools, to integrate the various business functional areas and to live with their prior decisions then you might well decide to use a general management simulation.

With the objectives firmly in mind you are now ready to identify the game characteristics along the dimensions previously cited. Since the dimensions are mutually exclusive, you may select any combination desired. For example you could select a general management, competitive, non-interactive, non-industry, team oriented, somewhat stochastic, and mainframe game for the business policy course. Within a specific game you will frequently find that you have some discretion concerning these dimensions. For example in the functional game FINANSIM: A Financial Management Simulation [10] which is non-industry, non-competitive, non-interactive, recommended for team play and somewhat stochastic the user can have the student input decisions and receive results right at the terminal to give an interactive effect. Further, the game could be played by individuals and the stochastic nature reduced by providing players with demand figures.

Further complicating the users decisions along these dimensions is the fact that each dimension has certain advantages and disadvantages. For example, industry games add a degree of realism not found in non-industry games, but one runs the risk that participants will make decisions based upon what actually happened in the industry rather than through careful analysis of the game environment. Or, in a competitive game, a single firm may make irrational decisions which disrupts the game for other participants.

Once you have established what it is you are looking for you can begin to identify games which are available which will meet your needs. As a starting point I would recommend that you review, The Guide to Simulations/Games for Education and Training [15]. This guide provides descriptive information for hundreds of games. It covers such things as characteristics of the game, equipment needed, publisher, estimated playing time, etc. Next I would review the publishers list of

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available books to see what they have and I would contact my publishers representatives to see if anything new is available. A list of some of the simulations available can be found in the Appendix. Incidentally, because simulations are a relatively new market for the publishers the representatives are frequently not well informed and therefore are often not a good first source of information. Finally, you should consult members of organizations such as ABSEL and your colleagues at other institutions to see what is being used.

Having identified the simulations in which you are interested you should obtain the student and instructor manuals, and the computer center manual, if there is one. Review the students manual carefully to be sure the game does what you want and also for readability. Some of the most widely used simulations have student manuals which are very unclear which creates problems for the students in their decision making. For example, one simulation in the second edition kept references to rules which were not being used in the second version of the game. An unclear manual will contribute to poor decisions on the part of the students and will require a great deal of classroom time. In reading the student manual check how complex the game is. How many decisions do students have to make per round of game play? In FINANSIM: A Financial Management Simulation [10], its 12; in Tempomatic IV: A Management Simulation [22] about 50, in the Carnegie Tech Management Game about 300. What is the nature of the output the students will receive? In one general management game the students receive not only an income statement and balance sheet but a complete production and sales analysis, and a cash flow statement. In addition, they receive estimated cash flow, production capacity, etc. for the next quarter. In some simulations, however, the student will have to calculate these figures. What are your objectives? Perhaps even more important what output does the instructor receive? Such information can range from none to summary data to grade indices. Read the instructors manual to gain additional insight into how the game operates to identify how much control you have over the simulation. For example, can it be tailored to replicate a specific industry or changed from one semester to the next. Frequently information on actually running the simulation is given in the instructors manual rather than a separate computer center manual and you will need someone to read this information unless you possess the appropriate computer knowledge. Note that I didn't say you would need someone from the computer center. I have had my greatest success in operationalizing simulations by having undergraduate student assistants do the work. In some instances I have paid them while in other instances I have set up an independent study. In one instance I had an undergraduate student who developed a procedure for adapting games designed for mainframe computers to minicomputers [4]. In another instance I agreed to spend a summer working with a student to get 10 simulations up and running on our system. Things got out of control and at the end of the summer we had 50 simulations running. Total cost of the project including purchasing the simulation packages was under \$1500. I would submit that this was a shotgun approach to having simulations available rather than the more procedural rifle method suggested earlier. Because of the availability of these simulations within two years we had a problem. In one year we were using 6 different simulations in 7 different courses-- introduction to business, business policy, principles of accounting, principles of

marketing, principles of finance, advanced finance, and investments. You should pity the poor student who in one semester was playing and therefore learning the rules of three different simulations. You can appreciate his problem when you know that at one point he decided to dominate the industry in one of the simulations and therefore put \$100,000 into advertising. Imagine his horror when the results came back and he had done very poorly because in that simulation he needed \$1,000,000 not \$100,000. He had mixed the rules of two of the simulations. You need to keep the student in mind when multiple simulations are being used in your institutions.

