THE DEVELOPMENT OF AN IMPROVED BUSINESS GAME

FOR USE IN

MASSEY UNIVERSITY MARKETING COURSES

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ABSTRACT

The thesis is a response to a problem situation in which a business game, having been used in undergraduate courses for several years, was thought to be inadequate by course and game administrators. The problem is first defined and objectives for the study are set. This is followed by a comprehensive overview of business gaming and a more specific review of the processes and problems of business game design. A description of the game in use, MARKSIM, is given. The MARKSIM experience at Massey University is evaluated from the game administrators' and game players' points of view, the latter by a survey of 41 second and third year marketing students. The specifications of a more satisfactory game are derived from this evaluation and alternative means of acquiring such a game are investigated. The solution chosen as most appropriate is to modify the game already in use and this is carried out.

Improvements to the game include reparameterization of the game to reflect the New Zealand business environment, adoption of a two-product product mix, inclusion of optional qualitative administrator inputs reflecting advertising efficiency and annual report quality, superimposition of a share market on the model business community, increased market research capabilities, and general improvement of the game's robustness against administrator and player errors.

Evaluation of the resultant game in terms of the problem situation is not possible within the time horizon of the thesis.

Program listings are appended.

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CHAPTER 1. Introduction

1.1 The Problem Situation

A business game called MARKSIM has been in use as a teaching aid at Massey University during the academic years, 1974, 1975 and 1976. This game is centered on the 'marketing' functional area of business and has been played by Marketing Strategy classes at the 200 level. The game has been played by students in parallel courses at Otago University and Waikato University.

The game, written by P.S. Greenlaw and F.W. Kniffen of Pennsylvania State University in 1964 [10], models an unspecified consumer durable product in a three-firm competitive industry selling to three market segments.

Teaching staff using this game at Massey University have been pleased with the educational effects of gaming sessions but have felt that the game, in its original form, was inadequate for use in this particular environment. The four principal problems initially reported were:

(i) The game involves firms and markets of vastly greater size than those found in the New Zealand business environment.

(ii) Some decision variables which the administrating staff consider highly important in the New Zealand context are absent from the game.

(iii) The 'response to decision' behaviour of the three market segments inadequately reflects established theories.

(iv) The administrating staff consider that more flexibility of, and more control over, computational aspects of the game would be of advantage.

The author's experience with MARKSIM prior to writing this thesis includes:

(i) Implementation of MARKSIM on Massey University B6700 computer, 1974.

(ii) Running computational aspects of MARKSIM, 1975.

(iii) A dissection of the response function segment of the game resulting in the unpublished report "Analysis of Response Functions used in MARKSIM" submitted as a partial requirement for the Masterate course 56.401 Marketing Models, 1975.

(iv) A re-specification of the parametric structure of the game, including reduction of scale and refinement of the market segmentation structure, and reorganization of the computational procedures, 1976.

Conclusions drawn from this experience were:

(i) The game concept and basic structure are theoretically sound.

(ii) The response function structure is flexible and appropriate, although the original parameters assigned by Greenlaw and Kniffen were inappropriate for New Zealand usage.

(iii) Computerization of the computational aspects of the game has been inadequately executed, resulting in a computer program which is difficult to 'read' for debugging purposes and is not robust against operator errors or game player errors.

After the re-parameterization of MARKSIM in 1976 the initial problems of game scale and market segmentation were overcome but it was increasingly obvious to the game administrators and the author that the game was unsatisfactory for the 200 level Marketing course. At this time the major problems were considered to be:

(i) too low a level of complexity for the game players,

(ii) no way of building into the game the efforts of players in preparing analyses of play, promotion plans and 'annual reports',

(iii) the lack of robustness of the computer aspects of the game.

1.2 Objective of the Study

The objective of this study is to produce a marketing game for use in marketing courses at Massey University which incorporates features considered desirable in this context. The reference point for the study is the business game MARKSIM.

The use of a reference game such as this is recognized as a constraining influence on the study but is justified on the grounds that marketing game experience at Massey University is almost entirely related to MARKSIM. The author considers that this experience and information is specific to the MARKSIM experience at Massey

University and can not be used as a general evaluation or knowledge of business gaming. It would therefore be inappropriate not to base the study on the MARKSIM game as the wealth of direct knowledge available could not be used.

1.3 Thesis Guide

In order to achieve the objective as stated, the thesis first reviews business gaming in detail, investigating the educational validity of the technique, analysing characteristics and use of business games and commenting on the problems, limitations and prospects of business gaming. In Chapter 3 the thesis reviews in more detail the processes and problems of designing business games. The material in this chapter is also directly related to evaluating business games and as a basis for both design and evaluation has a strong influence on the remainder of the thesis. Chapter 4 presents a description of the reference game MARKSIM and Chapter 5 evaluates the MARKSIM experience at Massey University arriving at a summary of suggested improvements to MARKSIM in this context. Chapter 6, entitled "Implementation of an Improved Game", opens with a discussion of alternate strategies to provide an improved game. Three alternate strategies are discussed and modification of MARKSIM is chosen as the most appropriate. Improvements are then applied to the basic model, the relationships between variables, the presentation of game performance, and administrative aspects of game play.

Computer programs, data files, decision forms, tabulated survey results and a discussion of functional equation forms used are appended to the thesis.

At the time of presentation of the thesis the modified game has been implemented on the Massey University computer system and has had several successful runs. It is envisaged, however, that parameterization of the game may need refining after more extensive in-use testing with student players.

The thesis contains no formal conclusion. The time horizon allowed for presentation of the thesis precludes comprehensive in-use testing of the modified game because this can only be accomplished by using the game in marketing courses for an extended period. The increased and optional complexity of the game, together with the other modifications will improve its efficiency as a teaching tool and will provide lecturers with a more potent and relevant vehicle for teaching marketing management skills to both elementary and advanced students. The degree to which lecturers use the potential of the improved game is beyond the influence of the author. The result of this thesis has been simply to remove some of the constraints on teaching efficiency imposed by the original MARKSIM game.

CHAPTER 2. An Overview of Business Gaming

2.1 Introduction

The use of models of reality instead of reality itself is an age-old training method, dating back at least to the origin of chess. Chess, at the time of its inception, was a model applicable to contemporary war strategy. As a formalized representation of real battle conditions, chess permitted warriors and rulers of old to develop attitudes and approaches to tactical situations without actual commitment of resources. The utility of such simulation of war conditions is evident in the continued reliance of the military upon war games and simulation exercises through the centuries up to the present.

The simulation of situations for training purposes has not been limited to war strategy, however. Perhaps the best known of all simulators, the Link Trainer, taught and still teaches pilots to fly without leaving the ground. From the Link Trainer one can readily extract the ingredients which make it a successful simulator. These are, firstly, an accurate, realistic model which properly interrelates causes and effects, and secondly, a set of decisions provided by the trainee on which the model acts. These features, a model and a set of decisions independent of the model, are essential to any simulator.

Business simulation is a relatively young field which had its origin in the application of war gaming techniques to business. Cooperation between management specialists and the armed forces during the Second World War left these specialists with the conviction that war gaming techniques could be applied to business models.

Since a business model is typically numeric in form, a sophisticated model requires extensive calculation. In pre-computer days it was not economically feasible to develop elaborate models. Digital computers, however, have allowed almost any degree of complexity in the models without imposing a time or cost burden on the participants.

The purpose of business simulation can be either to train personnel or to aid in making actual decisions or both. As a decision-making aid, the simulator predicts the results of a set of actions, thus aiding management in its decision-making process. As a training

technique, the simulator educates the participants by exposing them to some of the interrelationships and decisions which confront management. In this latter form simulation is referred to as a business or management game.

Management games can vary widely in scope and complexity and can be classified in many ways.

Most games are played by one or more management teams or individuals and contain some obvious measures of performance, such as net profits or net worth, which lead to rivalry among the players. One or more products may be involved and these products may be specifically defined or simply called "widgits". Games may or may not involve interaction between players, depending upon whether or not the success or failure of a set of team decisions is influenced by the decisions of other teams. The decision area involved in the game may be limited to one business function, or may encompass the total enterprise.

2.2 The Role of Business Gaming

Business games are experiments in management decision-making. The objective in utilizing any business game is to teach people to act intelligently under stresses similar to those encountered by business executives in the real business world. Each participant is required to act in the face of new experiences and to perform not just a single act but a series of actions to meet changing circumstances.

The growing complexity of modern business management demands that managers be familiar with a greater number of rules and regulations, be increasingly 'professional' in their approach to their work and use more sophisticated management tools than in the past. Top management especially is finding it harder to assimilate all the information they receive from experts and information systems. The modern manager therefore requires deeper insight and wider flexibility than did his counterparts in the past, and these requirements have resulted in a growing emphasis on managerial development.

Managerial development encompasses three general areas of skill development: (a) the development of skills specific to the manager's principal task, (b) the development of an understanding of other functions in his firm, and of his customers and competitors, and (c) the development of decision-making skills.

Skills to solve many of the problems encountered by executives are intangible, and the learning of rules and procedures to solve these problems has limited value. It is generally recognised [11][1][12] that the only way to develop these intangible skills is to provide the executive with involvement and practise in suitable problem situations. The means of providing this experience are limited to 'real life' experience or 'simulation' experience.

Training characteristics peculiar to the field of managerial development have been summarized as follows [11];

(1) difficulty of practise, in terms of (a) the long time necessary to experience the recognition, analysis and solution of each individual problem situation; and (b) the lack of objective evaluation of action and consequent reinforcement,

(2) prevalence of complex and abstract concepts such as the 'management cycle' (organise, plan, execute, coordinate and control) and its inherent error and correction process,

(3) dilemma between the instructor's need to break down the subject to communicate it, and the student's need to experience it in totality,

(4) the need to develop decision making skills which are aimed at the best overall benefit in terms of the firm's objectives, rather than sub-optimization within a functional area of the firm,

(5) the problem of overcoming the student's prior attitudes and limited self awareness which block learning and application (i.e. the need for an atmosphere of permissiveness where the objective is to gain 'experience' in making good decisions rather than to produce an immediate 'good decision').

1 Numbers within parentheses refer to the bibliography appended to this thesis.

'Simulation' experience in general, and business gaming in particular, overcomes many of the problems posed by these management training characteristics.

Most simulations allow trainees to get practice in situations which they would normally only come up against very rarely, or would normally take so long in the real world that the number of practices would be limited by time. However, of the various simulation techniques only business gaming provides very quick and entirely objective performance feedback for reinforcement by evaluation. Simulation in general provides practice in management techniques and interaction. Business gaming in particular provides objective feedback and continuity between rounds of gaming so that trainees experience the long term effects of their management technique. Business gaming is unique in that trainees can be allowed to make decisions in as broad an area as required. For instance in total enterprise games the trainee or team of trainees can make general management decisions which they would never have a chance to do in a real life situation. Simulations in general also allow trainees to make experimental decisions with a zero opportunity cost. Business gaming is the only type of simulation which allows trainees to make decisions in a dynamic and competitive environment without constraints on their level of performance. Outrageous experimental decisions can be tried without fear, and the consequences calmly studied, although this approach implies a lack of realism and responsibility and so should not be strongly emphasized.

Potential education objectives for which business gaming can be used are as follows [12]:

(1) General simulation objectives (apply to case studies, role playing and other forms of simulation as well as business gaming), i.e. to provide experience in
   - (i) illustrating elements of group dynamics
   - (ii) practising policy formulation
   - (iii) emergence of leadership
   - (iv) the role of communication
   - (v) resolution of disputes
   - (vi) the effect of morale and social pressure on behaviour.

(2) Potential objectives unique to business gaming, including provision of experience in

(i) the importance of planned and critically timed decisions

(ii) the balance between long run and short run considerations

(iii) the importance of flexible organised effort (time pressure can be applied to create stresses which encourage organization of the team)

(iv) the use of decision assisting tools such as forecast charts, budgets and even computer decision tools

(v) the significance of reaching a dynamic balance between interacting managerial functions

(vi) the 'Power of Modelling'. Many executives who have played management games have consequently become enthusiastic about actual decision making applications of simulations.

Computerized games also tend to reduce trainees' fear of computers in general. It is notable that no emphasis is placed on use of the game to give executive experience with the specific environment he works in. Although most business gaming is used as a general training in management skills, games which simulate a particular firm or industry can be used for more specific purposes such as testing current executives for their knowledge of the industry, selection of potential new executives, testing competitive reaction to your company's strategies, or introducing new employees to the environment they will work in. A model which simulates a particular situation can of course also be used as a decision making tool for real management decisions.

The major references on management games [2][9][10][11][12] place strong emphasis on the fact that business gaming should be part of an integrated training course. Suggested uses of business gaming in a training course are as follows [12]:

(1) Beginning of course - as an ice-breaker and motivator.

(2) At conclusion of course - as a summary.

(3) Before and after the teaching of a specific technique.

It is emphasized that gaming should only be used with a clear understanding of the specific educational objectives to be attained.

2.3 Educational Validity of Business Gaming

Most educators and psychologists agree [11] that the conditions under which the process we call learning occurs easiest and fastest include:

(1) Contiguity - In order for two events such as performance and reward to become associated, the two events must occur within a certain time interval. Additionally, before a trainee can put together several sub-tasks into a complex task, each of the sub-tasks needs to be promptly 'reinforced'. It is only then that the trainee can successfully integrate the several parts into a pattern of adequate performance for the whole job.

(2) Effect - The more satisfying the result, the more likely learning will take place. Conversely, the more 'motivated' the sujbect is before the task, the more likely learning will take place if the task is successfully completed.

(3) Intensity - The rate at which learning takes place increases as the learner's response to the situation increases.

(4) Organization - Learning is more rapid when the subject matter is organised into meaningful relationships.

(5) Facilitation and Interference - Previously learned material will assist in the learning of new things if we utilize the previously learned responses. Conversely, if we require new responses to the same stimulus, learning tends to be retarded.

(6) Exercise - While unmotivated repetition hinders learning, repeated occurrence of conditions favourable to learning gives them added force.

An examination of business games indicates that they exhibit a high level of agreement with these principles of learning, possibly higher than any other teaching tools available for the teaching of management [2]. Business games report effective performance by feeding back results of decisions made by the participants. What is more, the feedback can occur within a very short space of time, particularly when computer games are involved. Receiving the results so quickly after decisions are made enables the student to study the decisions before decision considerations are forgotten (i.e. the performance and reward effect is intense).

A high degree of involvement on the part of participants is invariably reported by game administrators. The result of this involvement is very high motivation and participation, a prerequisite for effective learning and normally a difficult hurdle for teachers to overcome.

'Facilitation', or the process of building on previous knowledge, is an obvious characteristic of interactive business games, but 'interference' (different responses to the same stimuli) can be a problem if the model is overly complex or if the administrator changes the parameters of the game during play. This emphasises the important point that business games may not satisfy any 'conditions' of learning if they are poorly designed or administered.

Organisation of the material to be learnt is a conflict between the high degree of organisation demanded by learning principles and wanting the game to be a reasonable replica of reality, which demands a 'total' approach. One approach to this problem is to progressively include more decision variables as the game proceeds.

A further compromise is that concerning contiguity. The payoff is between the same decisions giving the same results and the benefits of a competitive environment. Two distinct types of games have been developed to cover this point, those where the players are competing only with a fixed set of responses, and those where the players are either competing with a stochastic set of responses or in interactive competition with other players.

In spite of these problems in fully satisfying educational principles when teaching with business games, it is evident that business games compare favourably in these respects with other teaching tools.

It is again necessary, however, to emphasise that the business game is a learning tool which is best used either to reinforce, by application, techniques learned in more traditional ways, or to learn the more abstract skills of management. The playing of a business game does not in itself constitute a course in management. On the other hand the overwhelming success of business gaming as a teaching tool has led the Carnegie Institute of Technology Graduate School of Industrial Administration to build several courses around a business game, rather

than use it as a supplementary tool. This game encompasses a whole Faculty and when fully implemented, means that the school will have its own simulated business economy. "This involves a high cost in terms of both faculty and student involvement and time. When properly exploited the gains will far outweigh the costs."[5]

2.4 Structure and Characteristics of Business Games

A general definition of business games is "A sequential decision-making exercise structured around a model of a business operation, in which participants assume the role of managing the simulated operation."[11]

Two points should be made concerning the use of the word "game". Firstly, the implication of entertainment given by the word "game" is unfortunate and for this reason the word "simulation" is often substituted. However 'business simulation' is often used in a broader sense to encompass case studies, role playing and other techniques. Secondly, a clear distinction should be made between business games and the 'theory of games' developed by von Neuman and Morgenstern, which is a highly complex theoretical branch of mathematics and bears little relationship to educational gaming.

2.4.1 General Game Characteristics

The preceding definition will now be analysed to reveal the characteristics displayed by all business games.

(i) "Sequential" - An essential characteristic of business games not shared by other simulations is that they are dynamic. Each action by the players is replied to by the game; the players then take further action which is replied to, and so on. This characteristic is essential to replicate the 'error and correction' nature of management.

(ii) "Decision making exercise" - The player's input into the game is always in the form of decisions concerning the value given to a fixed or variable number of decision variables.

(iii) "Model ... business operation" - The third essential characteristic of business games is that of responding to the decisions made by the players. This response is determined by a model of a real or

imaginary business operation. The model may be of any level of complexity from a qualitative response to the decisions by a judge up to a highly complex quantitative model including interaction with other players and stochastic elements.

A further essential characteristic not mentioned explicitly in this definition but implied is that of feedback of performance. When games are based on quantitative models the objective nature of this feedback gives business games one of their great educational benefits, the opportunity for the player to evaluate his decision and reinforce his learning.

2.4.2 Variable Game Characteristics - a method of classification of business games.

(i) Participation Structure - Games are played by one or more individuals or teams. While some games can be played by any number of decision making units, others (principally interactive games - see (ii) below) require a fixed number. It is generally recommended that groups rather than individuals form decision units if one of the objectives of the game session is to teach the complexities of team effort and leadership and learn the importance of communication. It is often left to the teams to assign their members to functional positions or to arrange rotation within the team among functional responsibilities.

(ii) Competitive Structure - Decision making units playing the game may compete only with the model or may compete with other players through the model. The former case is called 'non-interactive' and the decisions of another team will have no effect on the results of a given team. The latter case is called an 'interactive' game. In this case the decisions of the different decision making units interact. An example might be several 'firms' competing for a fixed number of sales. In this case the model might assign sales to the 'firms' in proportion to, for instance, their respective advertising expenditures. It is reported that both types of competition produce intense rivalry between teams playing the games.

(iii) Feedback and Measures of Performance - Feedback and measures of performance vary with the objectives of the game and may range from a simple record of the number of sales for the period to a complete balance sheet, profit and loss statement, other internal performance measures and market research information.

(iv) Relationship Between Decision and Effect - This relationship is defined by the model on which the game is based. Disregarding the dimension of interactive/non-interactive games (covered in (ii) above), the determination of effect by decision falls conveniently into the three catagories, qualitative, quantitative and stochastic.

Where the relationship is dependent on a human judge, the model is qualitative. This could be considered the least sophisticated type of business game and lacks the feature of objective feedback for the players which is so desirable in the learning process. Nevertheless many games include at least an element of this qualitative relationship. An example would be the situation where a promotion campaign was presented to the administrator of the game, who qualitatively assessed it and then entered a promotion efficiency index into the model. The simplest games rely entirely on qualitative assessment of the type mentioned.

Games which are described as fully quantitative have a set relationship between inputs and outputs. With the same set of initial conditions, decisions and model parameters they will always produce the same results. These models could alternatively be described as deterministic. The majority of business games are either fully quantitative or semi-quantitative, as in the example above with the index of promotional efficiency added to an otherwise fully quantitative game.

The third type of relationships between decision and effect are those involving stochastic effects. Stochastic effects in this sense are best described in terms of the relationship between two variables; the decision variable and the effect variable. If a given level of the 'decision' variable is entered into a stochastic model a number of times a frequency distribution of the 'effect' variable will be produced. If this distribution is normalized (area under the curve set to 1) it becomes the probability distribution of the effect variable for the given value of the decision variable. This distribution, if found, would allow the game player to make statements of the type "if I spend $1,000 on advertising, there is a probability of 0.5 that my sales will be between $20,000 and $30,000" (assuming for simplicity that advertising is the sole determinant of sales). This is the strongest level of association between the variables the player can make for any one particular run of

the game. Of course, the designer of the game views the situation in the converse manner and simply inserts the desired probability distribution generator in the model. The purpose of stochastic effects in business games is usually either (i) to make the game a more realistic representation of the real world, or (ii) to disguise a very simple relationship between decision and effect which might otherwise become obvious after a few rounds of play. An interesting example of the former application is the McKinsey Game [1]. In this game, increases in advertising add to a company's chances of making a sale, added R & D expenditures increase the probability of obtaining an innovation, and salesmen 'resign' from companies on a random basis.

Caution should be exercised in the use of too many random effects as it will become difficult for players to see any consistent relationship between their decisions and results, leading to frustration, boredom and lack of interest.

The actual form of the relationships between decision variables and effect variables, known generally as response functions, is of critical importance to all model builders whether they are building models for use as real world decision tools or as the basis of a business game. However the requirements for a normative model centre on representing accurately the real relationships that exist. The requirement for business game response functions on the other hand is principally verisimilitude [12]. For this reason quite simple response functions are often successful in business games.

(v) Methods of Computation - The methods of computation used to generate the results of business games can be simply divided into 'manual' and 'computerised'. The advantages of each method depend to a large extent on the facilities available, however some general points are brought out.

The advantages of a manually scored game are the generally lower costs of building and operating the model, and in some environments, a quick turnaround. The principal disadvantage is restriction on complexity of the model. By far the majority of business games in use are manually calculated [5][11][12].

The main advantages of a computerised game are the speed and accuracy of calculating results, the provision of printed reports for players and administrators and the absence of constraints on the sophistication of the model. The principle disadvantage is the generally high development cost (e.g. 1 man - year [11]).

(vi) Periodicity - Generally business games are played in rounds of 'one simulated time period', e.g. month, quarter, year, etc. Most games use discrete periods of the same length throughout the game session, though this is not necessary. The ASCOT game of the Imperial Oil Company [11] is played on an analogue computer, the players being permitted to make decisions at any time while simulated hours tick away. Some games, for instance MARKSIM [9], operate on a basis of periods and sub-periods, in this case quarterly decisions and feedback and an annual major financial summary.

(vii) Orientation - Business games have been designed for both functional area management and general management. These alternatives are referred to as 'Functional Games' and 'Total Enterprise Games'. Total Enterprise Games usually include decisions in the areas of price, production, marketing, market research, research and development, investment, often taxation and depreciation, and sometimes labour relations and dividends. Usually only one or two decisions are made in each area. These games are usually used for students in Business Administration and executives participating in in-firm programmes. The objective is usually experience at integration of all facets of the firm.

Functional Games have been developed in many areas including personnel management, stock markets, marketing, sales, production, materials management and resource allocation in scientific and technical functions. These games are normally used for more specific training of students and executives in functional areas, and often, in the case of executives, to experience the problems of areas of the firm in which they normally do not work.

(viii) Industries and Products - The industries and products involved in the game are sometimes specified, sometimes described generally, or sometimes imaginary. Often this characteristic depends on the origin of the game. If it developed in a specific company and was then distributed more widely it often retains the product. Often general descriptions such as 'a consumer durable selling in the range $40 - $20 per unit' are given and the players decide if they want to call them lawnmowers or cakemixers.

The imaginary products are often described as 'widgets', a name used in some early games that modelled a manufacturing company. There is some evidence [11][12] that students are more likely to get deeply involved when they know the product they are selling. Many diverse industries have been modelled and as long ago as 1961 [11] educational game builders were turning their talents towards education games in administration and diplomacy for teaching Statecraft to developing nations.

2.5 Administrative Procedures and Problems

Although business games can be used in different types of training courses, from one-day businessmen's seminars to year-long university courses, the techniques for administering them are generally the same.

Administration will be considered in terms of the four chronological phases of the administrator's job; planning, briefing players, play and critiquing the game series.

2.5.1 Planning.

(i) Choosing the game. Criteria for choosing a game to use is a subject in itself. However, some useful general points can be made. The game should be chosen because it will reinforce and illustrate the principle analytical tools and concepts being taught. Choosing a game and then forcing it into the presentation may detract from the learning process. The game should be compatible with the resources available in terms of computational facilities, staff numbers and skills, and the budget available.

In some cases it may be best to develop a game if a suitable one does not exist. In this case a cost benefit analysis should be carried out to justify the investment which often includes at least one year of time. Regardless of the method of arriving at a game to use, the administrator must become thoroughly familiar with the game before proceeding any further.

(ii) Preparation of facilities. The physical environment is a very important aspect of game play, especially where the game sessions are to be intense, as in a one day seminar with, say, 12 half hour gaming sessions. Items for attention include preparation of briefing and training areas,

preparations of adequate data processing facilities and communication links (it is possible that teams be remote from each other and/or the administrator), provision of calculators etc. and adequate stationery for both formal and informal uses during play.

(iii) Staffing. Staff may be needed to collect decisions, supply consultation or help with data processing or other routine aspects. All staff involved with the game should participate in a 'dry run' before play to minimise the chance of an error during play, which may destroy the players' confidence in business gaming for all time.

(iv) Timing Schedule. The administrator must prepare a time schedule in advance. This must include the overall length of game in terms of number of periods of play and the time allotted to each decision making session. Some problems have been encountered with players who try desperate policies in the last few rounds. It is suggested that players be told that the game is, say, three periods longer than is actually intended. The time allowed for each decision session is a variable which may be manipulated by the administrator either to take account of the player's increasing familiarity with the game, or to provide stress so that the players are forced to organise themselves into more efficient decision making bodies.

In some situations the processing time for the game is the limiting time factor. Where this problem is encountered a technique termed "leap frogging" [12] can be used. A delay of one period is introduced into the reporting cycle, so that when the players are making a decision for period t the latest feedback they have is for period t-2. Meanwhile period t-1 is being processed. It has been suggested that this technique reflects the real business situation more accurately.

(v) Participant Structure. Lastly, the administrator must plan the participant structure. The game being used may be inflexible, dictating the number of teams required, or the decision may be entirely up to the administrator.

The number of participants in each team is usually recommended in a description of the particular game being used. These numbers are usually based on the number of functional areas involved, and if they are exceeded the result is often evolution of a sub-class of decision makers within the team, and a lack of involvement of others.

Teams may be assigned randomly or to take advantage of players' backgrounds, or alternatively, to purposely place players in an alien functional area. By the same token, positions within the team may be

assigned in these same ways, or left up to the individual team to decide between themselves. Often an administrator will require each member of a team to take turns at each functional position within the firm.

It is clear that each aspect of planning is dependent on the educational objectives of the gaming sessions, and it is implicit that the administrator has clearly identified these objectives before deciding to implement a business game.

2.5.2 Briefing Players.

(i) Preparation. Where possible it is advantageous for players to receive briefing material before the briefing session. This material should include general information about games, how they are used, and how they are played. It is also desirable, where possible, to select teams prior to briefing, so that they may have a chance to get to know each other and reduce the 'noise' created by interpersonal adjustments during the first periods of play.

(ii) Type of briefing. The administrator has a choice concerning the amount of direction he gives at the briefing. A highly directive approach might include detail on organising, setting objectives and budgeting, on the behaviour and responses of the model and on strategies to follow. A non-directive approach, on the other hand, would include only a limited amount of information. This second approach tends to provide more challenge, and stimulates a much greater receptivity to subsequent teaching [12]. It is, however, imperative that all details and mechanics of playing the game are clearly disseminated.

As has been mentioned before, an essential requirement of a game is verisimilitude. In line with this aim the briefing must appear businesslike and the administrator must project competence or the players may question the validity of the entire game programme.

The briefing should always include the specific objectives of the game series, and attention should be drawn to the fact that one of the features of a management game is complete objectivity of the model in arriving at the results of each team's decisions for each period. Kibbee, Craft and Nanus [12] emphasise that the administrator should not alter parameters during a game for arbitrary reasons. Any actions such as this which do not clearly aid in achieving the objectives of the game programme will probably adversely affect the players' confidence in the game.

A 'Check List on Briefing' is given by Kibbee, Craft and Nanus [12] and is summarised below:

1. Distribution of material.
2. Introduction to the history of simulation and gaming.
3. Outline the objectives of gaming.
4. Introduction to the game - this should cover the general structure of the game, decision areas, types of information given automatically and available on request or purchase, rules, penalties for breaking rules, and particular emphasis should be placed on the time lags involved when products travel down a channel (e.g. most games feature a delay between production and sale). Players should be shown examples of the reports they will receive from the game.
5. Starting conditions - when the player receives a normal report from the game as his starting conditions he is generally confused by learning the layout of the report and his starting conditions at the same time. For this reason it is recommended that the two learning processes be separated and that some considerable time be spent discussing the starting conditions, emphasising their effect on later performance.
6. Decision forms - one of the biggest points of confusion in any game programme is the clerical process which must be followed by the players when filling in the initial decision forms. A way to overcome this is display of a filled out form to explain the mechanics involved. The need for accuracy in filling out decision forms must be stressed, especially when a computer is used for processing, as illegal decisions may cause costly wastage of run time and turnaround time.
7. Time schedule and 'end effect' - there is some debate as to the desirability of players knowing the complete game schedule at the start. This is caused by the observed presence of 'end effect' where players make 'do or die' decisions in the late stages of the game, a situation which destroys verisimilitude. Strategies to overcome this end effect include misinforming players about the length of the game, and advising them that they will not know it is finishing until it has finished. Between-period times or a decision schedule should be given, and reminders should be included with each set of results distributed.
8. Preparation for the critique session. Teams should be advised about the information they should collect as they play, and which will be useful to them at the critique sessions. If a winning team is to be picked at the end of play the players should be told the criteria to

be used to pick the winner.

9. Special problems encountered in the briefing session -

- Fighting the model - sometimes as a result of antagonism of the player towards the administrator he will, for instance, continue to pursue a strategy that he has been told is unprofitable.
- The skeptic who doesn't believe the model will work, or thinks it unrealistic.
- The "gimmicker" who disregards the briefing session and looks for a 'whiz kid' approach to making a killing.

2.5.3 The Play.

The process of play is conveniently described in the flow chart (Fig.2.1) adapted from Babb and Eisgruber [2].

Once decision making has started the decision-making exercise becomes routinised. Teams analyse past results, make decisions, are presented new material while decisions are being processed, and receive results. However, the administrator must still maintain control and give assistance.

The amount of help an administrator should give to players is debatable. Clarifying questions should be answered but more definite help may be resented by either the team involved, their competitors or both. It is suggested [2] that the administrator should monitor group discussions and decide from these when and when not to advise. This also gives the administrator a good measure of the absorption of material currently being presented in the course. An administrator should definitely offer assistance when a team's performance is progressively worsening.

As decisions are completed the administrator should check them for errors and then initiate processing. If errors result from processing the decisions should again be checked and referred back to the players if in error. Every effort should be made to avoid errors which seem to be the result of processing, especially if one of the objectives of play is familiarization with computers.

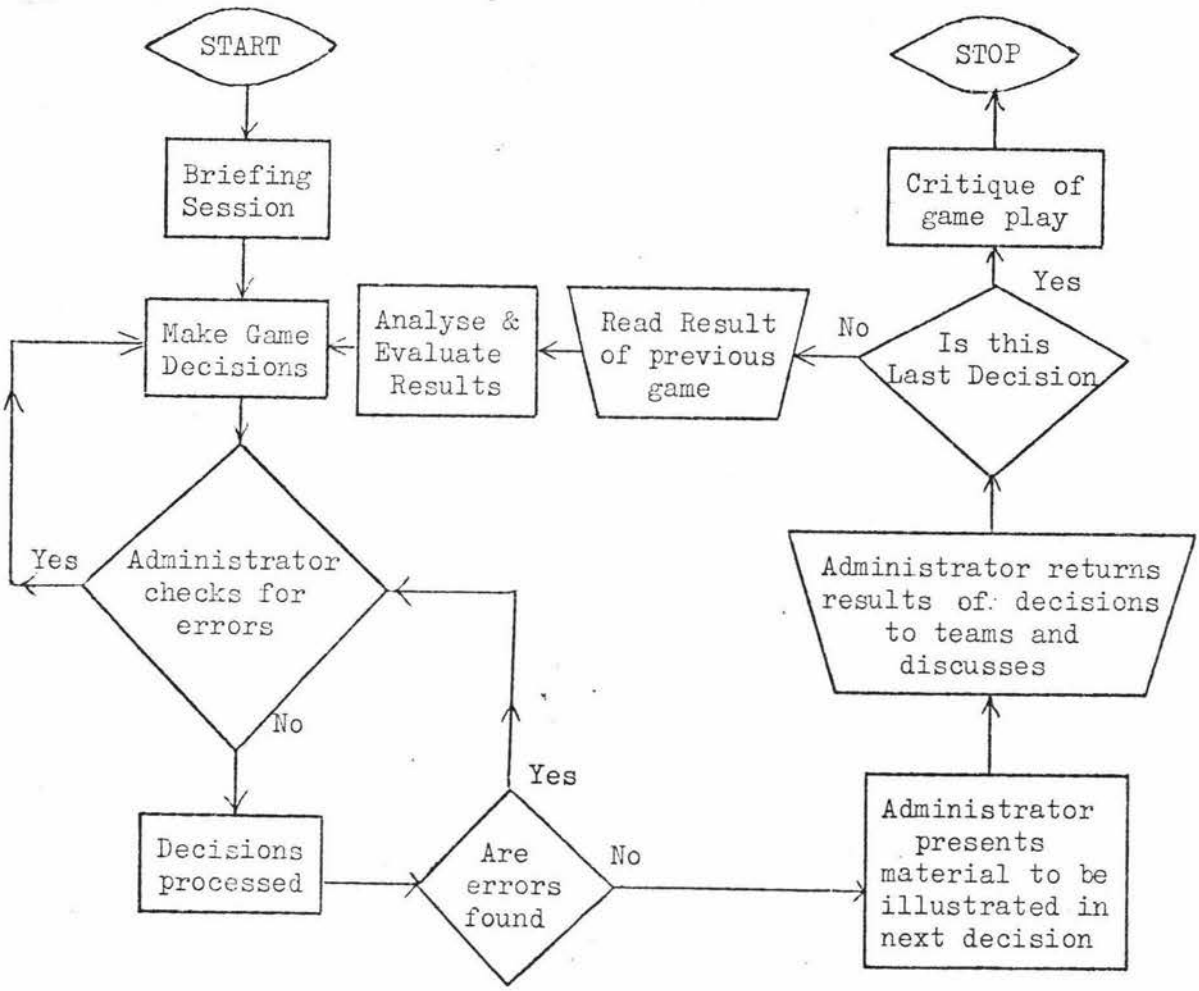


Figure 2.1. The process of game play [2]

The period between decision and results can be used in a variety of ways, one of which, the presentation of more formal material, is described in Figure 2.1. Alternative uses of the time are:

(i) Sequential presentations of the lecture type when the principles or techniques involved can be illustrated in the next round of play.

(ii) Reorientation of teams. Personnel changes may be made within or between teams. In addition the administrator may want to change the objectives, rules or parameters of the game to illustrate points in his presentation.

(iii) Presentation of reports by teams. These reports may be to help the teams manage themselves or to help the administrator grade their performance. They could be done on an individual or team basis. Such reports can contribute to the illustion of reality.

(iv) 'Leap frogging'. If time is short and the 'leap frogging' method of play used this processing time, for period t, is taken up with decision making for period t + 1.

(v) Relaxation and refreshment. Where games are played for long periods in workshops, some time between decisions should be used for relaxation. Discussion about the game will inevitably continue but tension will subside.

When the results of a round have been processed the administrator should check them for errors. He should then make some stimulating comments and hand the results to the teams for the next round. He should maintain familiarity with each team's performance and should keep records of their play to aid in (a) evaluating their performance and (b) constructively critiquing their game at the conclusion of play.

2.5.4 Critique of game play.

The critique is an essential part of a game programme. During the game whatever teaching that takes place is largely self-learned, and often points the administrator wanted to demonstrate are not apparent to the players. The critique is therefore needed to focus attention on the points that were illustrated. It is also an opportunity for the administrator to steer the players away from erroneous conclusions they have come to. For this reason it is often preferable to call the critique a 'de-briefing' emphasising the connotation of the un-learning of some of the illusions of reality and mechanics of game play which were essential to a successful game programme, but which have no transfer value in real life.

The critique also gives players the opportunity to 'let off steam' in a controlled and constructive manner. This process, together with his observations of game play, give the administrator feedback concerning the game programme.

It is essential that the administrator emphasise that no single measure of performance is important and that he evaluate each team in terms of their performance relative to their stated objectives.

The three principal problems encountered in critiques are: (1) the 'whiz kid' approach; (2) the 'end effect'; and (3) fighting the model. These three problems have been discussed already and their solution lies only in effective planning, briefing and critiquing coupled with exemplary personnel management. Of these three problems, the third is reported to be the most difficult to solve, because it is primarily the result of personality factors.

2.6 Problems and Limitations of Business Gaming

While the concept of gaming is now new, the complexity, detail and the applications of present day games are relatively new developments. Because business gaming is in a fairly early stage of evolution there are many problems and limitations still to be overcome. While most of these aspects have been covered earlier in this chapter, the following summary, adapted principally from Greenlaw et.al. [11] is included. The problems and limitations will be dealt with in terms of the learning function, the game design function and the game administration function.

2.6.1 Learning.

(i) Proper relationship of the game to the teaching objective. It is imperative that a gaming session only be used when the educational objectives of the session are clear. Furthermore, the educational objectives must influence the choice of game, not the availability of a game influence the educational objectives.

(ii) Possibility of learning the wrong things. The objective of any game play is to improve the decision making skills of the players. Games should rarely, if ever, be used to learn a set of decision rules for a given situation. For this reason it is critical that the players not go

away from the session thinking that the actual decisions they made during play have any external validity. It is generally recognised that the more realistic the game is the higher the chance of this type of erroneous carryover taking place. The solution is very careful briefing and critiquing.

(iii) The over and under confidence effects. "If we succeed in making games realistic and successful we may accentuate the problem that bright young business school graduates already have, when they go into industry. Now instead of 'thinking' they know how to run a company, they may really 'believe' from their experience with a game that they can run a company better than its present managers." Again the only solution available is careful briefing and critiquing. [11]

(iv) The need for validation of learning by gaming. Little empirical evidence exists with respect to the relative educational effectiveness of business games in comparison with other educational techniques.

2.6.2 Game design.

(i) Undue encouragement of conformity in decision making. Games are usually built to safeguard against extreme or gimmicky strategies. This has the effect of rewarding those players who conform to standard and conservative strategies. Some games have a capacity for some qualitative input so that innovation and insight can be rewarded.

(ii) Obscuring the obvious. There is a temptation for game builders to take advantage of the computer's capacity for complexity. If too many variables and relationships are modelled the game loses its simplicity to the detriment of its educational value. "The computer is not the heart of business gaming; it is only a tool for computing the results of play."[11]

(iii) Overemphasis on quantitative aspects of management. Because of the ease of modelling quantitative relationships there has been a strong emphasis on this aspect of management in most games written. Personal attributes of sensitivity, creativity and morale development have been largely ignored. (It is generally assumed that each team allocates its resources with the same managerial efficiency.)

(iv) Potential use of games as a testing instrument. Model builders are generally very cautious about this use of gaming. "Although no formal studies have been made, experience to date with simulation exercises does not suggest any correlation between success in a particular simulation and success in the real business world - nor have any specific discriminating

factors emerged ... [11] It is suggested however, that observation of participants under the conditions of gaming might provide some information about their reaction to stress.

(v) Adequacy of realism. Some elements of business gaming destroy realism, among these are:

- Spending fictitious money does not give a strong feeling of responsibility.
- Game rules, designed to limit extreme strategies, are artificial.
- Teams are commonly started on an equal basis.
- Information is easily bought in most games - in the real world it might often be unavailable at any cost.
- Only some of the relevant factors from business are included in the game.

Many game designers, however, believe that only verisimilitude is essential, and that too much realism complicates the game and detracts from its educational usefulness.

2.6.3 Game administration.

(i) Over-emphasis on time pressure. While the flexible use of the time dimension is a major feature of business gaming there are indications that some game administrators have attempted to speed up the learning process unreasonably and have consequently drastically reduced the educational efficiency of the game sessions.

(ii) Difficulty of measuring success in game play. This problem is unresolved, but to be compatible with educational principles, any team must be judged on their success in attaining their specific objectives, set at the beginning of play. It has been found helpful to discuss what criteria should be used during the critique session at the end of play.

(iii) Lack of respectability of the words 'game' and 'play'. These words have entertainment connotations and are consequently received unfavourably when time, moeny and effort of commercial organisations are involved. While many attempts to employ other descriptive terms have been made, the words 'game' and 'play' are so solidly entrenched in the simulation procedures that they are usually reverted to, but accompanied by an explanation of the associated educational benefits.

2.6.4 Common misconceptions.

It will be useful to dispell some common misconceptions which often give rise to implications concerning the limitations of business gaming. The following arguments are summarised from an article by

J.R. Green [7]:

- A business game is not an optimizing tool. It is a trial and error method used to gain insight into business problems that are too complex to be solved mathematically.
- No mathematics are needed. One of the major deterrents to the use of gaming is the widespread but erroneous belief that only accomplished mathematicians can develop useful games. In terms of 'response functions', these can be easily and adequately modelled by the mathematically naive by drawing a graph of the response function, and simply reading off the response to a given decision. These rough curves are not only less expensive to establish initially but are also more easily changed when any game modifications are required.
- A computer is not required. The purpose to which a game is to be put, the complexity of the model, or the speed required for computation may prescribe computer usage, but more often than not a computer is not necessary. The vast majority of business games in use are in fact not computerised.

2.7 Prospects for Business Gaming

The major references available were written in the early 1960's, when enthusiasm for business gaming was high. More recent literature gives no reason to believe that the course of development of business games has changed direction since that time. Kibbee [12] and Greenlaw [11] both emphasise that development in the field is of a problem oriented nature and that games are developing toward the needs of educators, rather than proceeding along the initial course which dominated until the 1960's - that of the highly quantitative theoretician. The development is away from total enterprise games and towards simpler functional games which better serve players who will not reach top management positions.

Games are also being used for research purposes in the areas of management behaviour patterns, 'value of information' studies, 'organisational efficiency' studies and 'marketing strategy' studies [7].

Games are being developed for more functional areas and more diverse industries and management areas, for example, Statesmanship.

Many new and strengthened features are being built into games. These include:

(a) Elements of a qualitative nature to test creativity and sensitivity.

(b) 'Modules' which can be added to a basic game structure to make it progressively more complex.

(c) Better integration of other training techniques with gaming.

(d) Inclusion of negotiating features between competing players and between players and administrator.

(e) Continuous rather than periodic decision making.

(f) More flexible use of the time dimension, for instance lags, and holidays for team members.

(g) Generalised models which can be used to represent different industries by modifying parameters, or adding specialised decision modules.

(h) Vastly greater flexibility in the two difficult functional areas of modelling, R and D and Accounting [12].

New ways to use management games are also being developed. As well as the traditional use as an 'ice-breaker' or as orientation to a firm, the game is being used in other roles, for instance, educating the Board of Directors about a particular problem. As well as the executive development role games are being used as actual decision making aids, where the decision rules which work in the model are externally valid (because the game is a very good and accurate simulation of the real world). These applications are often in terms of predicting competitive reaction to strategies.

In summary, the business game has become a permanent technique for business education in major private enterprise environments. It complements other procedures such as lectures, case studies and role playing as a highly effective tool of the teaching profession. "Business games provide most students with their first opportunity to solve the problems of a business in its totality, to develop the 'commercial courage' required in a risk-based private enterprise economy and to originate, place in effect, and experience the results of long range planning." [11]

CHAPTER 3. The Processes and Problems of Designing a Business Game

3.1 Introduction

One of the major problems involved in the gaming approach to management education is that of simulation design. The educational objectives of the game must be clearly defined, information must be gathered or manufactured to provide the basis for the game structure, the general features and characteristics of the game must be determined, specific elements, rules and relationships quantified and attention must be given to the mechanics of game play. In addition, considerable experimentation is invariably required before a game is ready for play. In this chapter attention is focused on the problems involved with game design. The material for the discussion is taken principally from Chapter 3 of Greenlaw, Herron and Rawndon [11], Chapter 7 of Kibbee, Kraft and Nanus [12] and Chapter 8 of Babb and Eisgruber [2].

3.2 Setting objectives

The first step in designing a simulation is that of determining its basic educational objectives. In setting objectives and relating the design of a simulation to these objectives it is important to realize that often several different games can be used to accomplish the same ends and that conversely, any one particular game can quite frequently be employed to serve more than one objective. Once the overall educational objectives have been established it will be necessary for the designer to determine (a) what specific types of learning situations he wishes to expose the participants to, and (b) which game characteristics and features will foster such learning. In relating the construction of the business game to its educational objectives the designer must also take into consideration a further very important factor - the available resources, both human and other, which he will have at his disposal for the simulation training exercise.

Games should not be geared to an abstract set of objectives but rather to the training needs of a specific group of individuals. The educational backgrounds and experience of participants will have an important bearing on these needs and should be a prime factor in determining the orientation of the game. The financial and physical resources available for the gaming exercise will also strongly influence the design of the game.

In deciding how complex the model should be the designer must carefully weigh the costs of its development against the anticipated return in terms of its training value.

3.3 Gathering information

Once the educational objectives have been established it is necessary for the game designer to obtain information on which to base the game structure. The approach employed varies considerably depending on the degree to which the real world business situation is to be replicated and the amount of complexity and detail incorporated into the model. Generalized business games which do not simulate a specific business situation will not require the gathering of information from any particular firm but will be structured around "manufactured" data and general business and economic principles. If the objective of the game is to replicate a specific business situation then real data must be gathered.

3.4 Building the basic game structure

The designer needs to decide on (a) the basic features and characteristics of the game, (b) the specific elements or variables to be included, (c) the rules of play, and (d) the relationships to be established between the various simulation variables chosen for inclusion.

Two difficult problem areas must be dealt with when developing the basic game structure. These are, the degree of realism to be built into the game, and the playability of the game and its acceptance by participants as valid educational experience.

3.4.1 Realism, complexity and participant acceptance.

In determining how much realism and complexity the designer wishes to incorporate in the game he should consider both the degree of each he desires and the degree of each he can attain with the resources at his disposal. More detailed and intricately structured games are not necessarily better than those of the simplified variety. As already mentioned the background and experience of the players should be the critical factor in determing the level of complexity. Those simulations which are too advanced for the participants will be of as little educational value as those which are too simple. Although it may be desirable to oversimplify or distort reality in business games for some educational reasons it is important that games are not grossly unrealistic in terms of usual business expectations. For player acceptance of the game it is especially important that the level of profits generated during play are not too unrealistic. This means that profits should be neither too easy nor too hard to obtain. It is also important that the difference in profit levels of competing teams of players is not too great as losing teams are likely to lose interest in the game and winning teams are likely to become complacent. Conversely, it is important that some differentiation in results among game players be possible. If all companies are equally profitable regardless of the decisions made there will be little or no inducement to undertake more thorough analysis, and decision making. The illusion of reality develops participant acceptance.

3.4.2 General features and characteristics.

Basic to the development of the game structure is the design of the specific elements, rules and relationships to be included in the model. Before their design can be undertaken however, it is necessary to determine the general features and characteristics of the simulation. Hence the following questions must be answered:

- What type of industry, if any, is to be simulated?
- Towards what functional area of management will the game be oriented?
- What level of organization will be established for the participant roles?
- Will single products or multiple products be manufactured and/or sold by the companies?
- What kinds of time lags, if any, will be included in the simulation?
- What other general characteristics will the game have?

The answers to these questions determine a general specification of the game.

3.4.3 Game elements.

The basic units of a management game are often referred to as its elements. Three basic types of elements exist in practically all simulations:

i) Input

ii) Output

iii) Informational.

3.4.3.1 Input and Output Elements.

Decisions made by players in a business game are inputs and the operating results obtained from play are outputs. Given a limited supply of resources it is the task of the players to determine what proportion of these resources should be expended or put into the operation

at any given time, and for what purposes. In return for such decision efforts something is then expected out of the operation, such as sales volume, sales income, profits, etc. Output is therefore a function of input. Developing an expression of this relationship in quantitative terms is one of the major problems in game design. It should be noted that frequently there are other inputs,besides players decisions, usually falling into two classes; those determined by the game administrator and those determined by the performance of the player in previous rounds of play.

(i) The Output Hierarchy

There exists in almost all management games a hierarchy of outputs or operating results. Many basic outputs are generated from the decisions made by the players and these are then combined to determine one or more overall measures of operating success. For instance, sales volume would be a basic output, sales income a higher level output as a function of sales volume and price per unit, and an overall measure of performance, dollars of profit, represents total operating expenses incurred subtracted from sales income. Often the most difficult task for the designer is to formulate the basic outputs. The overall outputs are often automatically defined by the inherent nature of the operation being simulated.

(ii) The Number of Simulation Inputs and Outputs

Most games involve a number of inputs and outputs. Some of the more complex games such as the Carnegie Institute of Technology game require hundreds of decisions per period. However most games require participants to make less than fifteen decisions at any given time. The MARKSIM game [10] requires players to make twelve decisions per period. The number of outputs generated in most games is similarly small - frequently less than ten information items. There is no optimum number of input or output elements for any particular kind of game but increasing the number of either generally increases the complexity of the model. It should be emphasized that a large number of input and output elements is not necessary to provide

a high degree of complexity from the player's point of view.

(iii) One-Shot Decisions

Some games have featured one-shot decisions which are made at relatively infrequent intervals rather than at each round of play. These are generally major business decisions such as plant location or new product launches. Two important considerations against the inclusion of one-shot decisions are (a) such decisions, if they markedly affect operating success, may have an unwarranted influence on the final results of game play, and (b) one of the major values of business games, the reinforcement of learning through repeated decision making, may be lacking when a particular type of decision is made only once or twice during twenty or thirty periods of play.

(iv) Plug in elements

In most games the number of input and output elements remains constant during play. It is possible however for the designer to provide for additional elements, such as new products or markets, to be incorporated or plugged into the model as game play progresses. This approach may be used either to increase the complexity of the game as players familiarize themselves with it, or to make the game more flexible so that it may be used in a number of educational situations.

3.4.3.2 Informational elements.

A major problem in game design is that of deciding what information will be provided to players both prior to and during game play. An informational element is any source of information made available to players in a game. There are five distinct types of informational elements which may be found in business games:

(1) Players' instructions

(2) Company operating statements

(3) Market Research information

(4) Annual or other periodic summary results

(5) Other kinds of reportive or predictive data which may be fed back to the players from time to time.

Of these five types only the first two are found in all games. The other three may or may not be included in any specific game.

While information of types (4) and (5) is often given either automatically or at the administrator's discretion, Market Research data is often purchased by the players. In this case the information supply decision is made by the participants rather than by the administrator.

(i) The functions of information in a business game

Information provided to the players may perform three distinct functions. Firstly, it may serve to help create the illusion of reality, secondly, it may enable the players to make more effective decisions and thirdly, it is necessary to provide the players with information concerning the rules and procedures to be followed during game play.

(ii) A basic problem in information supply

If too little information is available it may be difficult or impossible for players to do an adequate job of analysis and decision making. On the other hand, if too much information is provided the game model and the relationships incorporated within it may be so obvious that much of the challenge of the simulation experience is lost. It is important in most games to avoid revealing directly the relationships between decisions and results.

(iii) The players' instructions

The players' instructions for a business game frequently serve all three of the information functions indicated above. There are two special problems with regard to players' instructions. Firstly, it is important that game procedures and rules be described as clearly as possible so that

the players are not handicapped in any way as a result of misunderstanding the rules. Secondly, the designer must deal with the 'starting point' problem. This is: "What will the initial business conditions be for each of the companies in the game?". With few exceptions business games are designed so that all companies begin play in an identical position. However, it is more realistic for players to 'take over' firms as a going concern. A technique often employed is to provide players with an operating statement indicating the decisions and results of the previous hypothetical period. This approach also helps to minimize the possibility of one or more companies making very poor decisions during the first few periods of play. On the other hand, players may assume that the decisions in the initial period were optimum in some sense and that they should repeat these decisions throughout the game.

(iv) Company operating statements

Almost all games provide the companies with statements of their operating results after each period of play. The feedback of this data provides information to serve as a basis for making decisions for the following period. These operating reports can range from simple financial statements to detailed market analysis.

(v) Market Research reports

Some games provide participants with an option to purchase one or more pieces of Market Research information. These items commonly include share of market, competitors' or industry's expenditure on advertising, marketing, sales force, research and development and the like, and also the market potential for the following period. The designer's dilemma is again to provide sufficient information to make intelligent decision making possible, yet not so much as to give away the model structure. Prices for Market Research should be set at realistic levels in relation to the other expenditures and costs which will typically be called for in the game. It has often been found that players will purchase information as Market Research which they

could easily develop themselves from data to which they already have access.