A criteria in selecting a simulation about which people frequently worry is the cost. As my early comment points out, however, the cost of the simulation is frequently minimal. While it is true that some simulations cost \$10,000 or more, most of the simulations available from publishers can be obtained for the cost of the card deck, tape or disk, \$5 to \$20, and in many instances for free. You should be aware however, that some publishers will tell you that the program is free but is only available to adopters. When you receive such notification I suggest you write a letter to the publisher composed of a string of obscenities and conclude "strong letter to follow." Your strong letter would indicate that you would not consider adopting a simulation which you had not had an opportunity to test on your system. In fairness to the publishers, however, I think you are obligated to have done your homework before you request the program. Please don't have students purchase manuals for a game when you don't know if it will run. You are only asking for trouble! Also please note that I said card decks, tapes or disks are available from the publisher; you do not have to punch the program into the computer. A number of years ago I had a colleague who made both errors just cited -- he didn't pre-test and he tried to have the program punched in. At the end of the term he still didn't have the program running and he had 20 students with manuals they had never used but which they couldn't return because they had been written in. You see, he kept saying, "Keep reading we will be using it." I don't know what his course evaluations looked like but I can guess. I also had a call from an individual who had punched in the whole PORTSTRAT: A Portfolio Strategy Simulation [8] program of over 1500 lines. It wouldn't run and he wanted us to debug it. I should also point out at this point that microcomputers have changed the way in which instructor and computer center manuals become available. A number of microcomputer simulations now include the instructor and computer center manuals on the disk with the program. With the disk you receive a brief set of instructions on how to load the disk and print out the manuals so you now bear the cost of producing the manual rather than the publisher. Finally, before you make the final selection decision do at least one trial run on your system. Many of the simulations today provide you with a trial run data deck and a copy of what the output from the trial run should look like. Do the trial run and check the student output carefully. You should also check the history output which will, be used as part of the next periods input to be certain it looks okay and also to become more familiar with the simulation. I strongly recommend that you take the output from the trial run, add a set of dummy decisions and do an additional run. You should do this to make sure that the successful trial run wasn't a fluke, to test the rules of the simulation, and to blow the

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simulation up. The successful trial run could be a fluke because of differences between your computer and the computer on which the simulation was developed. For example, the trial run for PORTSTRAT: A Portfolio Strategy Simulation [8] runs beautifully on many machines. Because the simulation was developed on a 32 bit machine, however, the random number generator fails on a 16 bit machine. Since the random number generator does not have to be used in the trial run the problem does not show up until the next run. I should point out that we knew of the 16 versus 32 problem and therefore provided instructions in the instructor's manual on how to modify the simulation. We also provided a way to by-pass the random number generator to give greater instructor control and as an alternative to modifying the program. You should look for such information in the instructors manual.

The trial runs should also be used to test the rules of the simulation and to try to blow it up in order to find where the holes are. A few examples will point out the types of problems encountered. In one simulation the author accidentally put in an upward sloping demand curve. Fortunately, this error was caught before the simulation became available. In another simulation it was possible to fire more salespeople than you had. The effect was that your cash flow and profit improved because the expense per salesperson was now a positive value and the wage paid was treated as a receipt. In one simulation I changed one variable and caused demand for the industry to go negative (i.e., customers in that quarter returned more than they bought). A more subtle error exists in one simulation which has a penalty payment for early bond retirement. The penalty is assessed when the last payment is made even though it should not be. Even harder to detect was the situation in one simulation which provided for the production decision to be limited by raw materials, workers, or plant capacity whichever was lower. The fact was, however, if you violated all three constraints your decision would be implemented. In another instance the sales per team were calculated and allocated before the number of salespersons available was checked. Later, the number of salespersons for which the team was charged was reduced to the number of salespersons available but the market share calculation was based on the number assigned. Thus, you could get the benefit without the cost.