(vi) Annual Reports

Some games provide for the distribution of annual reports in which certain overall measures of progress are given. These reports generally cover the position of the firm (balance sheet). They are invariably provided to all companies free of charge.

(vii) Other reportive and predictive data

Other kinds of data are sometimes fed back to players. In some games a general economic forecast for the following year is provided annually to the participants. Historical data may also be provided to give the players some idea of the hypothetical history of their firm and it is felt this often adds to the illusion of reality.

3.4.4 Rules of the game.

The next step in building the simulation structure is that of determining rules of the game. The basic function of the rules is to define the patterns of player behaviour which are permissible during play. Game rules may be classified as either substantive rules or procedural rules. Substantive rules are those which define the scope and nature of the decision making itself; which decisions must be made, which strategies are optimal, which decision alternatives are available to the players, what actions are prohibited, and so on. Procedural rules are those which deal with mechanical aspects of the decision making function - procedures to be followed to enter the decisions on the appropriate forms, submitting decisions to the game administrators each period, keeping charts or graphs to record progress, and other necessary tasks. It is essential that these rules are conveyed as clearly and unambiguously as possible to the players. Existing games differ markedly in their robustness towards illegal decisions. Some games such as MARKSIM [10] severely penalise players by producing no sales at all when out of range decisions are made.

Other games such as 'Marketing Decision Simulation' [12] change out of range decisions to the nearest allowable decision pole.

A number of games also include rules prohibiting the players from varying their prices, expenditures or levels of production by more than a specified amount or proportion from one period to the next. These rules serve to prevent the making of extreme decisions.

3.4.5 Relationships in the model.

An important part of game design is that of determining the relationships which are to exist among the various elements of the simulation. The game designer will often first define these relationships verbally and then proceed to the development of their mathematical expression. If the game replicates a particular industry these relationships will be based on extensive research. If on the other hand the game simulates a generalized hypothetical industry these relationships can be developed to suit the designer's purposes.

Three basic types of relationships may exist in a game model.

Firstly there are 'deterministic' relationships where the value of one element will determine the value of others. The relationship between input and output elements is invariably of this type since output is a function of input. These determining relationships may be single (between two variables) or multiple (among several variables).

The second type of relationship which exists can be called a 'limiting' relationship. In this case the value of one element, although not specifically determined by the values of certain others, will be limited by them. For example, cash available limits expenditure but does not determine it.

The third type of relationship is that where the value of one element neither determines nor limits the values of certain other elements but the values of each must be considered in relation to each other in designing the overall simulation structure. These can be termed 'indirect' relationships.

For example a given price for a product may neither determine nor limit directly a company's expenditure on advertising but the values of each must be related in designing the model. If a company is to operate profitably, sales income (a function of sales volume and price) must exceed total expenditures (a function of advertising and other expenditures).

It is suggested [12] that a flow chart be used initially to diagramatically represent relationships in the model.

3.5 Quantifying the simulation model

Quantifying the simulation model, that is, the assignment of numerical values to the various simulation elements, presents the designer with many problems. This discussion will restrict itself to generalized simulations of hypothetical industries.

There are two basic facets to the quantification of most game models. First is the design of the functional forms of the relationships between input and output elements. The second is the assignment of values to the parameters of these functions. The two processes are interrelated but will be treated separately in the following sections for clarity.

3.5.1 Selection of a starting point.

In some games only one numerical value will be required for each of a few of the elements. For most input and output elements, however, the assignment of a range of values is required. With many thousands of different combinations of input and output values possible in most games, the major problem in quantification may often be deciding just which values to determine first. It is frequently useful for the designer before he proceeds to consider the whole range of output values for each element, to select as a starting point, one value for each decision element, and establish tentative relationships between these values to produce a desired output level.

3.5.2 Quantification of the input/output relationships.

Outputs are a function of inputs. Developing a quantitative expression of this function is the task of the game designer. These functions may be linear or non-linear and may be continuous or discrete. They may be bivariate or multivariate relationships and may include competitive interaction (i.e. the actions of other firms may influence the output/input relationship of a specific firm).

3.5.2.1 Linearity and player knowledge of relationships.

Relationships between decisions and results are often non-linear. These relationships usually express the principle of diminishing returns and have imposed cut-off points. Non-linear relationships expressing diminishing returns are incorporated into simulations for one or more of the following reasons:

(i) because relationships of the kind being simulated are non-linear in the real world

(ii) to keep the relationships from becoming too obvious to the players

(iii) as a means of penalizing extreme strategies.

A convention has developed among business game designers dictating that some input/output relationships are linear. These include ordering cost (a constant value per order) and cost of holding inventory (directly proportional to inventory size).

3.5.2.2 Ranges of input and output values.

In most games limitations are placed, in one way or another, on the number of possible values which may exist for the input and output elements. In such cases one of two different types of condition may exist for the players: either the number of decision alternatives available to them may be severely limited, or they may be permitted to select any decision alternatives they wish, but those beyond the limits established (and often unknown to the players)

will have no greater or lesser effect on the outputs than those at the limits. An important consideration in the determination of the ranges of values for input and output elements is that they be neither too narrow nor too wide. A narrow range will result in static game play but a wide range may increase the possibility of extreme results and of one company either pulling far ahead or falling far behind the others. A useful approach for game designers is to graphically illustrate the value ranges for input and output elements before considering the relationships which he wishes to exist between them.

3.5.2.3 Design of the mathematical expressions.

Design of linear relationships is simplistic and will not be considered in this discussion.

Given a set of limits for input and output values any one of a large number of curves might be employed to express the relationship between the variables. If the game is to be manually scored it is easy to describe a 2-variable relationship in simple graphical form and to read off the output for a given input directly from the graph. When a computer is employed, however, each of the values established by means of this approach will require a different computer memory location and this is extremely wasteful. The solution is to use continuous equations,which include parameters as well as the decision variable itself,and produce an output variable. Functional forms which produce the desired diminishing returns type response include the power function, the log function and the modified exponential function, and the commonly desirable S shaped curve can be produced by gompertz or logistic functions.

3.5.2.4 Expressions of multiple input/output relationships.

Game construction becomes more complex when multiple input/output relationships are incorporated into the model. Expressions for these

relationships may, however, often be devised by employing the same basic techniques as for simple two variable relationships. For non-computerized games and computerized games with parametric equations, the relationship among variables can be broken down into a series of relationships between pairs of variables. This approach is only useful when the input variables are independent. If several inputs interact to determine a particular output variable the problem is more difficult, especially for manually scored games. In this case the designer will be able to provide for the multiple relationship by firstly determining the values generated by the input and then relating these values to each other to obtain a single overall value expressing the relationship between all inputs and that output. When parametric equations are employed, on the other hand, the output value may be simply obtained by including all of the input variables in a single equation.

3.5.2.5 Probabilistic input/output relationships.

So far we have limited our discussion to the design of deterministic relationships (that is those where chance plays no role in influencing the outputs generated by inputs). The design of probabilistic relationships is basically quite similar to that of the deterministic relationships. Instead of assigning an output value to each decision alternative the designer will assign a value expressing the probability of occurrence of a certain output for a given input. In other words a probability distribution of outputs will be assigned for any given set of inputs. These probabilistic relationships can be easily modelled, either in graphical form for manually scored games, or in parametric form for computerized games. Both techniques require the generation of random numbers at some stage. The effect of chance in any probabilistic model is a function of both the probability distributions used and the importance of the outputs which are to be influenced by chance. It is useful to consider the effect of extreme cases, as follows:

i) High probability/high importance - will result in the relationship being largely one of chance and may weaken the game as it degenerates into a guessing game.

ii) High probability/low importance - will mean that a relatively unimportant output will occur quite frequently. The inclusion of such a relationship will have little effect on the game and serves little purpose.

iii) Low probability/low importance - similarly to (ii) above the infrequent occurrence of an insignificant event will have little effect on the game.

iv) Low probability/high importance - should generally be avoided. If a relatively important event is generated only two or three times during a course of gaming the final position of the competing firms is likely to be highly dependent on chance rather than the efforts and ability of the teams.

3.5.2.6 Other forms of probability.

There are two other ways in which chance may be included in business games.

Firstly, probability levels for the occurrence of certain outputs may be established completely independently of any input decision, although the occurrence itself is in part a function of the company inputs and/or outputs. For instance, if the proportion of production rejects varies completely randomly between periods the probability of a particular proportion of rejects will not be influenced by any company decisions. However, the actual number of rejects will depend on the level of production - usually an input decision.

Secondly, events may be designed to occur on a chance basis completely independently of all company inputs and outputs, e.g. if production rejects varied randomly between 5 and 10 units per period

rather than 5 to 10 percent in the above example.

Either of these forms of probabilistic influence may serve to add uncertainty or complexity to a game but their excessive use should be avoided.

3.5.2.7 Time lags and time cumulation.

Many games are structured so that decisions either do not take effect until one or more periods after they are made, or continue to have effect for a number of periods. If a time lag of one period is desired, for example, the value assigned to the decision alternative chosen in any given period may simply be employed in the next period. Time accumulation may be introduced by considering together a firm's decisions for a particular element for two or more periods to determine a value for current effectiveness. The principal use of this functional form is to determine advertising effectiveness.

3.5.2.8 Optimum decisions.

For most competitively interactive games it is not possible for the designer to determine in advance any optimum total set of decisions for a particular company. This is because many of the outputs of a particular firm are determined not only by its own decisions but also by those of its competitors. On the other hand, for non-interactive games an optimum total set of decisions may be easy to establish. If this is the case it will usually be important for the designer to consider carefully exactly what he wants the optimum to be. Again this should be determined principally by the educational objectives of the game.

3.5.2.9 Competitive interaction.

In competitively interactive games output values obtained for each company must be related to those of all other firms. Interaction is

usually provided as follows:

(i) A market potential is established, by the administrator, for each period of play.

(ii) One or more output values is determined to represent each company's effectiveness in the marketplace for this period.

(iii) Actual total sales available in the period is a function of both the market potential and the sum of the effectiveness of all competing companies.

(iv) Total sales available are distributed among the companies in proportion to their effectiveness in the marketplace.

This mechanism is used in many competitively interactive games, including the MARKSIM simulation.

3.5.2.10 Input/Output relationships - some problems.

In any period the performance of a company (i.e. the output elements) influences not only the decisions made by players in subsequent periods but also the players' attitudes towards the game. Relationships between input and output elements should therefore be constructed with both player acceptance and game playability in mind. The following types of input-output relationships should generally be avoided:

(i) Generally and consistently negative results which lead to player dissillusionment.

(ii) Players should not be able to obtain a performance benefit or potential performance benefit without having to pay for it (e.g. free market research options).

It should be possible, however, to obtain or at least have a chance to obtain a performance benefit from every decision which creates a cost. For instance, if dividends are declared they should produce some positive effect on the company's position.

(iii) The marginal return per dollar of expenditure should not differ too greatly between decision factors, since if they do the players will concentrate on high marginal return decision areas. This does not imply that the marginal return should not vary greatly over the range of specific decision factors, but that no decision factor should have a consistently higher marginal return over its entire range than other decision factors.

(iv) Conversely, it is not desirable for several input factors to have similar response functions as this limits the influence of effective resource allocation on operating performance. In short each input factor should serve a different function but no one of them should be dominant at all expenditure levels.

3.5.2.11 Qualitative factors.

Qualitative factors are occasionally built into games where input elements are not readily quantifiable. In these cases the input element is usually a qualitative assessment of some aspect of game play. The game administrator usually assigns a score which is then entered into the game. The M.I.T. Marketing Game [12] uses this technique to assess the content of the marketing program put forward - thus the expenditure on marketing (a quantitative decision) is modified by the score given by the administrator which assesses the efficiency of the expenditure.

3.5.3 Assigning numerical values.

As well as quantifying the input/output relationships the designer must also assign numerical values to the company's starting position, the market potentials for each period of play, fixed costs incurred by the firms and any other variables or parameters incorporated in the model.

The values must appear to represent a consistent state of the firm and be sufficient to operate without handicap from the first period of play.

Those variables which change value between periods, such as the

market potential, must vary enough to fulfill their function (usually to create an illusion of reality by introducing uncertainty) but not vary so wildly that the educational benefits of 'gaming are lost.

3.6 Design of the simulation mechanics

It is on this part of the design exercise that smooth function of the game is reliant. This includes the forms to be used and procedures to be followed in both decision making and calculating and feeding back results.

The following suggestions for game designers are provided by Greenlaw, et al [11].

3.6.1 Game procedures.

(i) Step by step procedures should be written out in detail. For computerized games these should cover the operations of checking decisions, card punching, computer operation and output printing, checking and disseminating. Similarly, detailed instructions for decision making procedures should be included in the players' instructions.

(ii) If computation time is a bottle-neck in the operation, the leap frogging technique can be used to advantage. In this system there is a one period delay between decision making and receiving the results of these decisions.

(iii) Checking of decision making, card punching, computation and report printing cannot be overemphasized. Players' results should never need to be recalled for correction.

3.6.2 Stationery.

(i) If several different decision or calculations forms are to be used it is useful to print these on different size and colour paper to facilitate identification and avoid errors.

(ii) The forms should be designed so that logical thought processes match the flow of the form.

(iii) The decision forms should be designed to facilitate transfer onto worksheets or card punches.

3.7 Testing the game

It is invariably necessary to test and 'debug' business games before they are ready for use. Attention should be focused on both the model structure and the mechanics of play. It is usually desirable to arrange teams of colleagues to play the game during testing as they are likely to approach the game from a broader point of view than the designer. This group approach is especially advisable when the game is designed to be played by groups rather than individuals.

All aspects of computation, checking, presentation of results, orientation to the game, dissemination of game rules and use of game forms should be tested before the game is used in a training role.

CHAPTER 4. A Description of the Business Game MARKSIM as played at Massey University

4.1 Introduction

MARKSIM is a business game that was developed in 1963 by Greenlaw and Kniffen at Pennsylvania State University. The game was designed as a teaching aid to complement the lectures, problems, reading,assignments and case studies normally used in Marketing Management courses, and consequently emphasises decision making in the marketing functional area.

The game is available as a computer card deck free of charge from the International Textbooks Company, Scranton, Pennsylvania. Documentation for the game consists of an Administrators Manual [10] and a Players Manual [9]. These Manuals are extensive and include all details necessary to conduct game play together with details of possible analysis and planning techniques which the players may use to advantage during game play.

The game is organised so that any number of Industries can participate. Each Industry consists of exactly three Firms. Each Firm may be managed by either an individual or a team. Teams are recommended for the following reasons: (a) the players are required to wrestle with problems of organising and working as a team, (b) each player can specialise in a part of the total MARKSIM problem, so that less time per student is required, and (c) fewer Industries are necessary for any given number of players, thus reducing the computer time required.

The authors recommend that groups, when used, consist of 3 to 5 players, but also emphasise that single player teams have two advantages: (a) each player has full responsibility for success or failure of the Firm, and (b) as a consequence, evaluation and grading of student performance is simplified.

4.2 Competitive structure

The game is interactive within each Industry but not between Industries. For example, a given set of decisions for Firm 1 produces different results for Firm 1 depending on the decisions of Firms 2 and 3, when these Firms are in the same Industry. Decisions of a Firm in one Industry however have no influence on the performance of Firms in any other Industry.

4.3 Feedback and measures of performance

The game is computerized and therefore allows for comprehensive and well set-out reports to be produced. Three types of report are produced for each Firm:

(i) The basic report given at the end of each round of play.

(ii) Five optional Market Research reports, available on specific request each period at a cost to the Firm.

(iii) An 'annual' summary at the end of every fourth period of play. This is supplied to each Firm at no cost.

Contents of the reports are as follows:

(i) The basic report.

This report is given to each Firm at the end of each period. The information given concerns only that particular Firm. The example given in Table 4.1 is from an actual run of play and illustrates both the information given and the presentation layout.

(ii) Market Research report.

Five optional market research items can be purchased on an individual basis by Firms. These are -

(a) Total Industry expenditure on National Advertising for this period.

(b) Total Industry expenditure on Advertising Allowances to Retailers for this period.

(c) The 'potential sales' of the requesting Firm in each market segment for this period.

(d) The total Industry 'market potential' in each market segment for the period after next.

(e) The requesting Firm's share of the market in each segment for this period.

The current retail prices of all Firms in the Industry are provided free of charge.

TABLE 4.1 Basic Period Report

MARKSIM

FIRM 1 PERIOD 1 INDUSTRY 1

I N C O M E S T A T E M E N T

SALES REVENUE		7021232.
COST OF PRODUCTION	2750000.	
PLUS, DECREASE IN INV. VALUE	1079475.	
COST OF GOODS SOLD		3829475.
GROSS PROFIT		3191757.
LESS, SELLING, ADM. AND GENERAL EXP.		
TRANS. TO RETAILERS	158243.	
TRANS. TO DISTRIBUTION CENTERS	150000.	
TRANS TO WHOLESALERS,	189891.	
INV. COSTS, FACTORY WAREHOUSE	11120.	
INV. COSTS, DISTRIBUTION CENTERS	183433.	
ADV. ALLOWANCES TO RETAILERS	300000.	
NATIONAL ADVERTISING	500000.	
MARKETING RESEARCH	50000.	
INTEREST CHARGES	0.	
FIXED EXPENSE	500000.	
		2042687.
NET PROFIT		1149070.

F I N A N C I A L S T A T E M E N T

ENDING CASH BALANCE	7228545.
ENDING INVENTORY VALUE	1945525.
TOTAL ASSETS	9174070.
LESS, DEBT	0.
OWNERS INVESTMENT	9174070.

continued

TABLE 4.1 continued

S A L E S I N F O R M A T I O N

RETAILERS

SALES (IN UNITS)	33217.	7361.	4423.
TOTAL RETAIL SALES (UNITS)			45000.
	UNIT VALUE		UNITS
BEGINNING INVENTORY	55.		45000.
ENDING INVENTORY	55.		58649.

WHOLESALERS

ORDERS FROM RETAILERS (UNITS)			31649.
DELIVERIES TO RETAILERS (UNITS)			27000.
SELLING PRICE TO RETAILERS ($)			109.
RECEIPTS FROM RETAILERS ($)			2936250.
	UNIT VALUE		UNITS
BEGINNING INVENTORY	55.		27000.
ENDING INVENTORY	55.		37978.

DISTRIBUTION CENTRES

ORDERS FROM RETAILERS (UNITS)			31649.
DELIVERIES TO RETAILERS (UNITS)			31649.
SELLING PRICE TO RETAILERS ($)			109.
COMPANY SALES TO RETAILERS ($)			3441780.
	UNIT VALUE		UNITS
BEGINNING INVENTORY	55.		35000.
ENDING INVENTORY	55.		33351.

FACTORY WAREHOUSE

ORDERS FROM WHOLESALERS (UNITS)			37978.
DELIVERIES TO WHOLESALERS (UNITS)			37978.
SELLING PRICE TO WHOLESALERS ($)			94.
COMPANY SALES TO WHOLESALERS ($)			3579451.
SHIPMENTS TO DIST. CENTERS (UNITS)			30000.
PRODUCTION THIS PERIOD (UNITS)			50000.
	UNIT VALUE		UNIT
BEGINNING INVENTORY	55.		20000.
ENDING INVENTORY	55.		2022.

TABLE 4.2 Optional Market Research Reports

MARKETING RESEARCH

INDUSTRY NATIONAL ADVERTISING	1500000.
INDUSTRY ALLOWANCES TO RETAILERS	900000.

	MARKET 1	MARKET 2	MARKET 3
COMPANY POTENTIAL SALES FOR THIS PERIOD (IN UNITS)	38936.	8628.	5184.
INDUSTRY MARKET POTENTIAL FOR PERIOD 3 (IN UNITS)	145000.	41000.	34000.
SHARE OF MARKET (IN PERCENT)	33.	33.	33.
	FIRM 1	FIRM 2	FIRM 3
PRICES OF COMPETITORS ($)	145.	145.	145.

TABLE 4.3 Four Period Summary Report

FIRM 1 PERIOD 4 INDUSTRY 1

ANNUAL REPORT (PERIODS 1 - 4)

FIRM 1

SALES TO CONSUMER (UNITS)	19792.
COMPANY NET PROFIT ($)	272232.
ENDING CASH BALANCE	696460.
ENDING INVENTORY VALUE	433271.
TOTAL ASSETS	1129732.
LESS, DEBT	0.
OWNERS INVESTMENT	1129732.

FIRM 2

SALES TO CONSUMER (UNITS)	21380.
COMPANY NET PROFIT ($)	138708.
ENDING CASH BALANCE	747818.
ENDING INVENTORY VALUE	110889.
TOTAL ASSETS	858708.
LESS, DEBT	0.
OWNERS INVESTMENT	858708.

FIRM 3

SALES TO CONSUMER (UNITS)	13709.
COMPANY NET PROFIT ($)	125878.
ENDING CASH BALANCE	826860.
ENDING INVENTORY VALUE	211517.
TOTAL ASSETS	1038378.
LESS, DEBT	0.
OWNERS INVESTMENT	1038378.

The charge for each item of information can be set by the game administrator. In the example given in Table 4.2 the charge is $1000 per item of information. This can be seen in Table 4.1 as an expense.
(iii) The Annual Report of each Firm in the Industry is supplied to competitors as well as to the specific Firm. An example is given in Table 4.3. An idential report is supplied to each Firm in the Industry.

As can be seen in Table 4.3 the report is restricted to
(a) two summary measures of performance; unit sales and profit, and
(b) a simple statement of assets and liabilities.

4.4 Relationship between decision and effect

This relationship is determined by the model on which the game is based. For convenience this section will be subdivided into discussions of (a) the model structure and (b) the specific form of relationships between the variables involved.

4.4.1 Model Structure.

For each period of play each Firm makes decisions about product retail price, production volume, product quality, national advertising expenditure, expenditures for advertising allowances to retailers and the number of units of product to be shipped to the Firm's distribution centres. The Firm may also purchase market research and/or repay any debt which may be outstanding.

The demand for a Firm's product in each period is created by the interaction of the price, quality and promotion of that Firm with the price, quality and promotion of other Firms and with the consumption environment created by the administrator.

This demand produces actual retail sales for the period which, in turn, create wholesale demand. Retailers can purchase product through two channels; either through independently owned wholesalers, or from the manufacturing firm's own distribution centres. Both of these wholesale channels receive product direct from the Firm's factory warehouse. The game players have responsibility for the number of units of product

shipped to the distribution centres, but have no control over the number of units ordered by wholesalers; these are based on an ordering rule, set at 1.2 times the number of orders received by wholesalers from retailers in the current period.

A MARKSIM Firm's sales revenue is realised at two sources: (a) sales by distribution centres to the retailers, and (b) sales to the independent wholesalers from the company factory warehouse. No transshipments are made from distribution centres to wholesalers or vice versa, and product may only travel down the channels.

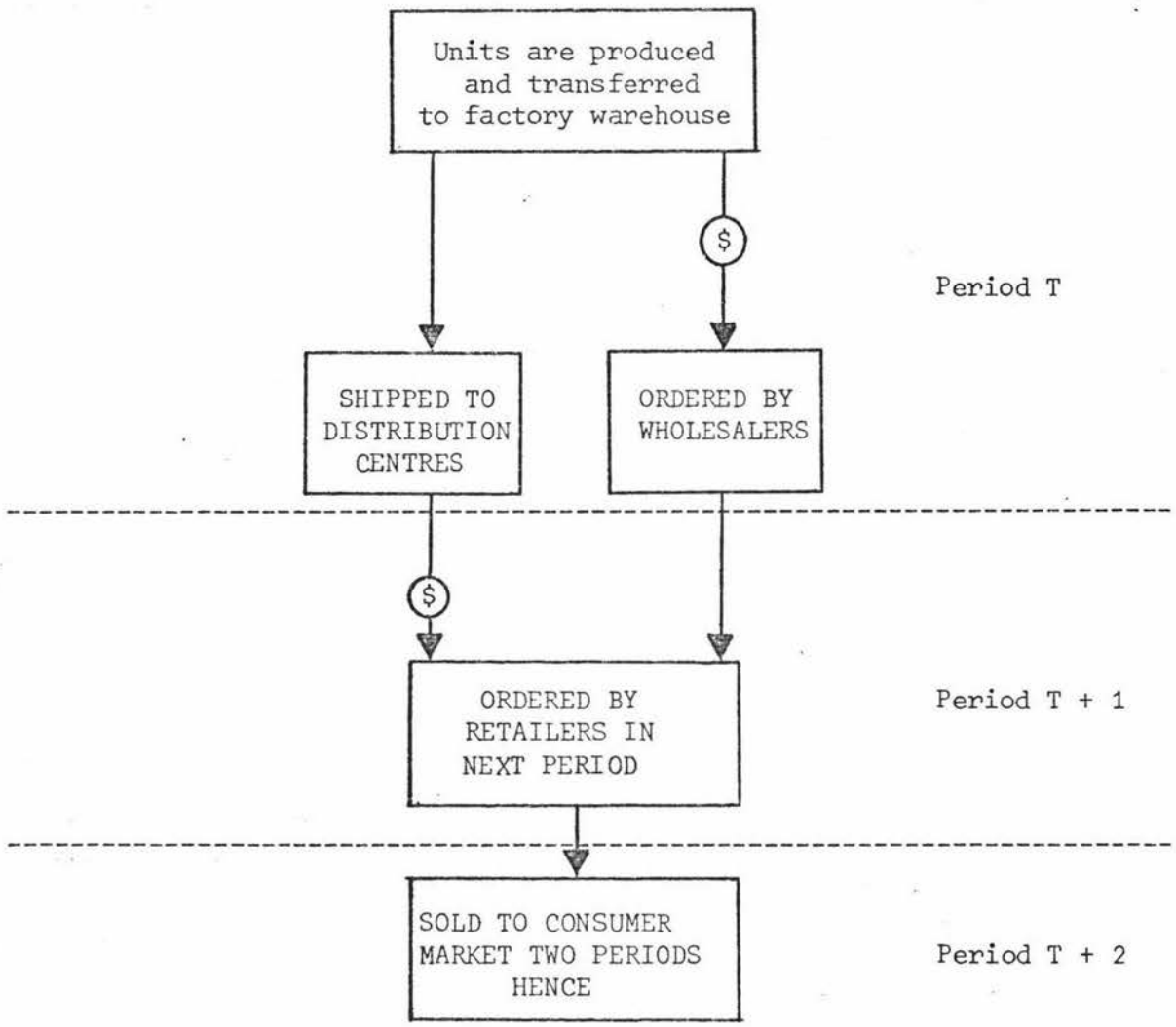
Time lags are built into the channels of distribution. In effect any physical transfer of product takes one simulated time period, so that products are available for retail sale two periods after they are manufactured. The retail price decision applies during the period it is made. Product quality decision applies to the product being manufactured during that period. As the product travels down the channel it is mixed with beginning inventory at each new location. The quality of this mix is deemed to be a simple weighted average of the qualities of new and existing inventory at that location.

The channels are illustrated in Figure 4.1 taken from the MARKSIM player's manual [9].

The operating characteristics of the various sites in the channels are as follows:

(i) Retailers

- All sales to consumers are made by retailers.
- In each period, retailers satisfy demand from their Beginning Inventories.
- After all sales for the period are transacted the retailers order so that their beginning inventory next period is enough to meet 1.2 times consumer demand during the current period.
- The proportions of these orders going to wholesalers/distribution centres is variable, unknown to the players (between limits) and is determined by the game administrator.
- The retailers markup is 25% of the consumer list price.



$ indicates where company sales are made, and hence, where revenue is generated for the MARKSIM firm

Figure 4.1 MARKSIM distribution channels

(ii) Wholesalers

- Wholesalers sell only to retailers and are independently owned.
- In each period, wholesalers sell to retailers only from their beginning inventory.
- Wholesalers order enough from the factory warehouse to meet 1.2 times current retailer demand from next period's beginning inventory.
- The wholesaler's markup is $13\frac{1}{3}\%$ of the wholesale price. This means that wholesalers pay the manufacturer 65% of the current retail list price.

(iii) Distribution Centres

- Sell only to retailers.
- In each period, sell only from their beginning inventories.
- Obtain product from the factory warehouse according to the MARKSIM manager's decision each period.
- Sell to the retailer at 75% of the current retail list price.

(iv) The Factory

Factories manufacture according to the dictates of the MARKSIM managers in terms of

(a) the number of units in that period, and

(b) the dollars of quality built into each unit.

However there is a constraint on this production in terms of the increase in quantity of production between two periods. Production may not be greater than 1.5 times the previous period's production unless the production in the previous period was less than 20,000 units. In this case production can be raised to 30,000 units.

Shipments to distribution centres and sales to independent wholesalers can be made from both beginning inventory and current production. Shipments to distribution centres take priority over sales to wholesalers.

(v) Costs

Costs are incurred when goods are transported and when goods are stored. Transportation costs are at a fixed rate per item and storage costs are a fixed percentage of inventory value.

Costs are also incurred by promotion, market research, and interest on borrowed capital.

A fixed expense is applied to all firms each period.

(vi) Consumer Market

Each MARKSIM firm competes with two other firms for sales to the ultimate consumer. Total consumer demand can fluctuate between periods at the discretion of the game administrator and as a result of the marketing efforts of the three MARKSIM competing companies.

The market is divided into three segments. These segments respond differently to the 'quality' of the products being sold.

4.4.2 The specific forms of relationships between decision variables and performance.

The decision variables which the players manipulate can be logically grouped into three classes; information decision variables, general operational decision variables and demand generating decision variables.

(i) Information decision variables are those involved in the market research decisions. Any or all of the five information options may be chosen. (See Table 4.2). The results of choosing an information option are the inclusion of the required information in the period report, and the appropriate charge against operating profits for the period.

(ii) General operational decision variables include the production level, shipments to distribution centres and debt repayment.

As explained in the previous section (see figure 4.1) production in period T is available for retail sale in period T + 2. However, the cost of production in period T is charged to the manufacturer in period T, and produces revenue for the manufacturer in period T (wholesalers) and period T + 1 (distribution centres). The total amount of product sold to the wholesalers in period T and to the retailers from distribution centres in period T + 1 is determined by the consumer demand generated in period T - 1.

Shipments to distribution centres are under direct control of the players. Goods sold through this channel return higher profits than those sold to wholesalers but ending inventory at the distribution centre incurs a storage expense as does ending inventory at the factory. The proportion of retailers' orders which go to the distribution centres is a variable controlled by the game administrator and unknown to the players.

Repayment of debt can be carried out any time the company has a positive cash balance. Debt incurs an interest expense while not repayed.

(iii) Demand generating decision variables. The demand generating decision variables are product quality, product price, national advertising and advertising allowance to retailers. The demand stimulated by these variables and by the administrator-controlled business environment is then transformed into actual sales subject to sufficient retail stock being available. This demand is conveyed up the channels in subsequent periods and, subject to the same inventory constraint at the wholesale level, creates actual sales for the MARKSIM company. Demand is generated for each 3-firm MARKSIM industry in the following manner:

1. Attractiveness of the current national advertising decision is computed. This index of attractiveness ATR in period t is derived from the following parametric equation

$$ATR_t = \frac{a\, A_t^{\,b}}{c + A_t^{\,b}}$$

where A_t is the National Advertising Decision in period t.

The actual function used in the original MARKSIM version is:

$$ATR_t = \frac{1.2\, A_t^{\,3.5076}}{4.8813 \times 10^{19} + A_t^{\,3.5076}} .$$

(See Figure 4.2.)

2. Attractiveness of the present National Advertising Decision is aggregated with the attractiveness of past decisions to give a lagged effect to the advertising decision variable.

The attractiveness of past and present advertising, ADVAT, in period t is calculated as:

$$ADVAT_t = a\, ATR_T + (1-a)\, ADVAT_{t-1}$$

where ATR_T is as above.

The default parameter used by MARKSIM is a = .3. This means the current advertising influences attractiveness by considerably less than past advertising and to build up a strong advertising attractiveness the MARKSIM firm must have a strong and consistent advertising expenditure.

3. Attractiveness of the retail advertising allowance decision is calculated.

This attractiveness index is calculated by the same functional form as national advertising attractiveness

$$\text{i.e.} \qquad ALLAT_t = \frac{a\, L_t^b}{c + L^b}$$

where $ALLAT_t$ is attractiveness of advertising allowance to retailers in period t, and L_t is the firm's advertising allowance to retailers decision in period t.

The actual function used by MARKSIM is:

$$ALLAT_t = \frac{1.2\, L^{4.419}}{7.989 \times 10^{23} + L^{4.419}}$$

(See Figure 4.3.)

4. Attractiveness of the price/quality ratio of the current period retail inventory is calculated.

Note that the price is a current decision variable, but that the quantity is determined by the quality of production in periods up to t-2 where the current period is t.

Attractiveness of the price/quality ratio is calculated by the following functional form:

$$P/QAT_t = \frac{ab}{b + \left[P/Q_t - 1\right]^c}$$

where P/QAT_t is attractiveness of current retail price/quality ratio, and P/Q_t is current retail price/quality ratio.

The actual function used in MARKSIM is:

$$P/QAT_t = \frac{1.5 \times 21.887}{21.887 + \left[P/Q_t - 1\right]^{4.0707}} \quad , 1 \leq P/Q_t \leq 4$$

$$= 0 \qquad \text{otherwise.}$$

(See Figure 4.4.)

5. Attractiveness of inventory quality in market segment M is calculated, and then total attractiveness of Firm K in market M is calculated as the product of past and present advertising attractiveness, advertising allowance to retailers attractiveness, price/quality ratio attractiveness, and the market segment quality attractiveness. The above are then calculated for the other two market segments in turn.

Until this point no market segmentation has occurred. Market segmentation operates only on the basis of retail inventory quality.

The general functional form used is:

$$Q(M)AT_t = a(Q_t - b)^c - d(Q_t - b)^e$$

where $Q(M)AT_t$ is attractiveness of retail inventory quality in market segment M for period t, and Q_t is retail inventory quality for period t.

The specific forms used in MARKSIM are as follows:

Market Segment 1 (High volume, lower quality)

$$Q(1)AT = 1.0190(Q-30)^{.11} - .02038(Q-30)^{.011} \quad , 30 \leq Q \leq 78$$

$$= 0 \quad , \quad Q < 30$$

If $Q > 78$ then $Q = 78$

Market Segment 2 (Middle quality)

$$Q(2)AT = .053333(Q-25)^{1.0} - .00088889(Q-25)^{2.0} \quad , 30 \leq Q \leq 82$$

$$= 0 \quad , \quad Q < 30$$

If $Q > 82$ then $Q = 82$

Market Segment 3 (High quality)

$$Q(3)AT = 1.445\times10 \quad (Q-27)^{9.0} - 2.89\times10^{-16}(Q-27)^{10}, \quad 30 \leq Q \leq 75$$

$$= 0 \quad , \quad Q < 30$$

IF $Q > 75$ then $Q = 75$

These functions are illustrated in Figure 4.5.

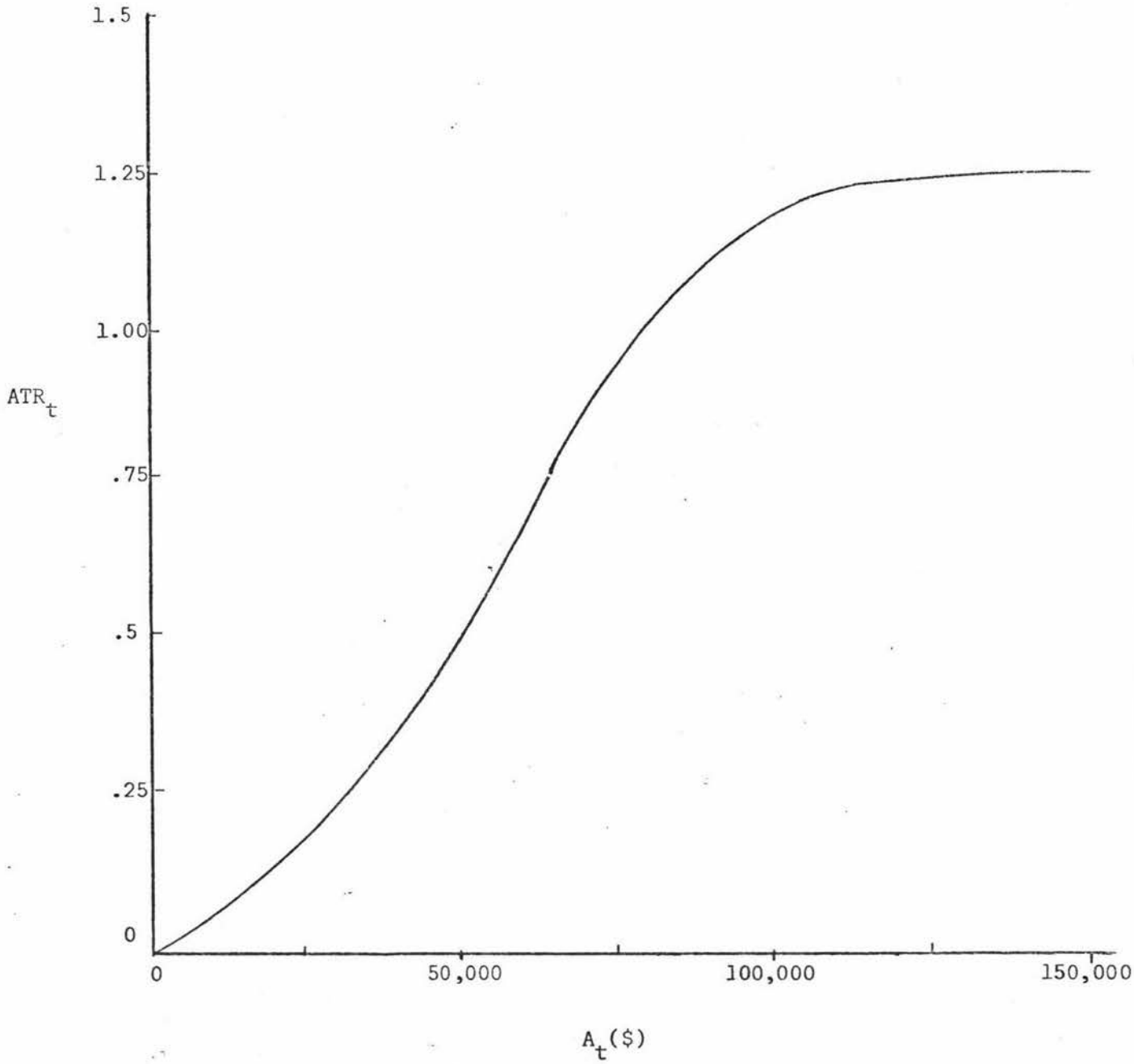


Figure 4.2 Response to National Advertising Expenditure

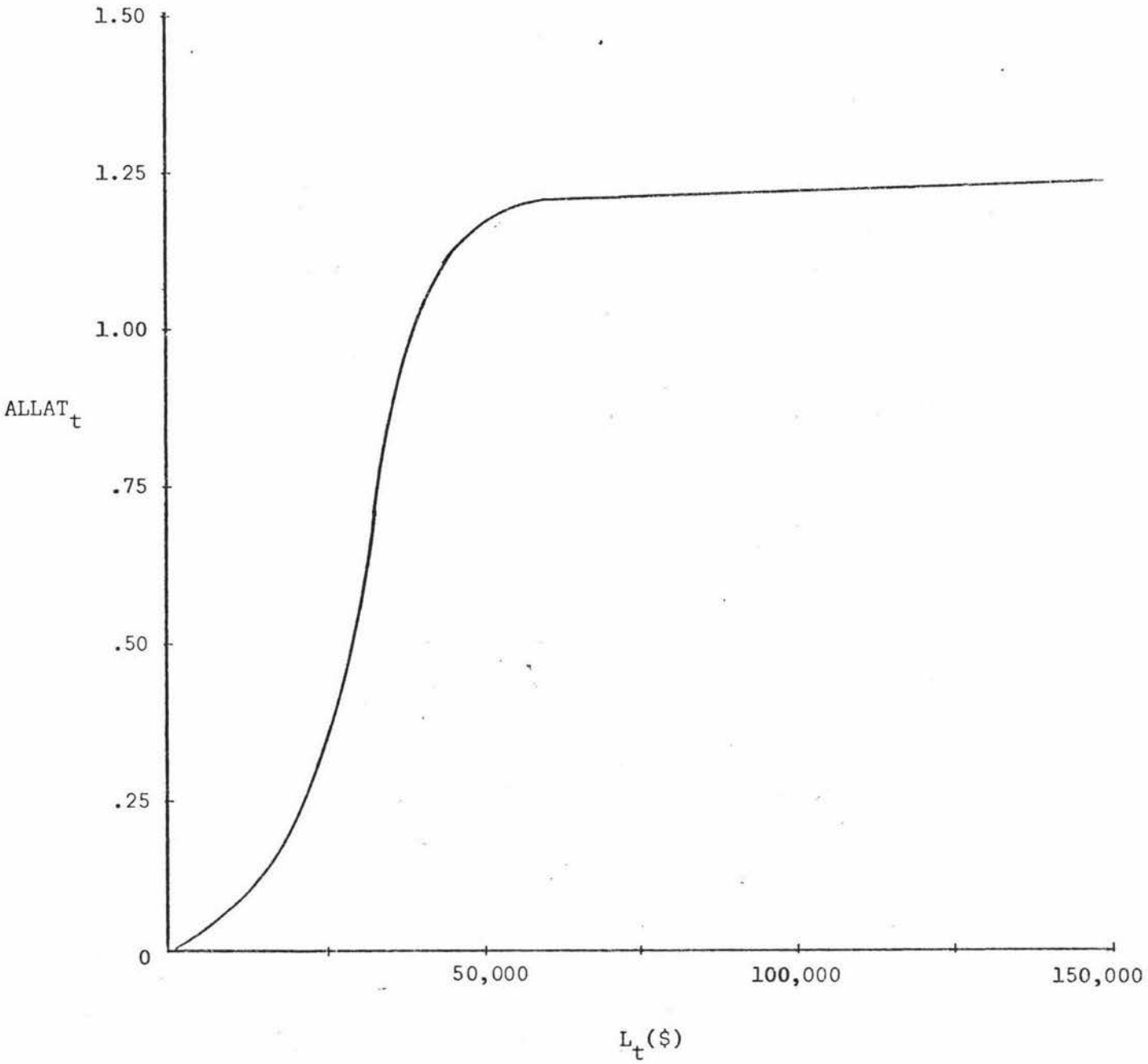


Figure 4.3 Response to Advertising Allowance to Retailers Expenditure

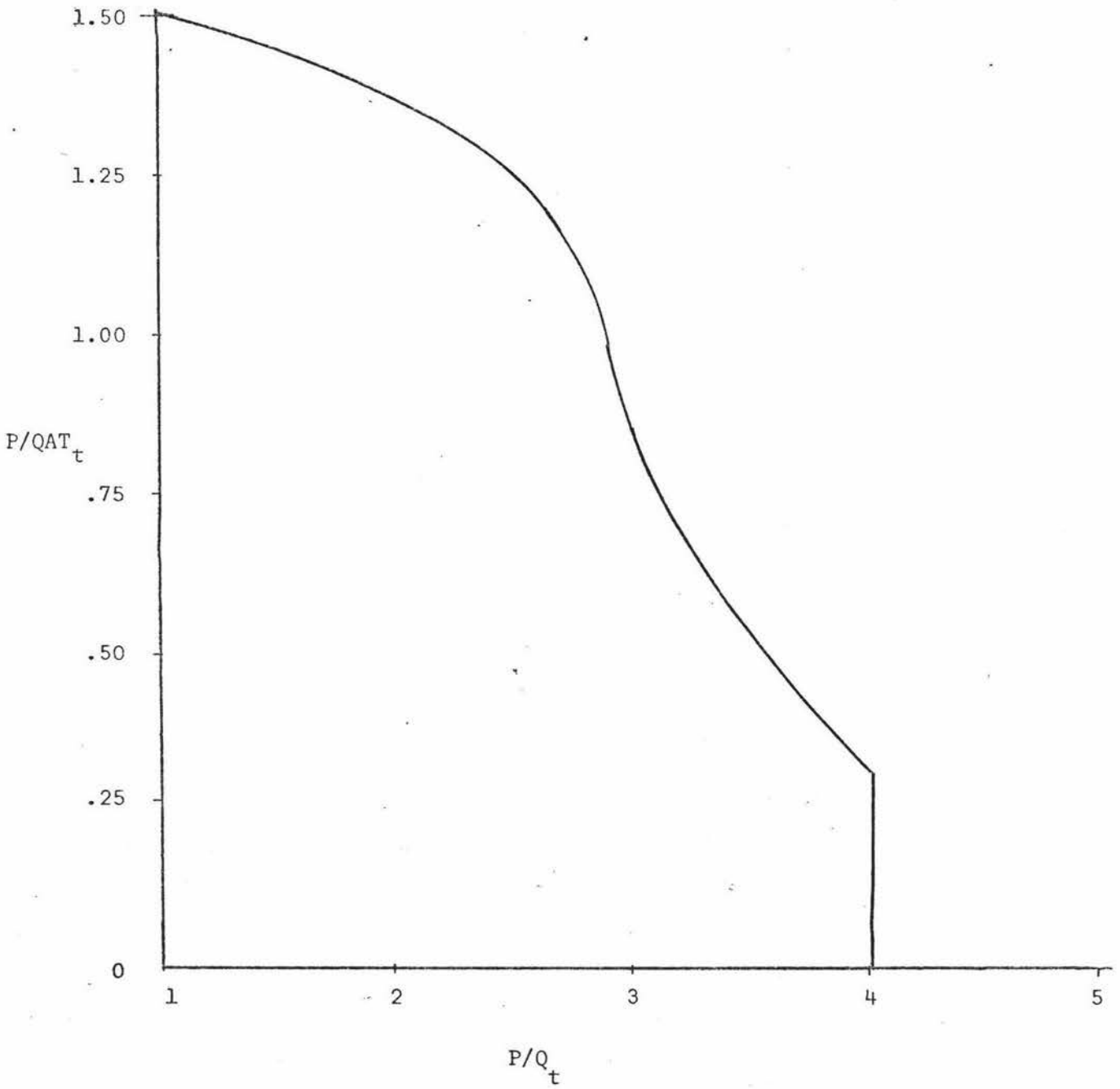


Figure 4.4 Response to Price/Quality Ratio

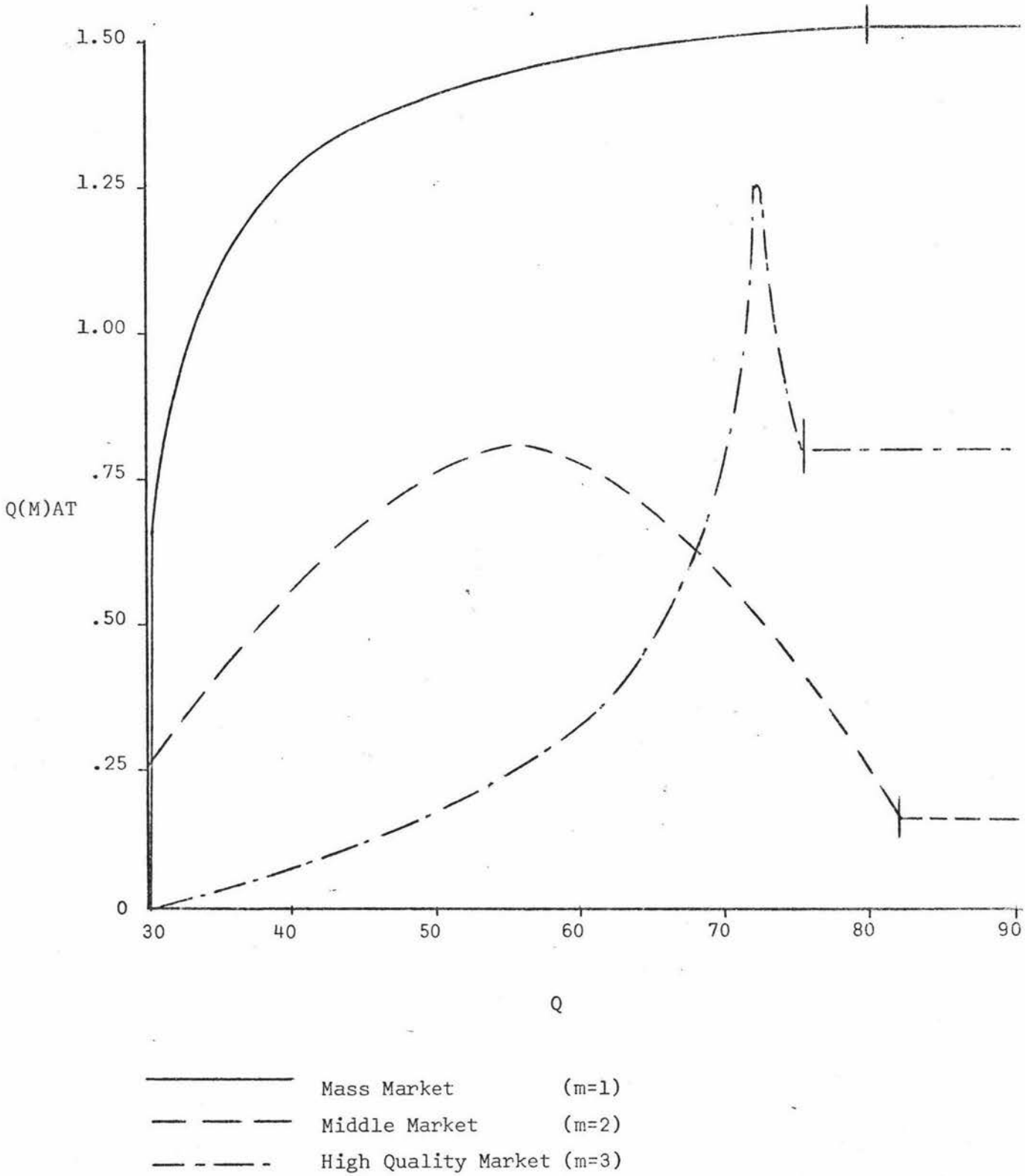


Figure 4.5 Response to Quality in the Three Market Segments

Computation of total attractiveness of Firm K in Market Segment M

This computation is a simple product of the individual attractiveness, i.e.

$$TA(K,M) = ADVAT(K) \times ALLAT(K) \times PQAT(K) \times Q(M)AT(K)$$

where TA(K,M) is total attractiveness of Firm K in Market Segment M. A discussion of the response function forms appears in Appendix 2.

6. The total attractiveness is transformed into actual consumer demand.

A two stage process is used to accomplish this. Firstly, the total potential demand in each market segment for this period (a game administration input) is modified by the sum of the attractiveness of all firms in this market segment. That is;

$$D(M) = POTL(M) \times \left(\frac{3 + STA(M)}{6}\right)$$

where D(M) is total demand in market segment M

POLT(M) is potential demand in market segment M (administration input)

STA(M) is the sum of attractiveness, TA(K,M), for all Firms, K, in market segment M.

Therefore if no attractiveness is present demand will be $\frac{3+0}{6} = 0.5$ times potential. It is possible for actual demand to exceed 'potential demand' if attractiveness of the three firms sums to greater than 3.

Secondly, Firm K's share of this actual demand is calculated in direct proportion to K's share of the total attractiveness in this market segment,

i.e. $$PSLS(K,M) = \frac{D(M) \cdot TA(K,M)}{STA(M)}$$

where PSLS(K,M) is potential sales for Firm K in market segment M. (That is, Firm K's share of the demand).

7. Transformation of demand into actual sales.

Actual sales equal potential sales [PSLS(K,M)] if sufficient retail inventory is held. If there is insufficient retail inventory to supply K's demand in all three market segments, then K's total sales are equal to retail inventory, and these sales are apportioned between the three market segments on the basis of the potential sales in each segment.

After sales for each firm are calculated, any unsatisfied demand for that firm's product vanishes. It is not transferred to the competing firms.

4.5 Method of Computation

The MARKSIM game is computerized and as published includes programmes compatible with either the IBM1620 or the B700/7000 series computers. The latter are compatible with the Massey University's Burroughs 6700 computer.

Any particular computer run (i.e. time period simulation) requires six distinct files to be entered to the computer, and results in two distinct types of output.

Inputs

(1) MARKSIM program deck
(2) State of the firm ("HISTORY") for each participating firm
(3) Players' decisions for the period
(4) Functional form and limit parameters (constant)
(5) Market potential and channel proportion parameters (period specific)
(6) Control parameters (number of industries participating, number of output reports printed per firm)

Outputs

(1) Reports to players
(2) State of the firm ("HISTORY" for the next round of play)

Between period changes need to be made only to the player decision cards and the HISTORY cards.

The game was originally designed to punch out the HISTORY cards so that they can easily be inserted into the deck for the next run. Unfortunately the Massey University computer installation does not have a machine-coupled card punch and so each HISTORY deck (6 cards per playing firm) had to be punched by hand between periods. The author has modified this system so that the object deck for the MARKSIM program, the constant and period specific parameters and the HISTORY cards are stored on tape files between runs. This is convenient but makes the system vulnerable

to any incidents which mean a repeat run must be made for a given period. This can be caused by a mispunched decision card or work flow control card, or a 'down' during processing of the MARKSIM job. To counteract these problems, two backup systems have been implemented.