Before turning to the decisions associated with using business simulations, I should point out that it is possible to get programs which have been pretested and evaluated, however, you are going to have to pay for the service. There is an organization known as CONDUIT [14] which evaluates and debugs programs.

USING THE SIMULATION

You have now selected your simulation and it is running perfectly so your troubles are over. WRONG! You now have a whole new set of decisions to make. First, are you going to use the simulation as written or is there something you wish to modify. Let me give two examples of why you might want to modify a simulation. In one simulation as originally written if you stockout in an area you lose one salesperson. There is no recognition of the magnitude of the stockout, however, therefore, a stockout of 1 unit or 10,000 units results in the loss of a salesperson. In this same simulation

plant capacity never wears out, therefore, depending upon the demand schedule students may be able to play the game and never be faced with the plant capacity decision. Incidentally, I recommend that you use the simulation once before making any modifications.

A second decision you need to make is what other activities are you going to package around the simulation. Are you going to require reports and/or calculations? For example, in the business policy course I require a strategy report and a management report which includes an annual report after each simulated year of operation (and we simulate three years). After each simulated year the students also have to make an oral presentation to a board of directors comprised of faculty and people from business. I know of people who require the students to keep a log in which they must record the rationale for each set of decisions and others who require the students to submit pro forma statements with each set of decisions. Some instructors have labor negotiations take place during the game. The list of activities with which you can surround a game is virtually unlimited. A few words of caution are in order. First, don't try to introduce too many activities. Second, remember that each semester you have a new group of students. You know the simulation but they don't. If you add in a new activity ask yourself if something else should be dropped. An example of an extra activity which illustrates the increasing complexity being put into simulation is the fact that at least two games [16, 22] now have separate management information systems available to supplement the simulation. Be careful that you don't overload the student.

A third decision you need to make is when the simulation should be introduced in the semester. While there are no hard and fast rules my personal experience, and belief in distributed learning, suggests that the simulation should be introduced early in the semester. Initially there should be more time between decision due dates then later in the semester. As the decision making progresses the time needed tends to decline at an exponential rate. It is not uncommon to find teams who spent 6 to 8 hours on their first set of decisions making their last sets in 30 to 45 minutes.

If you are going to have teams you have to decide on team size and on how to create the teams. The literature would suggest that for moderately complex games teams are best and that teams of 3 to 5 are optimal [30]. My experience with moderately complex general management games suggests 3 is the optimal number. With more than 3, I frequently find that one individual gets a free ride. Functional simulations can frequently be handled by individuals. As with all these decision areas, however, your objectives are important. If you really wish to create a hierarchy and have a great deal of interpersonal behavior then you would have larger teams.

The creation of teams is also a problem. Some argue that the instructors should create the teams by random assignment or by forced assignment to balance team skills for example a finance major, a marketing major, and a production management major. Others suggest that students should create their own teams for pragmatic reasons [27] -- they have to be able to meet outside of class -- and because students prefer to create their own teams [25]. My own views on this issue are mixed. I have seen

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students create their own teams where all the stronger students were together and all the weaker students were together. This causes me to believe I should form the teams. Incidentally, the strong teams don't necessarily perform well because they are composed of individuals who won't compromise. Overriding this problem, however, is the fact that students must get together outside of class, an increasingly difficult problem as we deal with part-time students who are working full-time.

A fifth decision you will need to make is how you will grade performance in the game. Some simulations have grading packages built right into the simulation. For example, one package uses seven variables (Sales, NI, ROS, ROE, ROA, EPS, and stock price). The instructor can weigh these variables. For each period an index is calculated for each team by finding the top team for each variable calling that team 100%, dividing each of the other teams by the top team, multiplying by the weights and summing the weighted percentage score for each team. Such an index should never be used as the only basis for assigning a grade. Rather, the instructor should also look at the decisions in terms of reasonableness. What I am arguing is that the instructor should use multiple variables, both qualitative and quantitative measures, and should look at both input and output measures. Interesting, Sugges [25] found that the majority of students preferred that the instructor set quantitative criteria to evaluate company performance. I would recommend that the performance grade be at least 20% to create an incentive to perform but not more than 25% when team play is involved so that a non-participant doesn't get a good grade as the result of the work of others. The reader who wishes more information concerning

grading performance in business games should refer to Biggs [1]; Butler and Parasuraman [5]; Hand and Sims [12]; and Sims and Hand [24].