Firstly, a lagged HISTORY tape file is kept, so that any run may be repeated immediately. Secondly, a record of the HISTORY file is printed out at each period, and HISTORY cards may be punched manually from this if required.

Other difficulties in processing have been encountered and these have mainly been caused by a lack of robustness of the MARKSIM program. No inbuilt checks are used and although both HISTORY cards and Decision cards carry information on Firm, Industry and period identity the Firm and Industry are not used in the program and the period number is read only from the HISTORY cards. The program assumes Firm and Industry identity from the order of the Decision and HISTORY cards, and most processing errors have been due to misordered cards. Simple programmed check procedures could avoid these errors.

4.6 Periodicity

Each round of MARKSIM play is a simulated three month period, and players receive annual reports every fourth period.

During the time MARKSIM has been used in Massey University marketing programmes, it has become evident that a trial period is required before real evaluated play commences. This is due, to a large extent, to the lack of robustness of the game programme which unduly penalizes players for any clerical rules broken on the Decision forms. It has been found that a trial lasting between four and six periods is a good introduction. The Firms are then started from a new position and the game is run for ten to twenty periods of play, usually with two Decision periods per week. Students take results away with them and are then required to turn in their next Decision by a certain time, usually about two days hence.

4.7 Evaluation of player performance

After completing five practice periods of play and prior to the commencement of real game play, the members of each Firm are required to prepare a statement of their objectives and strategies for achieving these. These statements were presented to the game administrator. Players were free to choose any objectives and any strategies but are asked to reconsider if either is inappropriate, inconsistent or inadequately detailed.

At the conclusion of every fourth round of play, that is at the end of each simulated year, the members of each team are required to prepare a detailed evaluation of the year's performance on a period by period basis. This report covers analysis of their own performance, the business environment and their competitors' activities, analysis of their inventory control and marketing expenditure, and details of the decisions made each period, together with the rationale for these. A summary of each report is presented verbally to the game administrator and the detailed written report is considered by the administrator at length. At the time of presentation of the report the teams could advance arguments to change either the objectives or strategies of their firm in the light of this analysis.

Whenever possible different administrators are used for each competing team in an industry so that the administrator evaluating the team's effort has no more knowledge of competitive action than the team itself.

A final grade for the whole exercise of game play is given to each group. The weights applied to the various sections of player activity are as follows:

	% of grade
1. Statement of objectives and strategies	
(a) Realism of initial statement	
(b) Achievement and/or modification during play	20%
2. Analysis carried out	
(a) Firm's own performance	
(b) The business environment	
(c) Competitive activity	20%

3. Control of
   (a) Inventory
   (b) Expenditure
   20%

4. Enthusiasm of group and participation of individuals 10%

5. Clarity and presentation of statement of objectives and annual reports
   10%

6. Decisions made
   (a) Well considered
   (b) Logical
   (c) Effective
   20%

   100%

A recognised shortcoming of the method used is the inability to effectively evaluate an individual's performance within a group and unless an obvious difference exists between individuals in a group, all members must be graded equally. Individuals suspected of putting less effort into the game are thoroughly questioned during the presentation session but the administrator can still only place a very qualitative evaluation on the individual's performance.

In total, game play accounts for between 30% and 40% of the final course grade. The reasons given by the course administrator for this level of credit are:

(i) it reflects the expected effort input
(ii) lesser credit reduces the student motivation
(iii) greater credit generates some resentment on behalf of harder working students who feel they are carrying their less diligent group members to a good final course grade.

CHAPTER 5. Evaluation of the MARKSIM Experience at Massey University

5.1 Methods of Evaluation

MARKSIM has been used at Massey University for three years as a part of the course content in a 200 level paper entitled Marketing Strategy.

In evaluating the performance of the game, problems arise concerning the different points of view of those concerned with the game, principally differences between administrators' and players' points of view, and problems also arise concerning measurement of these points of view.

In order to recognise each of these points of view, evaluation was divided into three sections, these being firstly the course administrator's point of view (recognised as being the most important as that person carries the responsibility for the efficiency of the course as a whole), secondly the players' or students' point of view, and thirdly the point of view of staff controlling computational and technical aspects of the gaming sessions.

The methods used to obtain the evaluation data were as follows:

(i) Administrator's evaluation. The course and game administrator has been Mr D. Bridgeman-Sutton for each of the three years the game has been used at Massey University and he also had experience of the game at the University of Otago prior to this. This evaluation of the game has been passed to the author in verbal and written form over this entire period, and some of this information was used by the author to change the parametric structure of the response functions, and to reduce the scale of the business activity by a factor of 10 prior to the 1976 gaming session. A formalised summary of Mr Bridgeman-Sutton's evaluation of the gaming session appears in Section 5.2.

(ii) Players' or students' point of view. Measurement of the players' point of view took place at the end of the 1976 academic year and because of time constraints during this period individual interviews with the students were not possible. Two self completion questionnaires were designed for these students.

One of these was designed for 200 level students who had recently finished playing the game and asked 32 structured and unstructured questions about the value of the game, possible improvements to the game and the place of the game in the course. The other questionnaire was designed for 300 level students who were just completing their marketing degrees and who had played the game during their 200 level courses the year before. The students were asked 14 general questions about MARKSIM and the place of business gaming in a marketing course. These students had played the original version of MARKSIM whereas the 200 level group of respondents had played the modified reduced scale version prepared by the author for the 1976 class. These questionnaires are reproduced in Appendix 4.

The major limitations of these surveys were the small number of respondents who completed questionnaires, 15 200 level students and 26 300 level students, representing 82% of all the students who had been enrolled in the Marketing Strategy course over the two years 1975 and 1976. As a consequence of these small numbers there was little possibility of analysis by student characteristics or ability, and only straightforward analysis of each sample was carried out. The tabulated results of these surveys are presented in Appendix 3. A summary of these is presented in Section 5.3.

(iii) Computational and technical aspects of the gaming sessions. Evaluation of this section is principally that of the author, having overseen all programming and computational aspects of the gaming sessions for the 3 year period of MARKSIM experience at Massey. Comments of the game administrator concerning aspects of the clerical portion of gaming sessions are also included.

This evaluation forms section 5.4.

Section 5.5 contains a summary of suggested improvements to MARKSIM.

5.2 The Game Administrator's Point of View

5.2.1 MARKSIM as an aid in achieving the course objectives.

The course in which MARKSIM has been used is called 'Marketing Strategy'. It is currently organiséd as a second half of year paper following either of two other papers called 'Principles of Marketing' and 'Marketing Appreciation'. The objective of the Marketing Strategy course, as described in the course outline, is to "consider the implications for the firm, and the managerial decisions required to implement, the principles outlined..." in the Principles of Marketing and Marketing Appreciation courses. It also aims to give students experience in "decision making, analysis and control in marketing through the use of a computer-based simulation".

A further piece of course documentation entitled "A Manual for Boards of Directors" (groups of students controlling each MARKSIM firm) outlines the specific areas of experience which should be gained from playing MARKSIM.

These are:

1. Dealing with a number of related decision variables
2. Planning ahead and reconciling short term marketing decisions with long term objectives
3. Making decisions as a management group under competitive conditions
4. Analysing situations and making decisions under uncertainty
5. Applying basic analytical skills to historical sales, cost, and other data
6. Presenting information to your Holding Board (Game Administrator), both verbally and in writing, in a clear, logical and concise fashion.

Mr Bridgeman-Sutton believes that MARKSIM performs very well in aiding acheivement of both course and gaming session objectives but that it could be more effective if refined and expanded in some ways. He has

previously taught courses at the same level with the same general objectives but without the use of a business simulation and found that students who had completed the course still did not appreciate the related nature of decisions concerning Price, Product, Promotion and Place. Students who have played MARKSIM as a part of the course seem to have a far better appreciation of the interrelation of parts of the marketing mix.

While no objective measurements of MARKSIM's effect on teaching efficiency have been possible, Mr Bridgeman-Sutton believes there are several areas of obvious and noticeable benefit including:

- Students gaining experience in group decision making and group dynamics in general, especially when problems of individual laziness or incompetence occur.
- Analysis of data. Students are far more highly motivated to analyse data resulting from their own decisions then they are with more impersonal case studies. The ongoing nature of the database also helps tremendously in giving experience in forecasting and budgeting.
- Using MARKSIM for a course of 30 students playing 2 rounds per week increases student contact hours by about 2 hours per week and this contact time, mostly listening to annual reports of the Boards of Directors (students) to their holding company (game administrator), is judged by Mr Bridgeman-Sutton to greatly complement the effectiveness of case studies and other alternative forms of contact in terms of both lecturer assessment of student ability and effort and stimulation of student discussion.

5.2.2 Observed deficiencies of, and suggested improvements to MARKSIM.

Observed deficiencies of the MARKSIM experience can be divided into administrative deficiencies and educational deficiencies.

i) Administrative deficiencies.

a) During the three years MARKSIM has been used at Massey University, computational problems affecting turnaround time have been the principal administration problem. Turnaround time is the time period between students handing in a decision and students receiving their computer printout of the period's operating results. The delays that have occurred usually upset the schedule of decision making and reporting times assigned

to the students. As these times are arranged around normal course meeting times any delays have serious affects both on the efficient use of course time and on the student's confidence in the course and in contact with computers in general. Although the reasons for delayed turnaround are hidden from the students, and to some extent from the administrator, they are of the following four distinct types:

1. Clerical errors in completion of the decision form not picked up by the technician punching the data.
2. Errors in transferring decisions into machine readable form (card punching or direct remote terminal input).
3. Errors in the control programme which converts history of past runs into inputs for the current run.
4. Slow computer operation due to heavy workload or maintenance problems.

b) The MARKSIM system, including computational, clerical and administrative aspects is highly dependent on the staff involved. As the game is used for one period of about three months each year there is a problem of continuity of staff. To date this problem has occurred mainly with administrative staff involved in student contact. Reasons for this are mainly staff resignations and the sabbatical system.

c) It is considered essential that students in MARKSIM company groups can meet and discuss their decisions and performance. As classes get larger it becomes an increasingly difficult exercise to assign individuals to groups which can meet regularly. The game has been observed to be best tackled by groups of students flatting together.

d) An associated point to c), also dependent on the size of the class, is the input of the course administrator to the course. For 20-30 students this amounts to

approximately 2 contact hours and 2 preparation hours per week over and above the normal course input. This input is proportional to the number of students involved in the gaming session and so either places a limit on the size of the class or requires that more administrators be available.

e) The use of groups of students to manage each MARKSIM firm is essential to realise some of the objectives of the gaming session but it does create problems for the administrator assessing student performance. Efforts are made during contact hours to invite alternate members of each team to make presentations and to encourage quiet students to display their ability and effort by asking questions of them. The inability to objectively assess performance of individuals within a group is the main reason that MARKSIM play performance is limited to 40% of the student's course grade.

ii) Educational Deficiencies.

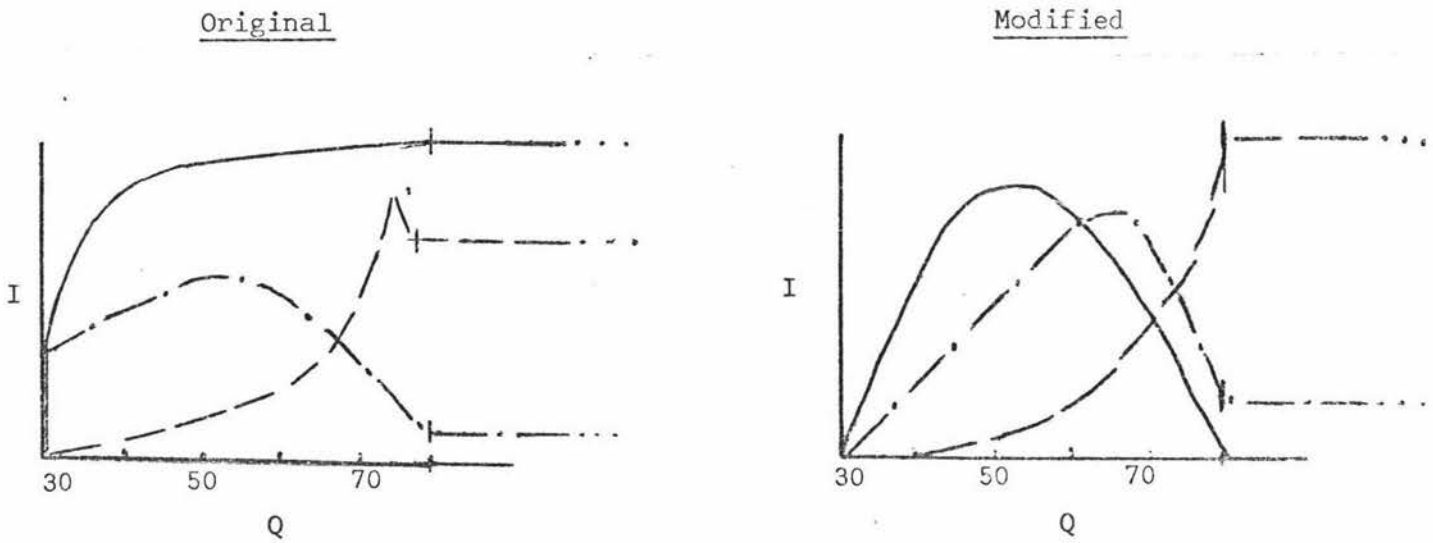
Mr Bridgeman-Sutton stresses that the naming of the specific industry being simulated, e.g. "motor mowers", is essential to student motivation. This has been done in each year of MARKSIM play although it is not specified in the original MARKSIM manuals.

Other educational deficiencies have been divided into three sections, the decision variables, the lack of between industry comparison and the presence or absence of factors listed in Chapter 2 as general deficiencies of simulation games.

a) Decision Variables.

Since the revision by the author prior to using MARKSIM with the 1976 class the administrator's criticisms of the relationships between decision variables and results and of the large scale of the business environment have been satisfied. This revision was restricted to:

1. Reducing the scale of operation by a factor of 10.
2. Decreasing the differentiation between the 'National Advertising' and 'Advertising Analysis to Retailers' response functions.
3. Changing the market segmentation structure as illustrated in Figure 5.1.



I = Index of attractiveness (Partial determinant of current sales)

Q = Quality of current retail inventory

——— Mass Market

——·—— Industrial Market

—— —— High Quality Market

Figure 5.1 Original and modified MARKSIM market segmentation

Mr Bridgeman-Sutton believes, however, that the usefulness of MARKSIM in achieving the objectives of the course could be greatly increased if a greater depth of decision making were required for both product and promotion decisions. He considers that the students should make decisions or prepare detailed strategies in these areas as follows:

Promotion Decisions 1 Budget (current decision)
2 Media choice
3 Timing
4 Specific appeals used
5 General style of execution of the appeals

(It is envisaged that points 2 - 5 would be subjectively assessed by the administrator and an index of effectiveness applied to the advertising budget).

Product Decisions - Meaningful segmentation or quality decisions, e.g. if the industry were motor mowers the following options might exist

- Petrol/Electric < 4 cycle/2 cycle / mains lead/battery
- Size
- Rotary/Reel

Mr Bridgeman-Sutton feels this sort of decision structure would greatly increase the reality of the game and consequently the motivation of students, and also allow students to derive simulated practical experience in a far greater portion of the theory to which they have been exposed.

b) Between-Industry Comparison. Mr Bridgeman-Sutton feels that between-industry comparison of firms is greatly needed in order to (i) increase the competitive spirit between teams, and (ii) increase the amount of self assessment by firms who are performing well in comparison with the other two firms in their industry but whose performance is indifferent in terms of other industries.

Currently a yearly (4 period) financial summary of each firm in an industry is given to all firms in that industry. The administrator's preference for between-industry comparisons would be the existence of a stock exchange type index, given to all firms each period and covering all firms playing the game. He suggests this index should be influenced by past and present profitability, degree of fluctuation in profitability and also by an index, assessed by the game administrator, of the quality of the annual report presented to him, as Holding Company Board, by the students as Board of Directors of their company.

Mr Bridgeman-Sutton also suggests that further items of market research, such as inventory level statistics and marketing expenditure statistics, might be purchased. In the past he has circulated to players maxima and minima statistics on these items and they have been well received by the students who found them a helpful reference to their own levels.

c) General deficiencies of simulation games.

Mr Bridgeman-Sutton was asked about the observed presence or absence of selected general problems of simulation exercises. His comments are recorded below:

i) The 'end-effect'. (This describes the act of making a 'do or die' attempt to achieve short term objectives in the last few periods of play.) There exists a real temptation for students to do this because the competitive situation makes them very profit oriented, regardless of their stated objectives. They are advised against doing this but still tend not to worry about the condition they leave the company in. Mr Bridgeman-Sutton believes that this effect is not too unrealistic as many group companies suffer from repeated 'end effect' policies as various managers finish with them before passing on to a higher position in the group. So called 'Company Doctors' are also known to turn assets into profits in a bid to make ailing companies attractive to potential purchasers. It is considered that the standard technique recommended in gaming literature

to overcome this problem would be a satisfactory solution in the case of MARKSIM. This technique is simply to pretend the game is to continue for some considerable time and make a shock announcement to the players that the previous decision was the final one. It is suggested that there could be some negative feeling generated by this approach as students thoroughly enjoy gaming and usually wish it to be extended to further periods.

ii) 'Fighting' the model. A few students 'fight' the model and refuse to alter unsuccessful strategies which they consider should work. However these students tend to be a small minority and tend to be caught up in the enthusiasm of their other team members after a few periods. A few students also become openly annoyed at the limitations of the model concerning the detail of decision making and wish they could make decisions about their product and promotion in more depth.

iii) 'The game is not realistic so we won't bother'. This attitude is held by a few students at the beginning of each term of play but gradually diminishes. Mr Bridgeman-Sutton emphasises to them that some aspects which apparently 'lack realism' are actually quite real. For instance, the averaging of inventory quality is quite real as consumer perception of a change in image or quality of a product is a continuous rather than discrete process because there is some inertia to overcome in changing their attitudes.

iv) Using unconventional strategies to make quick profits (the 'whiz kid' approach). Several students always start off in this manner but after a few periods settle down to conventional planning and strategies. The existence of this problem is one of the two main reasons for having an introductory run of 5 quarters before starting the game proper. (The other reason is to obtain familiarization with the clerical rules of decision making).

v) Erroneous Carryover. This phrase describes the phenomenon of applying successful strategies in one environment to another environment. The danger is that a student may assume that his exact strategies used in MARKSIM may give a similar result in the real world. This is to some extent an unmeasurable effect and Mr Bridgeman-Sutton contends that it is not a special problem of gaming but a general facet of human nature seen in business and in life in general. He sees no special remedy required other than assuring students that it is a simplified version of a specific commercial environment.

vi) Overconfidence arising from chance good results. Again this is seen as a facet of human nature and not a special problem of gaming. If long enough runs of gaming are held this chance element tends to even out over the various competitors and the problem ceases to exist. The chance element being discussed is not a stochastic element built into the game but one of guessing optimum levels of inputs in initial periods or of ones competitors making serious mistakes.

5.3 The Game Players' Point of View

To record the game players' point of view, surveys of 300-level and 200-level students were carried out. The survey details, questions and tabulated responses are recorded in Appendix 3. The following is a summary of the results of these two surveys.

The survey respondents were:

(i) Fifteen 200 level students who had just completed their last rounds of MARKSIM play. These students had played the modified version of MARKSIM (N.Z. scale).

(ii) Twenty six 300 level students who had played MARKSIM during the 200 level course earlier in their degree studies. These students had played the unmodified version of MARKSIM (U.S.A. scale).

Both groups were surveyed in October 1976 as they prepared for their final examinations.

This summary is organized into the following sections:

5.3.1 Evaluation of the usefulness of business gaming, and MARKSIM in particular, in a marketing course.

5.3.2 Recommended allocation of course time and grade to business gaming.

5.3.3 Specific aspects of the Marksim Operation

(i) Administration

(ii) Timing

(iii) Group Dynamics

(iv) The Model

(v) Reports and Output

5.3.1 Evaluation of the usefulness of business gaming, and MARKSIM in particular, in a marketing course.

* When asked their most prominent memory of business gaming, the 300 level respondents replied as follows:

positive memories	13
negative memories	2
no response	11
	26

Positive comments included 'interesting', 'challenging','realistic' and the high effort put into the games.

* Both groups were asked what they considered the most useful thing that can be learnt from playing business games.

Of the 41 respondents in total the answers given can be grouped as follows:

no response	14
general business experience	13
interaction of marketing variables	10
aspects of group dynamics	4
	41

* Slightly over half of the 300 level students and all of the 200 level students thought business games of the MARKSIM type were a good use of some marketing course time.

By far the most common reason given was the chance for "practical" experience in the application of marketing theory. It should be noted that the 300 level students had played the unmodified U.S.A.-scale game and that this may have had some bearing on their more negative attitudes.

* The 300 level students were asked if they thought it would be useful to play a marketing business game at 300 level. Slightly over half thought it would.

Reasons for the idea were principally an extension of those given for 200 level use of the course, i.e. practical application of theories and further general business experience. Reasons given for not using a game at 300 level were the time involved, better alternate uses of the time, and the adequacy of the 200 level gaming session by itself.

Of those who wanted a game at 300 level (14) only two thought MARKSIM would be adequate. Others thought a 300 level game should be more complex, more realistic and have more time pressure.

* 200 level students were asked how many years they thought would pass before they made real decisions of the type made in MARKSIM.

Replies ranged from two to eight years, with a mean of 4.4 years. Four students did not know.

This result implies that students regard the experience as relevant to their immediate career.

* 200 level students were also asked if they thought they could, as Marketing Managers, fit a model such as MARKSIM to their own industry and use it for strategy development. Over half of the students thought this possible.

Conclusion

All the 200 level students and over half the 300 level students had positive attitudes to the usefulness of business gaming in marketing courses. The same proportion of 300 level students thought gaming would be useful at 300 level but most of these thought MARKSIM was not adequate in terms of realism and complexity.

The short time in the future at which 200 level students considered they would be making real decisions of the MARKSIM type plus their willingness to consider the use of MARKSIM type models as a management tool suggest that the MARKSIM experience is relevant to the students' perception of their own careers.

5.3.2 Recommended allocation of course time and grade to business gaming.

Students were asked what proportions of 300 level courses should be allocated to each of a series of activities on the basis of both course time and final course grade.

The following summary of ranks was prepared by counting the number of students allocating greater than 20% to each activity. The columns headed "Wt.Av." contain the weighted average percentage assigned to that activity.

	200 level students			300 level students		
Course Time	Rank	Activity	Wt.Av.*	Rank	Activity	Wt.Av.*
	1	Lectures	34%	1	Lectures	54%
	2=	Business Games	20%	2	Case Studies	24%
	2=	Individual Projects	21%	3	Seminars	23%
	4=	Case Studies	14%	4	Business Games	21%
	4=	Seminars	13%	5	Projects	17%
	6	Other	7%	6	Other	
Final Grade	Rank	Activity	Wt.Av.*	Rank	Activity	Wt.Av.*
	1	Final Examination	30%	1	Final Exam	38%
	2	Business Games	24%	2	Seminars	20%
	3=	Case Studies	16%	3	Case Studies	22%
	3=	Terms Examinations	16%	4	Business Games	16%
	5	Projects	13%	5	Terms Exams	14%
	6	Seminars	12%	6	Indiv. Projects	10%

* Weighted Averages do not sum to 100% because no constraint was placed on students to this effect. The Weighted Averages are best considered as supportive ranking data and as relative percentage allocations.

Conclusions

For both samples of students, lectures were allocated most course time and final examinations were allocated most influence on final grade. Allocation of the other activities was, however, different for each of the student samples. 300 level students allocated higher weights to case studies and seminars than to business games for both course time and final grade. 200 level students allocated weights in the reverse manner, giving business games second rank overall for both course time and final grade.

Interpretation of this result is difficult because of the presence of two uncontrolled variables:

(i) the 300 level students have more experience of marketing courses than 200 level students;

(iii) the two groups of students played different versions of the games, as discussed in Appendix 5.

The author's preferred interpretation is that the improvements in the realism of the game resulting from the review carried out prior to the 1976 gaming session are responsible for the increased allocations of course time and final grade influence (as measured by ranking activities), the proposed influences being;

(i) increased realism leading to a perception of more relevance to the students' future work enviornment, and

(ii) increased reflection of marketing theory leading to more confidence in the ability of the game to reflect student effort in the results.

The small sizes of the classes and the lack of control in this experiment mean that the above interpretation is purely subjective.

Actual percentage assignments of the activities by these students give business gaming less weight than those used by the course administrator (business games are actually 40% compared with a high of 24% recommended by the 200 level students).

It is notable that only 6 of the respondents opted for no allocation to grade from final examination at a time when there is some general pressure to eliminate final examinations.

5.3.3 Specific aspects of the MARKSIM operation.

The following areas were covered only by the 200 level questionnaire.

(i) Administration

* No students had problems of access to the game administrators.
* A few respondents had problems in understanding the clerical aspects of game play but this was due mostly to lack of diligence in reading the course handouts.
* At least half the students had problems in assembling their management group (time and place). This appears to be a serious problem and is recognised by the game administrator as such.

(ii) Timing

* 8 of the 15 respondents thought the length of time between rounds was about right (2 decisions per week). A further 2 thought this initially acceptable but that the period between decisions should decrease once they were familiar with the game.
  4 thought the current time allowed to be too long.
* When asked the ideal period between decisions, answers ranged from 1 day to 1 week, with a modal value of 2 days (5 cases) and a mean period of 3.2 days. This mean is misleading because results were in two clusters, 1 - 3 days (10 respondents) and 1 week (3 respondents). Motivation for the 1 week period was ease of planning management group meetings.

* Slightly over half of the respondents thought 'leapfrogging' was a good idea at least for some of the main run of play. Some comments were received to the effect that this would be more realistic than the normal reporting and decision sequence.
* These students had received 5 periods of introductory play before commencing the main run. When asked the ideal number of introductory periods, students suggestions ranged between 1 and 8 rounds with a mean of 4.8 rounds and a modal group of 3-4 rounds. As it takes at least two periods before any market segmentation takes place we can conclude that the 5 periods currently allowed is fairly satisfactory.
* The students played 16 periods (4 years) of real play after the 5 introductory rounds. 12 of the 15 students would prefer more than 16 periods in the main run, 2 about 16 and only 1 less than 16. As student input is almost directly proportional to the number of periods played this response is a good indication of the level of enthusiasm generated by the game.

(iii) Aspects of group dynamics

* Two thirds of the respondents would prefer to play the game in management groups rather than on a one individual per firm basis.
* 11 of the 15 respondents would prefer functional positions within the group to be rotated during the game; 2 would prefer these to be assigned by the administrator and 2 would prefer permanent positions decided within the group.
* Only 2 respondents remarked about problems within the group. One of these referred to a member not pulling his weight, the other to difficulty in defining areas of responsibility of each member.
* As stated in section (i), 11 comments were received regarding difficulties in arranging meetings of the management groups.

(iv) The Model

* The relationship between decision and effect was described as reasonably clear by 8 respondents, obvious by 3 respondents and obscure by 4 respondents. As a class such as this would be expected to contain a range of abilities this symmetrical pattern of response is highly satisfactory.
* Respondents were asked questions about the complexity of the game. 12 of 15 respondents considered the game should involve more decisions, and these 12 were evenly divided in their preference for more general decisions and for more detailed decisions. Of the 300 level students

surveyed 14 thought a business game would be useful at 300 level. 5 of these thought a greater number of decisions should be required.

* Two thirds of the 200 level students thought the game was realistic but four fifths of them would prefer it to be more realistic. Suggestions for making it more realistic included more decisions in both the general and detailed areas, and also more firms per industry, more market research options, the possibility of buying out competitors and a call for more inter-firm performance comparison.
* Only 7 of the 15 respondents achieved their firms objectives during Marksim play. Of the 8 who failed to achieve their objectives 4 blaimed competitors' actions and 4 blaimed their own management.

  4 of those who failed to achieve their objectives made a 'do or die' attempt in the last few periods, in each case to achieve profitability at the expense of assets.

(v) Reports and Output

* 12 of 15 respondents found the basic period reports provided adequate information for decision making. The majority described the market research reports as 'very useful' but half would have preferred more or different market research information.
* Ranking the existing market research options in order of the number of students who found them most useful gives:

Rank of usefulness	Report
1	Own share of market
2	Market potentials for next period (Demand)
3=	Industry national advertising
3=	Industry advertising allowances to retaliers
5	Company potential sales for this period

* Suggestions for additional items of market research were
  - individual competitor's advertising expenditure
  - a form of inter-industry comparison
  - quality of competitors retail stocks
  - long range market growth trends
* As an inter-industry comparison of firms,

  5 respondents would like 'Annual Reports' of all firms in all industries

  12 respondents would like a 'Share Market Index' for each firm in each industry

  Only 1 of 15 respondents did not want some form of inter-industry comparison of firms' performance.

5.4 Computational Aspects of MARKSIM

The following evaluation of computational aspects of MARKSIM is based on the experience of the author in supervising all computer related aspects of MARKSIM play at Massey University since 1974, in writing a revue paper "Analysis of Response Functions used in MARKSIM" as a partial course requirement for the course 'Marketing Models' in 1975, and in parametrically modifying MARKSIM (to better reflect the New Zealand business environment and accepted market segment theory) prior to its use with the 1976 Marketing Strategy course.

The evaluation is divided into two sections covering firstly procedural aspects of computation and secondly specific computer programming aspects of computation.

Procedural Aspects

Processing a round of MARKSIM play involves performing a number of necessary tasks. Some of these tasks can only be performed by a human but other tasks may be performed by a computer program. A game constructor is faced with a value judgement concerning the degree to which these programmable tasks will be delegated to the computer. In general terms the benefits of assigning a task to the computer are:

(i) decreased probability of arithmetic errors
(ii) decreased probability of procedural errors
(iii) decreased cost per run.

The accompanying negative benefits are:

(i) higher programming cost in terms of time and expertise inputs
(ii) less flexibility in operating procedures
(iii) less transportability between computer systems
(iv) higher computer knowledge resource requirements for game administrators.

The game MARKSIM, as published, strikes an intermediate point in this continuum of program delegation. All arithmetic tasks and printing of reports are handled by the program but some of the non arithmetic procedural tasks which are programmable are left to the game administrator or game technician.

The required tasks and their level of delegation to the computer are illustrated in Table 5.1. The left'hand column of tasks, headed 'Original Procedure' describes the tasks and degree of delegation in MARKSIM as published. The middle column represents an increased degree of delegation, programmed by the author in 1976, which reduced punching effort by 86% and also decreased computer costs per round by approximately 25%.

The right hand column represents the degree of computer delegation of these tasks which the author considers optimal in the present Massey University marketing course environment.

In the system presently used (middle column) some errors have occurred due to deficiencies in the performance of tasks 2 and 9 from Table 5.1. These tasks can be delegated to the computer and in the author's opinion should be.

Although it would be theoretically possible for students to enter their own decisions on the computer terminal, the restricted hours of operation and unreliability of the Massey University Computer installation mean this alternative would create many problems of coordination and would involve considerable resource expenditure to train students in the use of the computer.

Machine aspects of computation

The MARKSIM computer program (see Appendix 1) is written in FORTRAN and two versions are published, both for IBM systems. One version is suitable for 700 or 7000 series systems and the other for 1620 systems. The former of these is suitable for the Burroughs 6700 systems used in New Zealand universities.

Although in the view of computer scientists, FORTRAN is an ancient and inefficient language, it has two advantages for a program such as this:
(i) Most computer installations have FORTRAN capability, regardless of their size or location.
(ii) Of those marketing educators and other potential administrators of MARKSIM who have some computer experience FORTRAN knowledge tends to be the most common factor.

The author originally considered that the game might be more efficiently programmed in COBOL, an almost universal business computer language. However, discussions with computer scientists and marketing educators and practitioners leading to the conclusions listed (i) and (ii) above, suggested

	Task No.	Original Procedure	1976 Procedure	Optimal Procedure
Technician	1	Collection of Decision forms (D/f)	Collection of Decision forms (D/f)	Collection of Decision forms (D/f)
	2	Order D/f into firms, industries	Order D/f into firms, industries	-
	3	Check validity of Decisions	Check validity of Decisions	Check validity of Decisions
	4	Punch Decisions onto cards	-	-
	5	-	Enter Decisions on terminal	Enter Decisions on terminal
	6	Check (punching)	Check (entry)	Check (entry)
	7	Punch 'FILE 2' onto cards	-	-
	8	Assemble card deck	-	-
	9	Check Decisions and History contemporaneous	Check Decisions and History contemporaneous	-
	10	Submit to computer	-	-
	11	-	Start job	Start job
Computer	12	Read Program	-	-
	13	Compile Program	-	-
	14	-	Read compiled Program file	Read compiled Program file
	15	Read FILE 1,FILE 7,FILE 4 from cards	-	-
	16	-	Read FILE 1,FILE 7,FILE 4 from Disk	Read FILE 1,FILE 7, FILE 4 from Disk
	17	-	-	Order Decision Cards
	18	-	-	Check Decisions and History contemporaneous
	19	Compute Results	Compute Results	Compute Results
	20	Generate FILE 2 on Disk	Generate FILE 2 on Disk	Generate FILE 2 on Disk
	21	Print Results	Print Results	Print Results
	22	Print FILE 2	-	-
	23	-	Store FILE 7 as Backup	Store FILE 7 as Backup
	24	-	Change FILE 2 to FILE 7 on Disk	Change FILE 2 to FILE 7 on Disk
Technician	25	Check Results	Check Results	Check Results
	26	Separate Results from FILE 2	-	-
	27	Hand out Results	Hand out Results	Hand out Results

Technician Tasks	12	9	7
Computer Tasks	7	7	9
Total Tasks	19	16	16

that FORTRAN is the best language to use for business simulations in the New Zealand environment.

The computer program itself has three deficiencies, consisting of one error, one lack of robustness and one inefficiency. These are considered specifically:

1. When the option for multiple copies of output reports is set (at least two copies are usually required, one for the players and one for the administrator), the program does not produce multiple copies of annual reports (these are output every fourth period).
2. As mentioned in the preceding section entitled 'Procedural Aspects' the program has no inbuilt checks to ensure either that the decision and history files are in the required order sequence of firms and industries or that the decision and history files are contemporaneous. The program assumes both decision and history files are ordered as follows:

Industry 1	FIRM1
"	FIRM2
"	FIRM3
Industry 2	FIRM1
.	.
.	.
.	.

   The program also assumes that the decision and history files present refer to the same time period.
3. Some inefficiencies are present in the program itself. For instance, where upper and lower limits are placed on input variables, these limits are checked after complex computation of the resultant variables rather than before, thus wasting small but significant amounts of machine time.

The actual response function forms used in MARKSIM (Appendix 2) are very efficient from the administrator's point of view. Simulations of this nature, used in a training function rather than as an explanation or simulation of real data, may use any functions which have the necessary general characteristics to reflect the desired real world or theoretical response. The functional forms used in MARKSIM are extremely well suited to this purpose as they combine a high degree of flexibility in response curve shape with relatively straightforward solution of their parameters for a given shape.

A further criticism, again related to the lack of robustness of the program, is the severe penalisation of clerical or decision errors such as price exceeding four times retail inventory quality. This type of error results in a zero sales level, usually leading to large losses and very high inventory levels. While some penalisation may be justified the zero sales result is both harsh and unrealistic.

5.5 Summary of suggested improvements to MARKSIM play

The following is a summary of improvements suggested in sections 5.2, 5.3 and 5.4, and is organized into the logical sections -

Improvements in the basic model	:	Section 5.5.1
Improvements in relationships between variables	:	Section 5.5.2
Improvements in presentation of game performance	:	Section 5.5.3
Improvements in administrative aspects	:	Section 5.5.4
Improvements in MARKSIM in the content of the marketing course	:	Section 5.5.5

5.5.1 Improvements in the basic model.

A strong demand for increased realism and increased complexity is present in both game administrator and game player evaluations.

Emphasis is placed on the specification of the industry being simulated together with increased depth and realism in decision making in the promotion and product areas.

The game administrator's suggestions are as follows:

(i) Promotion decisions should consist of:
   (a) a budget decision as at present,
   (b) a promotion plan consisting of media, timing, style of advertising and specific appeals submitted to the game administrator who would assign an index of efficiency to the promotion plan. This index would then be input to the model. This scheme has the added advantage that the promotion plan may be excluded from the game and an index of 1 applied for all firms.

(ii) Product decisions should be discrete and realistic. The administrator suggests that the industry be "motor mowers" and decisions consist of petrol/electric, 4 stroke/2 stroke or mains lead/battery, size and rotary/reel. Dollar input quality would apply within each of these classes as in the original version.

Although these specific solutions are not the only satisfactory ones they illustrate the type of deeper and more realistic decisions required in the promotion and product areas. These alternatives are discussed in more detail in Chapter 6. In all other aspects the basic model was generally judged adequate.

5.5.2 Improvements in relationships between variables.

Players reported various perceptions of the obscurity of relationships between decision variables and results ranging from "obvious" to "obscure". The spread of responses suggests that the level of complexity of the game is sufficient to mask obvious relationships but that relationships in most cases conform to accepted marketing theories.

There appears to be a higher satisfaction with the game since the re-parameterization of the response functions prior to use with the 1976 class. This re-parameterization was principally to make the game more realistic in terms of the size of the business environment and the market segmentation behaviour.

Some concern was also expressed about the unfair penalties imposed on players when rules of the game are broken. The normal results is a zero level of sales which is unrealistic and often leads a team into a position of hopeless unprofitability.

5.5.3 Improvements in presentation of game performance.

Generally output reports are judged to be adequate in presentation and content. However some students felt that further items of market research should be available, and the game administrator felt industry wide statistics on marketing expenditure and inventory levels could help firms considerably in this management.

The main deficiency in reports seems to be the lack of an inter-industry comparison. A strong plea from the administrator plus an almost unanimous request from player respondents indicates a need for some form of evaluation across the whole class. Of the two options suggested, circulation of all annual reports or a 'sharemarket index', the latter was universally preferred. Discussion with game administrators suggested that the share index should be influenced by four factors:

(i) Present profitability.

(ii) Past profitability.

(iii) Fluctuation in profitability.

(iv) An evaluation of the Annual Report presented by the 'managers' of the MARKSIM firm.

It is suggested that the first three of these be quantitatively determined and that an index be applied to the fourth influence.

5.5.4 Improvements in administrative aspects.

The following administrative improvements are shown to be desirable:

(i) Decrease in turnaround time by:
   (a) elimination of clerical errors which necessitate re-runs
   (b) possibly 'leapfrogging' as described in chapter 2

(ii) Improvements in the organization of management group meetings, including the choice of group members with concurrent free periods and the provision of meeting places for groups.

(iii) Increased delegation of computational checking tasks to the computer to avoid (i)(a) above.

(iv) Correction of multiple copy output error in computer program.

(v) Increase of efficiency of computer program.

Responses to questions of timing reinforced the adequacy of the present arrangements. Suggested ideals were:

* Decision rate = 2 per week
* Some enthusiasm for 'leapfrogging' at least for part of a run
* An introductory run of 5 periods
* A main run of somewhat more than the present 16 periods

No other serious administrative problems were found and it is notable that access to game administrators was never a problem.

5.5.5 Improvements in MARKSIM in the context of the marketing course .

The course administrator and students found the game a valuable part of a marketing course at 200 level and subject to increased complexity thought it would be useful at 300 level. The principal reported benefits of gaming were practical application of theory, recognition of the interaction between marketing variables and experience in group decision making.

The short period (mean = 4.4 years) in which 200 level students though they would be making similar real decisions suggests the game identifies closely with their career objectives.

Students at 200 level placed high priority on gaming than students at 300 level for both course content and final grade influence. However both groups assigned mean course time proportion and grade proportion of about 20%. This compares with the 40% currently assigned at 200 level. The students' lower time assignment is however inconsistent with their desire to play more periods of the simulation.

In conclusion, the use of MARKSIM in the Massey 200 level marketing course appears highly beneficial and with increased complexity it seems that the game could be of even greater benefit in the 200 level course and could also be used fruitfully in 300 level marketing strategy courses. The proportion of course content and grade represented by the game appears to be of an acceptable level at present.

CHAPTER 6. Implementation of an Improved Game

6.1 Discussion of alternate strategies to provide an improved game

When deciding on a strategy to provide an improved game for the Massey University marketing environment, three possibilities present themselves;

(i) to modify MARKSIM,

(ii) to search for an alternate but fully developed game,

(iii) to construct a new game.

In the situation under discussion the selection of one of these alternatives must be on a pragmatic basis, rather than to obtain a game which 'best' suits the situation. The reasons for the previous statement are essentially of two types. The first of these concerns the cost/benefit relationship and takes into account the following types of costs.

(i) Capital costs, including the cost of purchase of alternative games for evaluation or cost of computer time for developing new games.

(ii) Manpower costs, including reviewing and evaluating alternative games or developing new or improved games, and familiarization of game administrators with the game to be implemented.

(iii) Opportunity costs, including the loss of the asset of administrator familiarity with MARKSIM and the provision of less than optimum teaching effectiveness both during the time of development of a new game, and after the new game is implemented if it is less than perfect for the teaching environment.

The second consideration for taking a pragmatic approach is the difficulty of specifying an ideal game for this environment. Factors contributing to this difficulty are the limited experience with gaming of both game administrators and the author, the vast number of variable characteristics of games, and the lack of any objective means of measuring the relative effectiveness of any one characteristic either by itself or in interaction with other game characteristics.

To evaluate the three alternative approaches to providing an improved game the information covered in Chapter 2 on general aspects of gaming, Chapter 3 on aspects of building games and Chapters 4 and 5 on a description and evaluation of MARKSIM has been used to construct

Table 6.1, a summary of advantages and disadvantages of each of the three alternatives. It should be noted that additional advantages and disadvantages might become apparent as each strategy was executed as Table 6.1 includes only factors which have been noted in the secondary and primary data searches carried out prior to writing the above chapters.

An inspection of Table 6.1 reveals that strategy 1, modification of MARKSIM, is superior to either of the other strategies in terms of the cost related choice criteria discussed above. In terms of the other principle criterion discussed, the 'ideal game' criterion, strategies 2 and 3 are only superior to strategy 1 when the ideal game characteristics are known. The author contends that these are not known and cannot become known within a realistic time or cost horizon.

The conclusion drawn is that strategy 1, the modification of MARKSIM, is superior to strategies 2 or 3 because it

(i) takes advantage of currently held knowledge.

(ii) minimizes capital and manpower costs.

(iii) deals only with game characteristics known to be acceptable or known to be suboptimal (it does not deal with game characteristics of unknown effect),

(iv) will produce a game which is at least as effective as MARKSIM, whereas an introduced or entirely new game could well be less effective than MARKSIM.

On these grounds strategy 1 has been accepted and implemented.

TABLE 6.1 Advantages and Disadvantages of Alternate Game Producing Strategies

Strategies	Advantages	Disadvantages
Strategy 1: Modification of MARKSIM.	1. Game administrators and other gaming staff are familiar with the basic game. 2. By implication it is known what aspects of the game are acceptable. If a different game is used these aspects become variables of unknown effect. 3. Lowest capital costs. 4. Lowest manpower costs. 5. Shortest implementation time.	1. Does not consider some features of other games which could be advantageous in the Massey University marketing course context.
Strategy 2: Searching for a fully developed game which satisfies the new specifications.	1. Games should be fully developed and error free (although the MARKSIM experience has shown this to be not necessarily true). 2. Capital and manpower investment in the search would lead to a wider knowledge of business gaming.	1. No adequate descriptive catalogue of available games has been discovered during the literature search. 2. Some games are not freely available. 3. High capital cost in obtaining games. 4. Manpower cost in familiarizing with and evaluating games. 5. Very long lead time if alternate games are to be fully evaluated. 6. No guarantee of providing an improved game.
Strategy 3: Constructing a special game.	1. Freedom to incorporate any aspects or characteristics without constraint.	1. Insufficient information and inadequate evaluating techniques hinder the specification of an ideal game. 2. High capital cost (principally computer time). 3. High manpower cost (estimated 1 man year). 4. As 6. above.

6.2 Implementation of improvements in the basic model

As discussed in section 5.5.1 required improvements in the basic model are restricted to;

(i) provision of a qualitative input to reflect the effectiveness of promotional expenditure, and

(ii) a restructuring of market segmentation to allow discrete product decisions to be made.

(i) The qualitative input reflecting the effectiveness of the players' prepared promotion campaign will be assigned by the game administrator after reviewing the campaign. The details of assignment of the index are beyond the scope of this thesis and under the control of the game administrator.

To allow for the optional inclusion of this variable, two indices will be built into the game, one for 'national advertising' and one for 'advertising allowances to retailers'.

The allowable range for each index will be the integers 1 to 9, so that administrators can consider them as a mark out of 10 (no provision will be made for a maximum score of 10). As advertising response would not realistically be a proportional function of the quality of advertising over the whole range of 'quality' from 0 to 9 index value it is desirable that the demand effect generated by the advertising not be proportional to the index applied. If this were the case actual demand would be proportional to the index assigned as demand is a multiplicative function of several attractiveness indices including the two advertising attractiveness indices.

The author proposes that each of these indices be applied to the attractiveness generated by expenditure on promotion as:

$$\frac{i + 5}{10}$$

where i is the index applied by the administrator to one of the promotion campaigns. The effect on demand would then range from 5/10 times (i=0) to 14/10 times (i=9) the demand generated in the original MARKSIM program.

A strong benefit of these indices is that they can be automatically set to a value of 5 at the beginning of the program. This value would retain the original MARKSIM response effect unless overridden by another value entered on the decision form by the administrator. Thus the feature would be optional and could be included or excluded from period to period at will.

The indices will be applied to the 'attractiveness' generated by a firm's decision expenditure. In the case of national advertising this will affect only the current portion of the lagged advertising effectiveness. Spaces will be provided on the decision form for the administrator to enter the appropriate index.

Experiments could be carried out during actual play to determine the size of the effect this index should have, for instance the indices could be applied as

$$\frac{i + 15}{20} \quad \text{or} \quad \frac{i + 10}{15}$$

to give varying weights to the indices as they affect demand. To allow this, the modifications will be programmed in the form

$$\frac{i + a}{a + 5}$$ where a is a variable parameter.

(ii) Restructuring of market segmentation to allow discrete product decisions implies that the product must be specified and the discrete product options also specified. While it would be possible to have different products for different industries and thus simulate a mini-economy, it is considered that the cumbersome programming required outweighs any advantages which might accrue from this approach.

As recorded in section 5.5.1 the administrator feels that a combination of discrete product qualities, together with the original MARKSIM dollar quality concept is a realistic simulation of market segmentation. To this end the following scheme has been designed.

1. The Industry specified makes lawn mowers and the Firms make two products only, - reel mowers and rotary mowers.
2. Markets are segmented on quality as in the original MARKSIM but the response to quality in each of the three markets is different for each of the products.

3. Production, quality, shipment, market research and price decisions are made individually for each of the products but promotion decisions are common to both products.
4. Decisions concerning debt repayment will be as in the original MARKSIM.

It is envisaged that this two-product system will allow players to aim at high market shares in more than one segment and reduce the frustration produced by the fixed relationship between the shares in each of the market segments in the original game. It will also make the game more complex as it will double the effort needed to study inventory management problems. An alternative system of three variable product categories giving eight product possibilities was rejected on the grounds that the resultant complex channels and market segments would tend to make players very product oriented. It is considered that the chosen solution will add an appropriate degree of complexity to the game but when associated with the detailed promotion campaign preparation will provide a good balance of product and promotion orientation.

Implementation of this modification involves duplicating the distribution channel structure, accounting mechanisms, market segmentation procedures and re-designing the decision forms to allow the additional decision.

6.3 Implementation of improvements in relationships between variables

Required improvements to these relationships are restricted to the following:

(i) A lessening of the penalties for breaking game rules. The main problem is the price to quality ratio. If this statistic exceeds 4 the firm makes no sales at all. This will be reprogrammed to provide a low but not disastrous level of sales in this event.

(ii) Some changes to response functions are warranted. These are
   (a) a greater distinction between 'national advertising' and 'advertising allowances to retailers' response function.
   (b) a further restructuring of market segmentation response curves to take account of the dual products and to make the industrial middle segment respond in a more constant manner between relatively narrow 'specification' quality levels.

6.4 Implementation of improvements in presentation of game performance

Improvements to presentation of game performance are required in three areas.

(i) Presentation of dual product information in the profit and loss statement, market research reports and channel inventory reports.

(ii) Addition of marketing research items to cover the dual product market potentials, company sales potentials, market shares and product prices and to cover options of industry wide statistics on inventory levels.

(iii) Inclusion of some measure of performance which compares each firm with all other firms in all industries, such as a share market index.

These improvements are provided in the following form:

(i) Presentation of dual product information in the profit and loss statement, market research reports and channel inventory reports will be automatic, and a duplication of the present single product information. Market research items will be selected on an individual product item basis, with cost kept at the present $1000 per item. This will effectively double the market research costs and thus make them more realistic.

(ii) Four market research options will be added. These will cover

a. Industry total inventory count of each product at retailers.

b. Industry total inventory of each product at independent wholesalers.

These market research items will also cost $1000 each and they will enable firms to compete more effectively with others in their industry.

(iii) A share market index will be calculated for every firm playing the game each period. This index will be based on a number of performance attributes. Experiments with manual calculation of a similar index during the 1977 MARKSIM student session suggest that useful attributes for calculating such an index were; the quality of the last report presented to the administrator, profitability in the last period, well-managed inventory levels, and potential for share price increases.

To form a share market index these factors will be taken into account as follows:

(a) Annual Report - A mark for the last presented initial or annual report will be included on the decision form, this mark to cover the range 1 - 9.

(b) Profitability - Profitability is difficult to measure as past profits go into cash reserves and hence earn no return. A good solution to this problem is to include an additional decision variable called "term investment". A decision 'x' would result in $x,000 dollars of cash being invested for one period earning an interest rate of 4% per period (16% per annum). This rate of interest is 1% per quarter lower than that charged for debt. Interest earnings will be presented in the profit and loss statement as the first income item. The inclusion of this investment decision will allow calculation of a net profit/owners equity statistic which will reflect past profits as a stable 16% return. In the absence of this investment decision past profits lowered the value of this statistic by increasing the denominator without effecting the numerator.

At the end of each period the investment will be returned to cash reserves and will have to be actively reinvested for the next period. Investments greater than cash reserves will be allowed as these will incur a debt charge greater than the investment return. In the interests of realism firms with high accumulated profits could be allowed to cease manufacturing and rely on the investment return. Their share market index would, in this case, suffer from low scores on inventory management, growth potential and possibly annual report scores.

(c) Inventory levels are a guide to astute management in MARKSIM as this is one of the more difficult aspects of profitably managing a MARKSIM firm. It is proposed that only grossly high or low inventory levels at the factory or distribution centre should have an effect on the share market index. If inventory of a product at either of these sites exceeds x times current retail demand of that product the firm will be penalized. Also if either distribution centres or

factory warehouse have not been able to satisfy all orders during the period a similar penalty will occur. It is envisaged that a value of 1.5 for the variable x above would be appropriate. However this will be programmed as a variable to allow experimentation.

(d) Growth Potential - Growth potential of share prices is directly related to each of the previous factors, together with the current share price. For the purposes of the MARKSIM economy we will assume that the growth potential is inversely proportional to the previous period share price. This factor will have a tightening effect on the distribution of share prices over all firms, and as it will actually be programmed in terms of the original $5 par common share value it will tend to bring share prices towards par in the absence of other effects.

To combine these influences a sum of weighted effects will be calculated.

Profitability is normally the most important single effect and will be used in this capacity in the MARKSIM economy.

A normal return of 5% per period on owner's investment will be used as a par value. This return, in the absence of other effects, should maintain a $5 share price. Other arbitrarily chosen values for rates of return have been chosen as follows:

minimum share price	$1.00
0% return on investment	$3.50
10% return on investment	$8.00

A response curve has been fitted to these points and relates share price to rate of return on investment as a partially stepped and partially exponential function.

(The specific function used is illustrated in Section 6.8.)

The resultant share price is then modified to take account of the influences of annual report, inventory control and share price growth potential.

Each of these other influences also has a par value of 5. Annual Report evaluation ranges from 1 to 9, with a mid-value of 5, inventory management has a value of 5 unless either of the conditions which reflect bad management exist, in which case a value of 1 will be given and growth potential will simply be calculated as 5 minus the last share price.

Each effect is designed to reflect a share price of $5 for an acceptable performance. The effects will be summed, with weights, to give the share market price.

Share market price = a. Return on investment effect + b. Annual Report score
+ c. Inventory management score + d. growth potential

where $a + b + c + d = 1$.

a, b, c and d will be programmed as variables but will initially have the following values assigned on an intuitive basis.

$a = .4$
$b = .2$
$c = .2$
$d = .2$

This solution to the share market computation has several major advantages.

(a) Previous share price is the only information which needs to be carried from period to period within the program.