You will also find that you need to make decisions while the students are playing the game as unanticipated events take place. What do you do when a team member comes to you and says "I am doing all the work?" Peer evaluations at the end may help alleviate this problem as will a provision that a team member may be fired. What do you do if you find out in a competitive simulation that collusion is taking place? What do you do if a student posts a notice which appears to be from you which indicates that demand in the next period will drop 30% and one team believes it? What do you do if a student finds a loophole in the simulation and takes advantage of it? Remember nothing is fool-proof because fools are so ingenious. What do you do if there is an input error? If the students input their own decisions you can say too bad but if you or your assistant have put the decisions in incorrectly you rerun. Be sure to leave adequate time from when decisions are due to when they are returned to when the next set is due.

SIMULATION BIBLIOGRAPHY

In the Appendix a list of some of the business games currently on the market is provided. Table I below groups the simulations listed in the Appendix according to whether they are of a general management or functional nature and also by whether they are for the mainframe, micro, or both types of computers

TABLE I
COMPUTERIZED BUSINESS GAMES LISTED BY AUTHOR

| Game Type | Mainframe Computer | Micro Computer | Mainframe & Micro Computer |
|--------------------------|----------------------------------|----------------------------------|---------------------------------|
| General Management Games | Babb, 1979 | Cotter and Fritzsche, 1985 | Edge, Keys and Remus, 1985 |
| | Barton, 1974 | Eldredge, 1984 | Henshaw and Jackson, 1984 |
| | Cotter, 1973 | Fisk and Fisk, 1984 | Jensen and Cherrington, 1984 |
| | Courtney and Jensen, 1981 | Hinton and Smith, 1985 | Scott and Strickland, 1984, 85 |
| | Darden and Lucas, 1969 | Mills and McDowell, 1985 | Smith, 1984 |
| | Eldredge and Bates, 1984 | Wilson, 1982 | |
| | Frazer, 1975, 1977 | | |
| | Gupta, 1974 | | |
| | Keys and Leftwich, 1977 | | |
| | McFarlan, McKenney, Seiler, 1970 | | |
| | Meredith, 1977 | | |
| | Nichols and Schott, 1972 | | |
| | Smith, Estey, and Vines, 1974 | | |
| | Strang and Pray, 1981 | | |
| | Thorelli and Graves, 1964 | | |
| Functional Games | Boone and Hackleman, 1971 | Carrell and Smith, 1985 | Faria, Nulsen and Roussos, 1984 |
| | Boone, Kurtz and Braden, 1982 | Lee and Shem, 1986 | Ness and Day, 1983 |
| | Brobst and Bush, 1982 | Low, 1985 | Gitman, Robana, and Biggs, 1981 |
| | Brooks, 1982 | Smith, 1983 | |
| | Goosen, 1973 | Sprenger, Werdkamp & Burns, 1984 | |
| | Greenlaw, Frey and Vernon, 1979 | | |
| | Greenlaw and Hottenstein, 1969 | | |
| | Greenlaw and Kniffen, 1964 | | |
| | Johnson and Hendrich, 1984 | | |
| | Keiser and Lupul, 1977 | | |

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With the exception of the Scott and Strickland simulations, the simulations which are useable on both mainframe and microcomputers have the same title and publication date. One additional comment regarding the bibliography is of interest. Five years ago the list would not have included simulations for service industries whereas today there are an increasing number of such simulations available.

CONCLUSION

I hope that my comments have pointed out to you that statements such as, "Use a computerized simulation in your course, its easy." Or "Computerized business simulations don't require any work on the instructors part; they run themselves," are foolish and fall in the same category as the statements: "Look why don't you take our old baby crib? We wont be needing it any more." or "You'd be crazy not to claim it as a deduction."

I also hope, however, that my comments have illustrated that by drawing upon research, careful planning, putting forth some effort, and experimenting one can incorporate computerized business simulations into a wide variety of courses successfully. I encourage you to use computerized business games.

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