(b) The provision of investment opportunities for past profits allows a realistic return on investment analysis, both for the share market and for the students' own use in evaluating their performance in terms of their company objectives.

(c) The weights applied to various influences on the share market index can be easily altered by the administrator.

(d) The administrator input to the share index, the evaluation of Annual Reports, will be automatically set to the par value of 5 in the program. This, along with the advertising effectiveness indices, provides the game with three optional qualitative inputs which may be included or excluded on a period to period basis as time or educational requirements prescribe.

6.5 Implementation of improvements in administrative aspects

Suggested improvements in administrative aspects (section 5.5.4) were

(i) decrease in turnaround time between periods by eliminating clerical errors and possibly by 'leapfrogging',

(ii) improvements in the organisation of MARKSIM firm management meetings,

(iii) increased delegation of computational checking tasks to the computer,

(iv) correction of the multiple output error in the computer program,

(v) increase of efficiency of the computer program.

These improvements will be implemented as follows:

(i) and (ii) above are administrative problems outside the scope of this thesis. It is sufficient to record that this thesis has increased the awareness of administrators to these problems. The technique of 'leapfrogging' was used during the 1977 MARKSIM exercise for several periods and was successful in that it placed more emphasis on the need for MARKSIM managers to plan several periods ahead, particularly for inventory control.

(iii) The computational checking tasks of input ordering and HISTORY/DECISION temporal compatability will be programmed into the MARKSIM computer process so that errors are detected before the actual processing begins and a suitable error message returned to the game administrator.

(iv) The multiple output error will be corrected.

(v) Inefficiencies in the computer program will be rectified as detected during the general reprogramming.

6.6 Implementation of improvements in MARKSIM in the context of the marketing course

All improvements mentioned in the preceding sections are aimed at this general objective. The increased and optional complexity of the game, together with the other modifications will improve its efficiency as a teaching tool and will provide lecturers with a more potent and relevant vehicle for teaching marketing management skills to both elementary and advanced students. The degree to which lecturers use the potential of the improved game is beyond the influence of the author. The result of this thesis has been simply to remove some of the constraints on teaching efficiency imposed by the original MARKSIM game.

6.7 Method of programming improvements

While a detailed description of programming of the improvements will not be provided, the following is an outline of the approach taken.

(i) Mock-up of improved decision form created.
(ii) Mock-up of improved output sheets created.
(iii) Mock-up of improved HISTORY files created.
(iv) Identification of required new variables.
(v) Reprogramming to include new variables and new procedures.
(vi) Parameterizing existing and new functional forms as required.
(vii) Testing for debugging purposes.
(viii) Testing for parametric performance purposes.

The improved decision form appears in Appendix 7, the improved output reports in Section 6.9, a list of added variables in Appendix 8 and the resultant improved computer program appears in Appendix 6.

Essential points concerning parameterization of response functions in the improved game appear in the following section, 6.8.

6.8 Parameterization of response functions in the improved game

In the improved game parametric response functions are used for the purposes of

(i) calculating the effect of National Advertising expenditure,
(ii) calculating the effect of Advertising Allowance to Retailers expenditure,
(iii) calculating the effect of Price/Quality ratio,
(iv) calculating the effect of quality in each market segment for each product,
(v) calculating the effect of 'Return on Investment' on the share market price.

Each of these response functions is presented below. The functional forms used are those described in Appendix 2.

(i) National Advertising expenditure.

$$ATR_t = \frac{1.2\ A_t^{3.1699}}{5.3144 \times 10^{11} + A_t^{3.1699}}$$

ATR_t = Index of National Advertising attractiveness, period t

A_t = National Advertising expenditure, period t

(See Figure 6.1)

(ii) Advertising Allowances to Retailers expenditure.

$$ALLAT_t = \frac{1.2\ L_t^{2.0639}}{4.5043 \times 10^{7} + L^{2.0639}}$$

$ALLAT_t$ = Index of Advertising Allowances to Retailers, period t

L_t = Advertising Allowances to Retailers expenditure, period t

(See Figure 6.2)

N.B. (i) and (ii) above are the same specific functions used in MARKSIM since the reparameterization exercise in 1976 and have performed satisfactorily.

(iii) Price/Quality ratio response is unaltered from the original MARKSIM over the allowed range. However outside of this range the previous zero sales penalty has been replaced by a low sales penalty.

(iv) Market segmentation on the basis of Quality.

The two product markets differ in their response to quality of product to reflect the different end uses of reel and rotary mowers. The mass and quality markets reflect the generally higher quality required in reel mowers over rotary mowers. The industrial market for each product is relatively 'flat' over a narrow quality range. At the upper end of the range there is a definite cut off point above which quality is too high for industrial users.

The specific functions used are as follows.
Q(M)AT is the attractiveness to the segment (M) and Q(M) is the retail inventory quality.

Reel Mowers

(a) $Q(1)AT = .005688(Q_1-0)^{1.6666} - .0000711(Q_1-0)^{2.6666}$, $30 \leq Q(1) \leq 80$

$= 0$, $Q(1) < 30$

IF $Q(1) > 80$, then $Q(1) = 80$.

(b) $Q(2)AT = .02(Q(2)-40)^{1} - .0001(Q(2)-40)^{2}$, $40 \leq Q(1) \leq 60$

$= 0$, $Q(2) < 40$, $Q(2) > 60$

(c) $Q(3)AT = .128(Q(3)-55)^{1} - .00256(Q(3)-55)^{2}$, $55 \leq Q(3) \leq 80$

$= 0$, $Q(3) < 55$

If $Q(3) > 80$, then $Q(3) = 80$.

These functions are illustrated in Figure 6.3.

Rotary Mowers

(a) $Q(9)AT = .39197(Q(9)+30)^{.53846} - .0037197(Q(9)+30)^{1.5384}$,

$30 \leq Q(9) \leq 70$

$= 0$, $Q(9) < 30$

If $Q(9) > 70$, then $Q(9) = 70$.

(b) $Q(10)AT = .0048(Q(10)+50)^{1} - .0000048(Q(10)+50)^{2}$, $35 \leq Q(10) \leq 45$

$= 0$, $Q(10) < 35$, $Q(10) > 45$

(c) $Q(11)AT = .00313(Q(11)-45)^{1.8571} - .0000313(Q(11)-45)^{2.8571}$,

$45 \leq Q(11) \leq 75$

$= 0$, $Q(11) < 45$

If $Q(11) > 75$, $Q(11) = 75$.

These functions are illustrated in Figure 6.4.

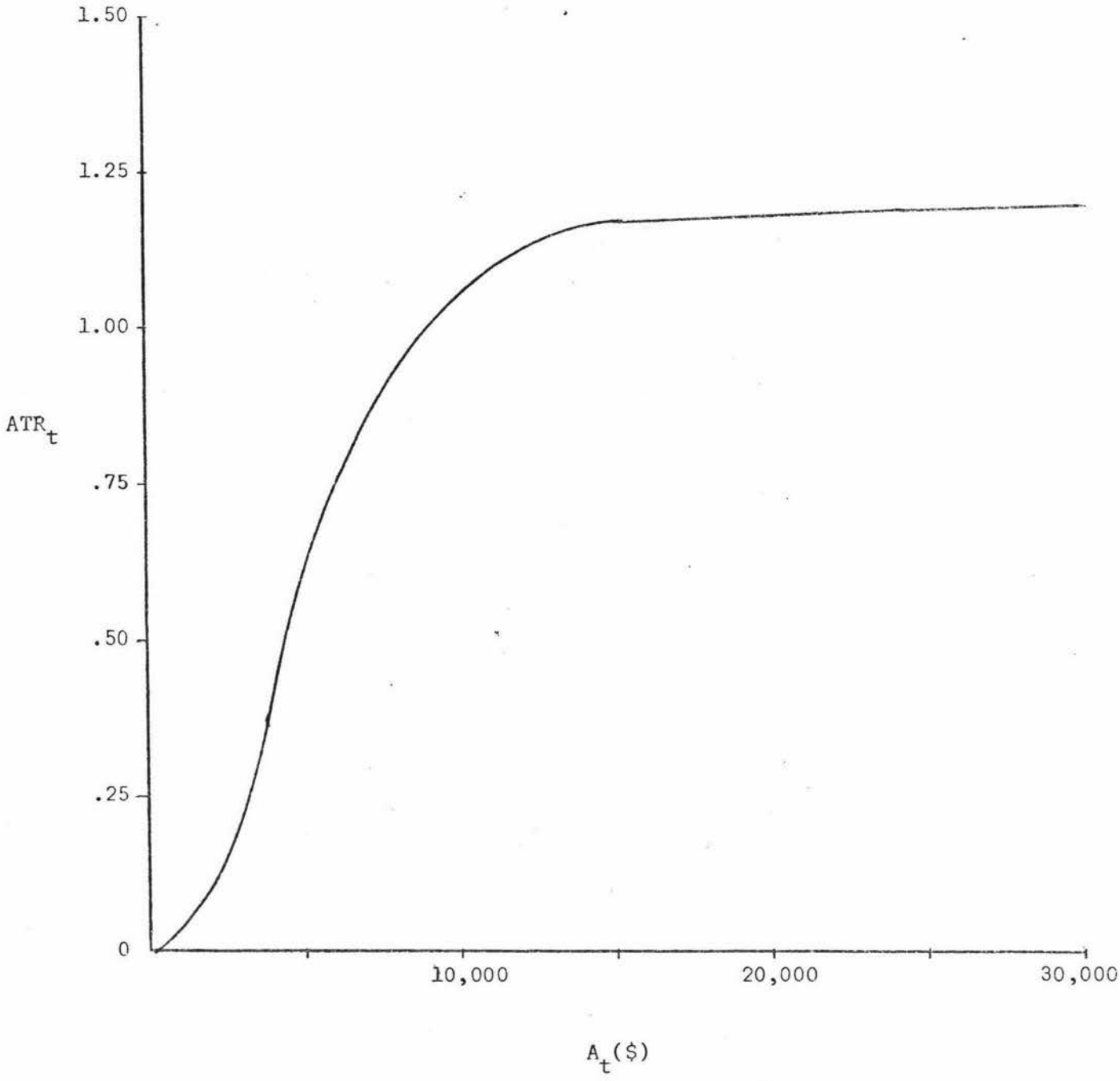


Figure 6.1 Improved Response to National Advertising Expenditure

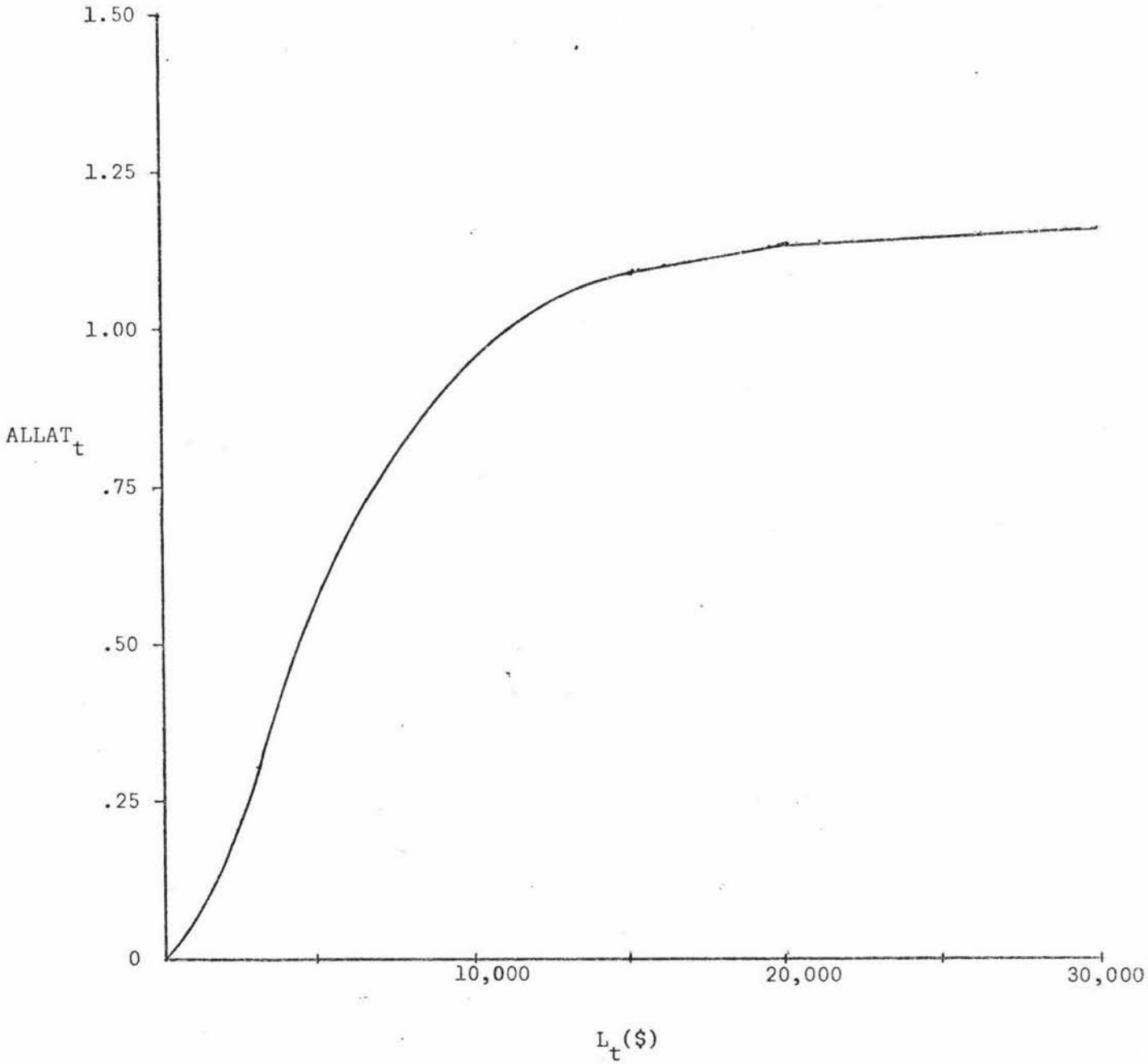


Figure 6.2 Improved Response to Advertising Allowance to Retailer Expenditure

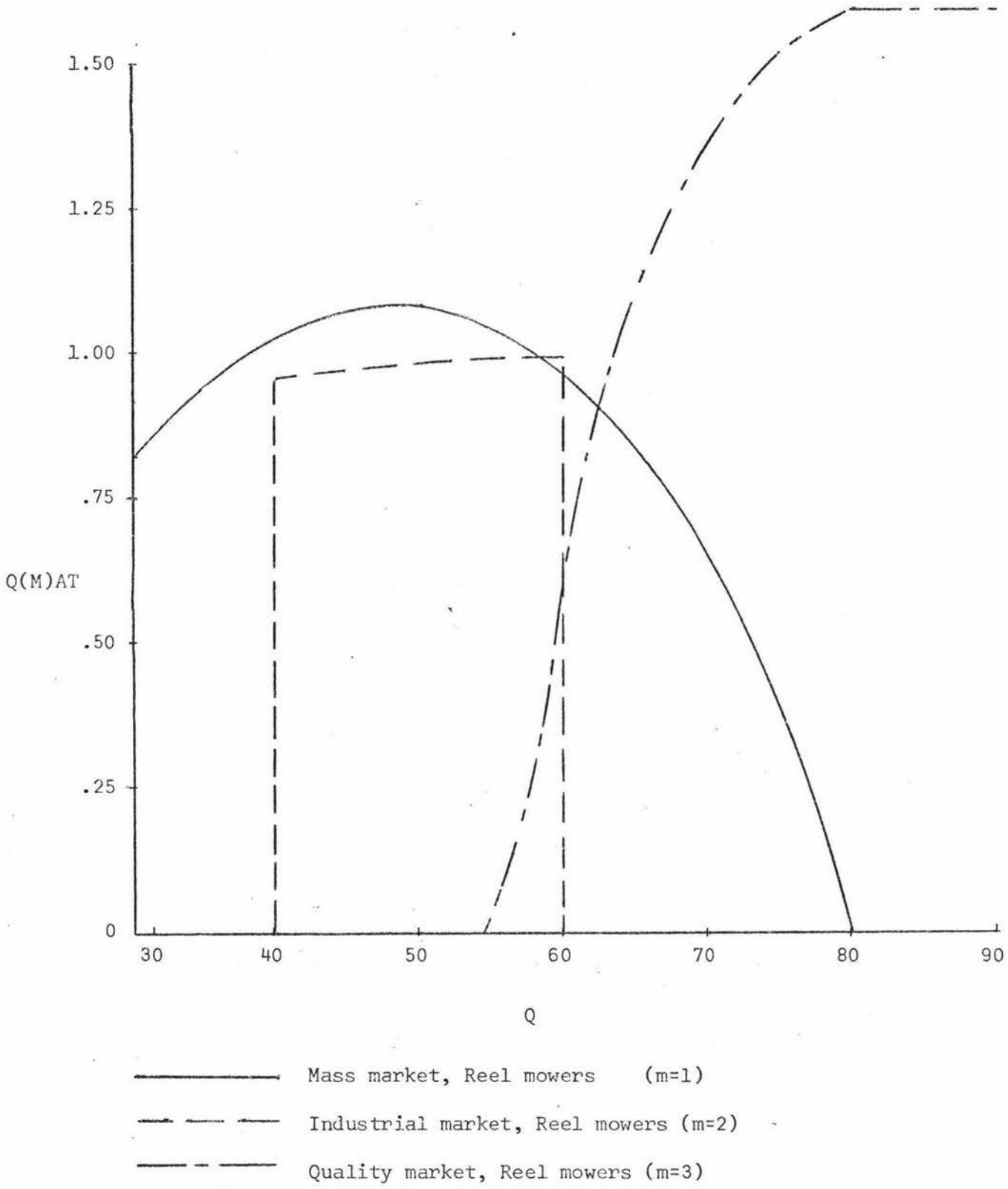


Figure 6.3 Improved Market Segment Response to Quality - Reel Mowers

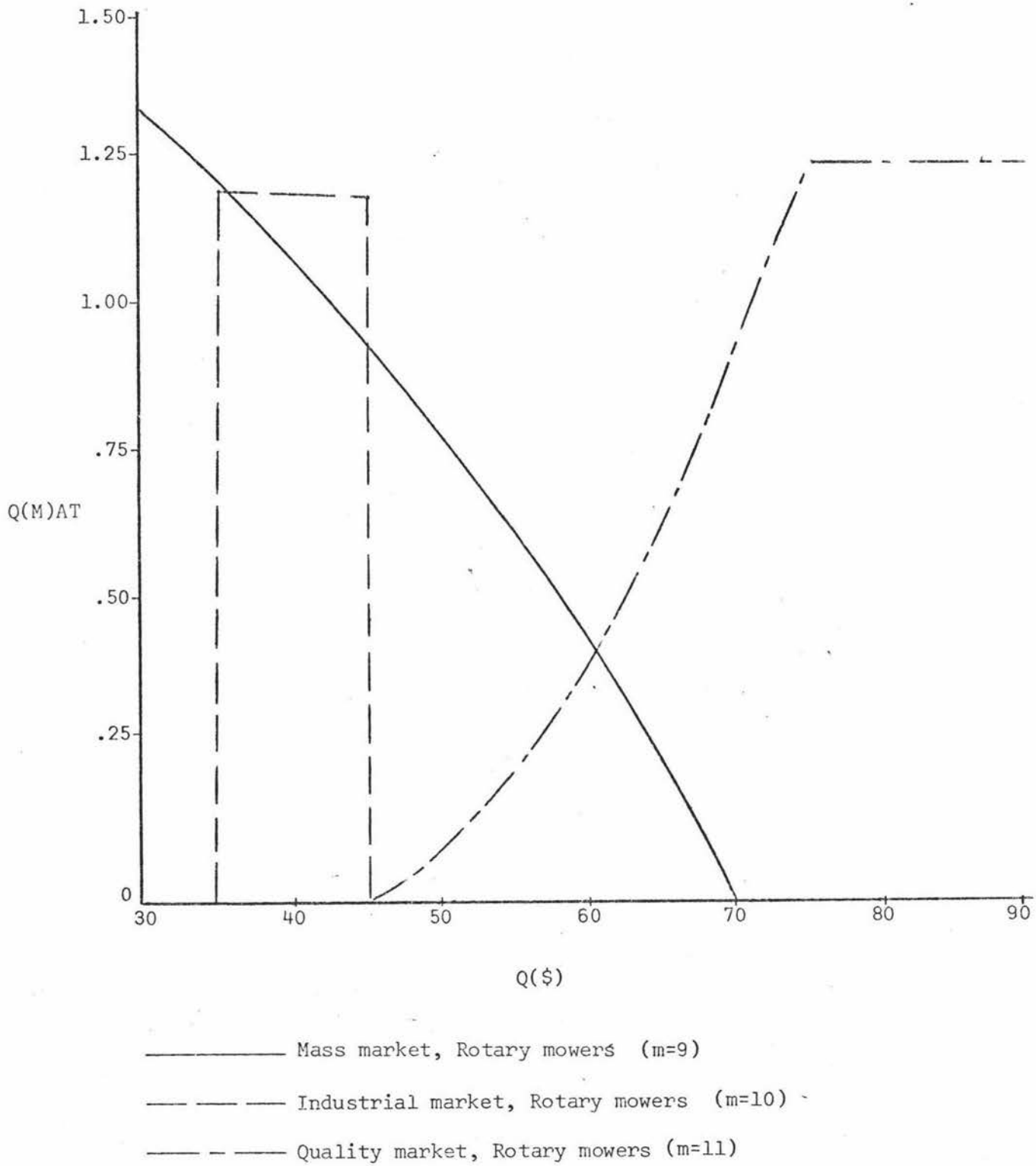


Figure 6.4 Improved Market Segment Response to Quality - Rotary Mowers

(v) The Return on Investment response function is an exponential form for non-negative returns on investment, i.e. for non-loss situations, and treats all loss situations as the same. The functional form used is:

$$SPI = 180\ ROI^{1.6} + 3.5 \quad , \quad ROI > 0$$
$$= 3.5, \quad ROI = 0$$
$$= 1 \quad , \quad ROI < 0$$

where SPI is Share Price Index, ROI is Net Profit/Total Assets.

This response is illustrated in Figure 6.5.

N.B. This is one of four influences on the Share Price.

6.9 Improved MARKSIM output reports

The improved MARKSIM output reports are essentially those of the original MARKSIM game extended to provide for the dual product line and the additional market research and reporting items. However there is one additional report, the share market summary report, which is necessarily printed out at the end of the printing session. The number of copies of this report printed matches the number of copies of firm period reports printed plus a further report for the game administrator.

These reports, shown in Tables 6.2 to 6.5, are self-explanatory. It should be noted that the Market Research report, illustrated in Table 6.3, consists of automatic and free reports on product prices and the firm's own share price for the previous period and for the current period, and a series of twelve optional reports costing $1000 each.

6.10 A guide to mechanical aspects of running the improved MARKSIM game

The original MARKSIM player and administrator manuals [9][10] should be used as the basic guide to game play. However the administrator must use the appendices and text of this thesis as a guide to the changes made. The following is a summary of essential changes that have been made, organised into changes affecting players and changes affecting administrators.

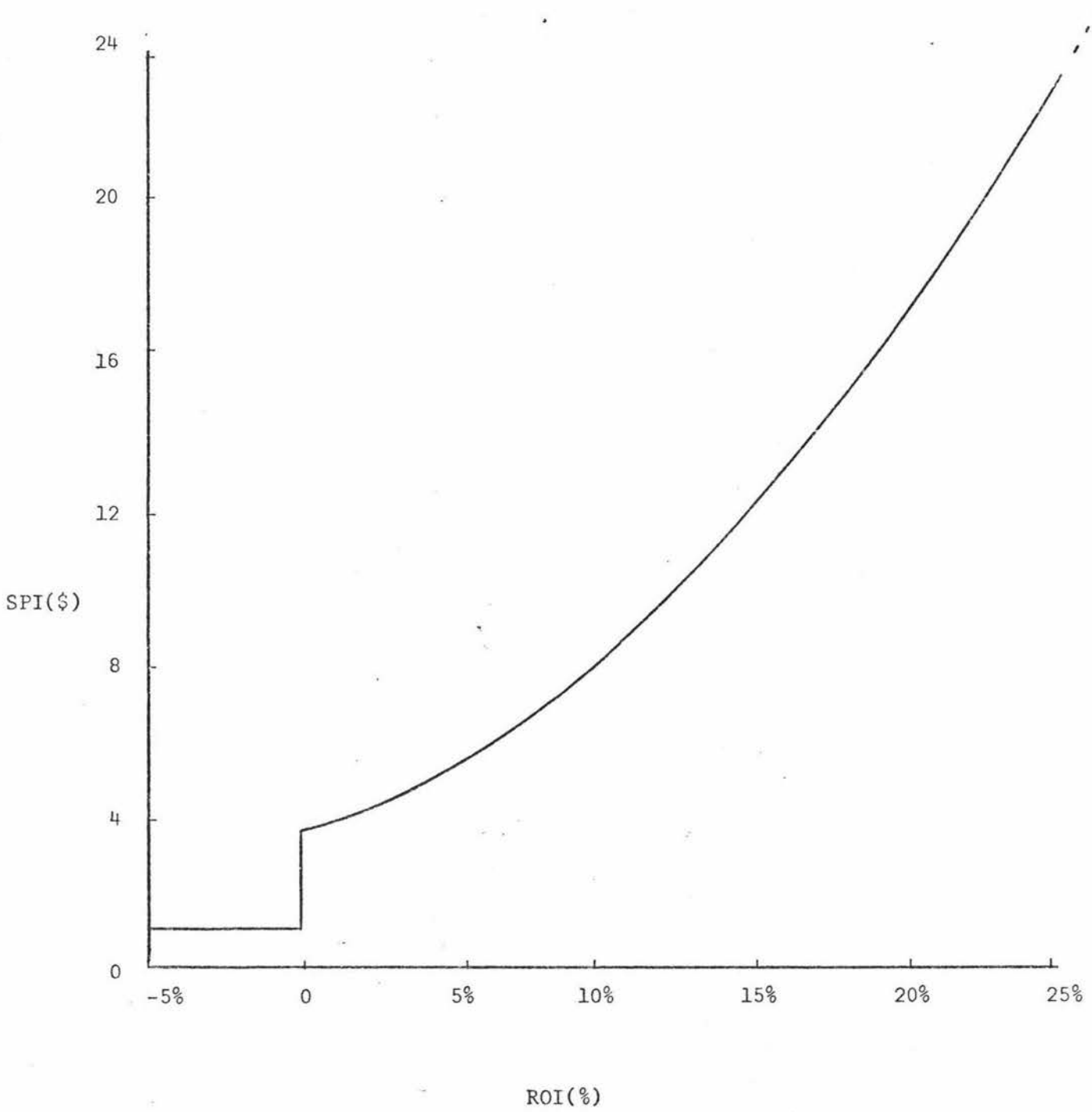


Figure 6.5 Share Price Index response to ROI performance

MARKSIM

FIRM 1 PERIOD 2 INDUSTRY 3

INCOME STATEMENT

INVESTMENT INCOME		400.
SALES REVENUE		602833.
COST OF PRODUCTION	360000.	
MINUS. INCREASE IN INV. VALUE	-140141.	
COST OF GOODS SOLD		219859.
GROSS PROFIT		383374.
LESS. SELLING. ADM. AND GENERAL EXP.		
TRANS. TO RETAILERS	6000.	
TRANS. TO DISTRIBUTION CENTERS	12000.	
TRANS TO WHOLESALERS.	10912.	
INV. COSTS. FACTORY WAREHOUSE	27736.	
INV. COSTS. DISTRIBUTION CENTERS	32000.	
ADV. ALLOWANCES TO RETAILERS	6000.	
NATIONAL ADVERTISING	5000.	
MARKETING RESEARCH	12000.	
INTEREST CHARGES	0.	
FIXED EXPENSE	50000.	
		161648.
NET PROFIT		221726.

FINANCIAL STATEMENT

ENDING CASH BALANCE	416880.
ENDING INVENTORY VALUE	597361.
TOTAL ASSETS	1014241.
LESS. DEBT	0.
OWNERS INVESTMENT	1014241.

TABLE 6.2 continued

SALES

INFORMATION	REEL			ROTARY		
RETAILERS						
SALES (IN UNITS)	456.	720.	451.	0.	0.	0.
TOTAL RETAIL SALES (UNITS)			3500.			0.
	UNIT VALUE		UNITS	UNIT VALUE		UNITS
BEGINING INVENTORY.	65.		3500.	55.		2500.
ENDING INVENTORY	65.		3288.	55.		2500.
WHOLESALERS						
ORDERS FROM RETAILERS (UNITS)			2088.			0.
DELIVERIES TO RETAILERS (UNITS)			2088.			0.
SELLING PRICE TO RETAILERS ($)			195.			98.
RECEIPTS FROM RETAILERS ($)			407235.			0.
	UNIT VALUE		UNITS	UNIT VALUE		UNITS
BEGINING INVENTORY.	65.		2412.	55.		1500.
ENDING INVENTORY	65.		2506.	55.		1500.
DISTRIBUTION CENTRES						
ORDERS FROM RETAILERS (UNITS)			2262.			0.
DELIVERIES TO RETAILERS (UNITS)			1200.			0.
SELLING PRICE TO RETAILERS ($)			195.			98.
COMPANY SALES TO RETAILERS ($)			234000.			0.
	UNIT VALUE		UNITS	UNIT VALUE		UNITS
BEGINING INVENTORY.	65.		1200.	55.		3200.
ENDING INVENTORY	65.		1200.	55.		4400.
FACTORY WAREHOUSE						
ORDERS FROM WHOLESALERS (UNITS)			2182.			0.
DELIVERIES TO WHOLESALERS (UNITS)			2182.			0.
SELLING PRICE TO WHOLESALERS ($)			169.			85.
COMPANY SALES TO WHOLESALERS ($)			368833.			0.
SHIPMENTS TO DIST. CENTRES (UNITS)			1200.			1200.
PRODUCTION THIS PERIOD (UNITS)			3000.			3000.
	UNIT VALUE		UNITS	UNIT VALUE		UNITS
BEGINING INVENTORY.	65.		586.	55.		3000.
ENDING INVENTORY	65.		206.	55.		4800.

M A R K E T I N G R E S E A R C H

INDUSTRY NATIONAL ADVERTISING 15000.
INDUSTRY ALLOWANCES TO RETAILERS 18000.

	MARKET 1		MARKET 2		MARKET 3	
	REEL	ROTARY	REEL	ROTARY	REEL	ROTARY
COMPANY POTENTIAL SALES FOR THIS PERIOD (IN UNITS)	472.		746.		467.	
COMPANY POTENTIAL SALES FOR THIS PERIOD (IN UNITS)		0.		0.		0.
INDUSTRY MARKET POTENTIAL FOR PERIOD 4 (IN UNITS)	3000.		3000.		3000.	
INDUSTRY MARKET POTENTIAL FOR PERIOD 4 (IN UNITS)		0.		0.		0.
SHARE OF MARKET (IN PERCENT)	33.		33.		33.	
SHARE OF MARKET (IN PERCENT)		0.		0.		0.

INDUSTRY STOCK LEVELS RETAIL REEL	3288.			
INDUSTRY STOCK LEVELS RETAIL ROTARY	2500.			
INDUSTRY STOCK LEVELS W/SALE REEL	1200.			
INDUSTRY STOCK LEVELS W/SALE ROTARY	4400.			
PRICES OF COMPETITORS ($) REEL	260.	260.	260.	
ROTARY	130.	130.	130.	

SHARE PRICE-LAST PERIOD ($) 3.
-THIS PERIOD ($) 3.

TABLE 6.4 Annual Reports

MARKSIM

FIRM 1 PERIOD 4 INDUSTRY 2

A N N U A L R E P O R T (PERIODS 1 - 4)

FIRM 1

SALES TO CONSUMER (UNITS) -REEL	2500.
-ROTARY	0.
COMPANY NET PROFIT ($)	7759.
ENDING CASH BALANCE	134752.
ENDING INVENTORY VALUE	528785.
TOTAL ASSETS	663537.
LESS: DEBT	0.
OWNERS INVESTMENT	663537.

FIRM 2

SALES TO CONSUMER (UNITS) -REEL	2500.
-ROTARY	0.
COMPANY NET PROFIT ($)	31042.
ENDING CASH BALANCE	0.
ENDING INVENTORY VALUE	528785.
TOTAL ASSETS	528785.
LESS: DEBT	186969.
OWNERS INVESTMENT	341816.

FIRM 3

SALES TO CONSUMER (UNITS) -REEL	2500.
-ROTARY	0.
COMPANY NET PROFIT ($)	31042.
ENDING CASH BALANCE	0.
ENDING INVENTORY VALUE	528785.
TOTAL ASSETS	528785.
LESS: DEBT	186969.
OWNERS INVESTMENT	341816.

TABLE 6.5 Share Market Summary Report

SHARE LISTINGS-PERIOD 2

INDUSTRY	1	FIRM	1	($)	3.56
INDUSTRY	1	FIRM	2	($)	4.78
INDUSTRY	1	FIRM	3	($)	1.34
INDUSTRY	2	FIRM	1	($)	2.50
INDUSTRY	2	FIRM	2	($)	6.78
INDUSTRY	2	FIRM	3	($)	3.80

6.10.1 Changes affecting players.

(i) There are two products now sold, Reel Mowers and Rotary Mowers.

(ii) The volume of sales for each product is approximately one-tenth that of the total original MARKSIM industry.

(iii) Decisions are made for each product independently. The products are in no way substitutes.

(iv) Surplus accumulated profits may now be invested on a period by period basis at 16% p.a. interest rate. Interest on debt is charged to the firm at 20% p.a.

(v) The industrial market segment for each product only buys over a narrow "specification" quality range. If a product is not offered in this range, industrial demand ceases to exist. Unsatisfied demand does not carry over into future periods.

(vi) Market research decisions can now be made over a range of 12 items. Each item costs $1000 per period. Competitive prices and share market prices are provided free each period.

(vii) The share market price for any firm is affected by its return on investment, inventory management, annual report (at the option of the game administrator) and previous share price.

(viii) The efficiency of promotional campaigns prepared by players may be judged by the administrator and entered on the decision form.

6.10.2 Changes affecting processing.

(A new variable list appears in Appendix 8.)

(i) The HISTORY file is called FILE7 and must be on DISK. This file now consists of 10 cards per firm rather than 6 cards per firm. The 2-dimensional variables which used to be on cards 3 - 6 are now 3-dimensional and occur again on cards 7 - 10. A two industry example is presented in Appendix 10. After each period a new HISTORY called FILE2 is produced. This must be changed to FILE7 before commencing the next period of play.

(ii) The PARAMETER file is called FILE4 and must be on DISK. This file now carries 13 parameter cards rather than 9. The variables on these cards are t(n), u(n), v(n), w(n), x(n), y(n), and z(n), where n = 1-13.

After the 13 parameter cards there are 34 market potential cards. These now carry 7 columns, columns 4 - 7 representing potentials in the second product markets. It is essential that exactly 47 cards are present in FILE4 even though the administrator may not plan to run 32 periods of play.

(iii) The DECISION file is called FILE1 and must be on CARDS or TERMINAL. This file still carries one card per firm but the format of the card is changed substantially. An example of an appropriate decision form appears in Appendix 7. The small superscripts beside the decision boxes give the card column in which the field starts. The decimal points in the boxes must be entered and entries in non-decimal fields must be right justified. If administrator inputs are entered on the input cards they will automatically be included. If a zero is entered or if the column is left blank an automatic 'status quo' value of 5 will be assumed by the program.

(iv) As before HISTORY and DECISION files must be organized so that firms are treated in order, i.e.

Industry 1, Firm 1
Industry 1, Firm 2
Industry 1, Firm 3
Industry 2, Firm 1
. .
. .
. .

However if there is a mistake in the order of one of these files the new program will not carry on and run the period with incorrect data, but rather will print out the message:

DECISION DECK DOES NOT AGREE WITH HISTORY DECK -
CHECK PERIOD, ORDER OF FIRM, ORDER OF INDUSTRY

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APPENDICES

APPENDIX 1 Original MARKSIM Computer Program Deck

```
      DIMENSION EVAL(3,4),HIST(3,4),ORDER(5),ZA(3,4),PRICE(2)
      DIMENSION T(10),U(8),V(8),W(8),X(8),Y(8),Z(8)
      DIMENSION BINV(4),BVAL(4),DCA(3),DPT(3),DQ(3),DPRI(3)
      DIMENSION PSLS(3,3),RES(6,3),RM(3,6),SALES(3),SLS(3,3)
      DIMENSION DPROD(3),DSHFW(3),DPA(3),COST(18),DMD(3),EINV(3,4)
      DIMENSION SPSLS(3),SSLS(3),STA(3),TSLS(3),TA(3,3),TMP(34,4)
    5 FORMAT (F10.0,F10.0,F10.0,F10.0,F10.0,F10.0)
    9 FORMAT (I10,I10,I10,I10,I10,I10,I10)
   10 FORMAT (10X,4F10.0)
   11 FORMAT (E10.0,E10.0,E10.0,E10.0,E10.0,E10.0,E10.0)
  371 FORMAT (72H
     1                    )
  372 FORMAT (72H
     1                    )
  373 FORMAT (72H
     1                    )
C
C   READ PARAMETER CARDS
C
      DO 30 J=1,8
      READ(4,11) T(J),U(J),V(J),W(J),X(J),Y(J),Z(J)
   30 CONTINUE
      DO 37 I=1,34
      READ(4,10)  TMP(I,1),TMP(I,2),TMP(I,3),TMP(I,4)
   37 CONTINUE
      READ(1,9) NOIND,NCOPY,NOPER
C
C   READ HISTORY CARDS
C
   25 DO 26 K=1,3
      READ(7,9) MTIME,MFIRM,MIND
      GO TO (291,292,293),K
  291 READ(7,371)
      GO TO 23
  292 READ(7,372)
      GO TO 23
  293 READ(7,373)
   23 DO 26 I=1,4
      READ(7,5) EINV(K,I),EVAL(K,I),HIST(K,I),ZA(K,I)
   26 CONTINUE
      NPER=NOPER
C
C   INITIALIZE
C
   16 DO 776 K=1,3
      SPSLS(K)=0.0
      TSLS(K)=0.0
  776 CONTINUE
      DO 777 M=1,3
      SSLS(M)=0.0
      STA(M)=0.0
  777 CONTINUE
C
C   READ DECISION CARDS
C
      DO 19 K=1,3
    1 FORMAT (2I2,I3,-3PF6.0,F5.0,0P2F5.0,-3P2F5.0,F8.2,0P7F1.0)
      READ(1,1)  J,M,N,DCA(K),DPA(K),DQ(K),DPRI(K),DPROD(K),DSHFW(K),
```

```
     1DPT(K),(RM(K,I),I=1,5)
      RM(K,6)=1
      IF (DQ(K)-T(1)) 18,18,19
   18 DQ(K)=T(1)
   19 CONTINUE
C
C  COMPUTE ATTRACTIVENESS OF EACH FIRMS ADVERTISING ALLOWANCE,
C  NATIONAL ADVERTISING,QUALITY, AND PRICE-QUALITY RATIO
C
      DO 60 K=1,3
      EDCA=T(4)*(DCA(K)**T(5))/(T(6)+(DCA(K)**T(5)))
      HIST(K,3)=T(7)*EDCA+(1.0-T(7))*HIST(K,3)/1000.
      EDPA=U(4)*(DPA(K)**U(5))/(U(6)+(DPA(K)**U(5)))
      A=DPRI(K)/EVAL(K,1)
      IF (A-V(7)) 46,44,44
   46 A=V(7)
   44 EDPRI=(V(4)*V(5))/(V(5)+(A-V(7))**V(6))
      IF (V(8)-A) 48,43,43
   48 EDPRI=0.0
   43 IF (Z(6)-DPRI(K)) 42,49,49
   42 EDPRI=0.0
   49 DO 60 M=1,3
      A=EVAL(K,1)
      IF (Z(M)-EVAL(K,1)) 54,55,55
   54 A=Z(M)
   55 IF (EVAL(K,1)-T(M)) 57,56,56
   57 EDQ=0.0
      GO TO 58
   56 IF (M-1) 59,59,61
   59 EDQ=U(M)*((A+V(M))**W(M))-X(M)*((A+V(M))**Y(M))
      GO TO 58
   61 EDQ=U(M)*((A-V(M))**W(M))-X(M)*((A-V(M))**Y(M))
   58 TA(K,M)=HIST(K,3)*EDPA*EDPRI*EDQ
      STA(M)=STA(M)+TA(K,M)
   60 CONTINUE
C
C  COMPUTE SALES FOR EACH FIRM IN EACH MARKET
C
      DO 79 K=1,3
      HIST(K,3)=HIST(K,3)*1000.
      DO 72 M=1,3
      DMD(M)=TMP(MTIME,M)*((3.0+STA(M))/6.0)
      IF (STA(M)) 68,68,70
   68 PSLS(K,M)=0.0
      GO TO 71
   70 PSLS(K,M)=DMD(M)*TA(K,M)/STA(M)
```

```
   71 SPSLS(K)=SPSLS(K)+PSLS(K,M)
   72 CONTINUE
      DO 79 M=1,3
      SLS(K,M)=PSLS(K,M)
      IF (EINV(K,1)-SPSLS(K)) 76,77,77
   76 SLS(K,M)=EINV(K,1)*PSLS(K,M)/SPSLS(K)
   77 TSLS(K)=TSLS(K)+SLS(K,M)
      SSLS(M)=SSLS(1)+SLS(K,M)
   79 CONTINUE
C
      DO 168 K=1,3
C
C  INITIALIZE SOME MORE
C
      DO 203 I=1,18
      COST(I)=0.0
  203 CONTINUE
      DO 779 M=1,3
      RES(1,M)=0.0
      RES(2,M)=0.0
  779 CONTINUE
      DO 90 I=1,4
      BINV(I)=EINV(K,I)
      BVAL(I)=EVAL(K,I)
   90 CONTINUE
C
C  DETERMINE IF PRODUCTION DECISION IS WITHIN ALLOWABLE RA
C
      A=Z(7)*HIST(K,4)
      IF (A-Z(8)) 83,84,84
   83 A=Z(8)
   84 IF (A-DPROD(K)) 85,86,86
   85 DPROD(K)=A
   86 HIST(K,4)=DPROD(K)
      COST(2)=DPROD(K)*DQ(K)
      EINV(K,4)=EINV(K,4)+DPROD(K)
      IF (EINV(K,4)) 100,100,102
  100 EVAL(K,4)=0
      GO TO 103
  102 EVAL(K,4)=(BINV(4)*BVAL(4)+COST(2))/EINV(K,4)
  103 ORDER(1)=SPSLS(K)
      SALES(1)=TSLS(K)
      EINV(K,1)=EINV(K,1)-SALES(1)
C
C  COMPUTE RETAILERS ORDERS FROM DIST CENTER AND FROM WHOLESALER
C
```

```
      T(9)=TMP(MTIME,4)/100.
      T(10)=(1.0-T(9))
      DO 110 I=1,2
      J=I+1
      ORDER(J)=T(I+8)*(U(7)*ORDER(1)+SALES(1)-BINV(1))
      IA=I+3
      IF (ORDER(J)-W(IA)) 91,91,92
   91 ORDER(J)=W(IA)
   92 SALES(J)=ORDER(J)
      IF (EINV(K,J)-ORDER(J)) 104,105,105
  104 SALES(J)=EINV(K,J)
  105 EINV(K,J)=EINV(K,J)-SALES(J)
      EVAL(K,1)=(EVAL(K,1)*EINV(K,1)+SALES(J)*EVAL(K,J))
      EINV(K,1)=EINV(K,1)+SALES(J)
      IF (EINV(K,1)) 106,106,108
  106 EVAL(K,1)=0
      GO TO 110
  108 EVAL(K,1)=EVAL(K,1)/EINV(K,1)
  110 CONTINUE
C
C   COMPUTE ORDERS AND SALES BETWEEN DIST CENTER AND FACTORY WAREHOUSE
C   COMPUTE SALES AND ORDERS BETWEEN WHOLESALER AND FACTORY WAREHOUSE
C
      ORDER(4)=DSHFW(K)
      ORDER(5)=U(8)*ORDER(3)+SALES(3)-BINV(3)
      DO 120 I=2,3
      J=I+2
      IA=I+4
      IF (ORDER(J)-W(IA)) 111,111,112
  111 ORDER(J)=W(IA)
  112 SALES(J)=ORDER(J)
      IF (EINV(K,4)-ORDER(J)) 114,115,115
  114 SALES(J)=EINV(K,4)
  115 EINV(K,4)=EINV(K,4)-SALES(J)
      EVAL(K,I)=EVAL(K,I)*EINV(K,I)+SALES(J)*EVAL(K,4)
      EINV(K,I)=EINV(K,I)+SALES(J)
      IF (EINV(K,I)) 116,116,118
  116 EVAL(K,I)=0
      GO TO 120
  118 EVAL(K,I)=EVAL(K,I)/EINV(K,I)
  120 CONTINUE
      DO 125 I=1,4
      IF (EINV(K,I)) 124,124,125
  124 EVAL(K,I)=0
  125 CONTINUE
C
```

```
C  COMPUTE COSTS FOR THE PERIOD
C
      PRICE(1)=X(4)*DPRI(K)
      PRICE(2)=X(5)*DPRI(K)
      COST(1)=PRICE(1)*SALES(2)+PRICE(2)*SALES(5)
      COST(9)=X(6)*EINV(K,4)*EVAL(K,4)
      COST(10)=X(7)*EINV(K,2)*EVAL(K,2)
      COST(6)=Y(4)*SALES(2)
      COST(7)=Y(5)*SALES(4)
      COST(8)=Y(6)*SALES(5)
      COST(11)=DPA(K)
      COST(3)=EVAL(K,2)*EINV(K,2)+EVAL(K,4)*EINV(K,4)
      COST(3)=COST(3)-BINV(2)*BVAL(2)-BINV(4)*BVAL(4)
      COST(4)=COST(2)-COST(3)
      COST(5)=COST(1)-COST(4)
      DO 135 I=1,5
      COST(13)=COST(13)+Y(7)*RM(K,I)
  135 CONTINUE
      IF (HIST(K,2)-DPT(K)) 136,137,137
  136 DPT(K)=HIST(K,2)
  137 HIST(K,2)=HIST(K,2)-DPT(K)
      COST(12)=DCA(K)
      COST(15)=Z(5)
      DO 147 I=6,15
      COST(16)=COST(16)+COST(I)
  147 CONTINUE
      COST(17)=COST(5)-COST(16)
      HIST(K,1)=HIST(K,1)+COST(17)-COST(3)-DPT(K)
      IF(HIST(K,1)) 138,138,139
  138 HIST(K,2) = HIST(K,2)-HIST(K,1)
      HIST(K,1)=0.0
      GO TO 140
  139 COST(14) = HIST(K,2)*Z(4)
      A = HIST(K,1)-COST(14)
      IF(A) 140,141,141
  140 COST(14) = (HIST(K,2)-HIST(K,1))*(1.0/(1.0-Z(4))-1.0)
      HIST(K,2) = HIST(K,2)+COST(14)-HIST(K,1)
      HIST(K,1) = 0.0
      GO TO 142
  141 HIST(K,1) = A
  142 COST(16) = COST(16)+COST(14)
      COST(17)=COST(17)-COST(14)
      LL=MTIME+2
      DO 156 I=1,3
      RES(1,1)=RES(1,1)+DCA(I)
      RES(2,1)=RES(2,1)+DPA(I)
```

```
      RES(3,I)=PSLS(K,I)
      RES(4,I)=TMP(LL,I)
      IF (SSLS(I)) 143,143,144
  143 RES(5,I)=0
      GO TO 145
  144 RES(5,I)=(SLS(K,I)/SSLS(I))*100.
  145 RES(6,I)=DPRI(I)
  156 CONTINUE
C   UPDATE INFO FOR ANNUAL REPORT
C
      ZA(K,1)=ZA(K,1)+SALES(1)
      ZA(K,2)=ZA(K,2)+COST(17)
C
C   PRINT OUT RESULTS
C
  301 FORMAT (55H                                                    MARKSIM
     1 /)
  302 FORMAT (34H                                          FIRM,I4,10H    PERIOD,
     1I4,12H    INDUSTRY,I4//)
  303 FORMAT (32H I N C O M E   S T A T E M E N T/)
  304 FORMAT (14H SALES REVENUE,F58.0)
  305 FORMAT (23H      COST OF PRODUCTION,F39.0)
 1306 FORMAT (34H      MINUS, INCREASE IN INV. VALUE,F28.0)
 2306 FORMAT (33H      PLUS, DECREASE IN INV. VALUE,F29.0)
 1307 FORMAT (27H           COST OF GOODS SOLD,F45.0)
  307 FORMAT (F72.0)
  308 FORMAT (72H
     1          "--------)
  309 FORMAT (13H GROSS PROFIT,F59.0)
  310 FORMAT (41H      LESS, SELLING, ADM. AND GENERAL EXP.)
  311 FORMAT (28H           TRANS. TO RETAILERS,F34.0)
  312 FORMAT (39H           TRANS. TO DISTRIBUTION CENTERS,F23.0)
  313 FORMAT (30H           TRANS TO WHOLESALERS,F32.0)
  314 FORMAT (38H           INV. COSTS, FACTORY WAREHOUSE,F24.0)
  315 FORMAT (41H           INV. COSTS, DISTRIBUTION CENTERS,F21.0)
  316 FORMAT (37H           ADV. ALLOWANCES TO RETAILERS,F25.0)
  317 FORMAT (29H           NATIONAL ADVERTISING,F33.0)
  318 FORMAT (27H           MARKETING RESEARCH,F35.0)
  319 FORMAT (25H           INTEREST CHARGES,F37.0)
  320 FORMAT (22H           FIXED EXPENSE,F40.0)
  321 FORMAT (62H
     1--------)
  322 FORMAT (11H NET PROFIT,F61.0//)
  323 FORMAT (38H F I N A N C I A L   S T A T E M E N T/)
  324 FORMAT (24H      ENDING CASH BALANCE,F48.0)
  325 FORMAT (27H      ENDING INVENTORY VALUE,F45.0)
```

```
326 FORMAT (21H          TOTAL ASSETS,F51.0)
327 FORMAT (15H      LESS, DEBT,F57.0)
328 FORMAT (26H          OWNERS INVESTMENT,F46.0)
329 FORMAT (36H M A R K E T I N G   R E S E A R C H/)
330 FORMAT (34H      INDUSTRY NATIONAL ADVERTISING,F38.0)
331 FORMAT (37H      INDUSTRY ALLOWANCES TO RETAILERS,F35.0)
332 FORMAT (72H                                                  MARKET 1  M
   1ARKET 2  MARKET 3)
333 FORMAT (32H      COMPANY POTENTIAL SALES FOR)
334 FORMAT (30H         THIS PERIOD (IN UNITS),F22.0,F10.0,F10.0)
335 FORMAT (34H      INDUSTRY MARKET POTENTIAL FOR)
336 FORMAT (14H         PERIOD,I3,11H (IN UNITS),F24.0,F10.0,F10.0)
337 FORMAT (72H                                                    FIRM 1
   1 FIRM 2    FIRM 3)
338 FORMAT (33H      SHARE OF MARKET (IN PERCENT),F19.0,F10.0,F10.0)
339 FORMAT (30H      PRICES OF COMPETITORS ($),F22.0,F10.0,F10.0)
341 FORMAT (34H S A L E S   I N F O R M A T I O N/)
342 FORMAT (14H      RETAILERS/)
343 FORMAT (25H          SALES (IN UNITS),F27.0,F10.0,F10.0)
344 FORMAT (35H          TOTAL RETAIL SALES (UNITS),F37.0)
345 FORMAT (72H                                                  UNIT VAL
   1UE          UNITS)
346 FORMAT (28H          BEGINNING INVENTORY,F29.0,F15.0)
347 FORMAT (25H          ENDING INVENTORY,F32.0,F15.0/)
348 FORMAT (16H      WHOLESALERS/)
349 FORMAT (38H          ORDERS FROM RETAILERS (UNITS),F34.0)
350 FORMAT (40H          DELIVERIES TO RETAILERS (UNITS),F32.0)
351 FORMAT (39H          SELLING PRICE TO RETAILERS ($),F33.0)
352 FORMAT (39H             RECEIPTS FROM RETAILERS ($),F33.0)
353 FORMAT (25H      DISTRIBUTION CENTRES/)
354 FORMAT (42H             COMPANY SALES TO RETAILERS ($),F30.0)
355 FORMAT (22H      FACTORY WAREHOUSE/)
356 FORMAT (40H          ORDERS FROM WHOLESALERS (UNITS),F32.0)
357 FORMAT (42H          DELIVERIES TO WHOLESALERS (UNITS),F30.0)
358 FORMAT (41H          SELLING PRICE TO WHOLESALERS ($),F31.0)
359 FORMAT (44H             COMPANY SALES TO WHOLESALERS ($),F28.0)
360 FORMAT (43H          SHIPMENTS TO DIST. CENTERS (UNITS),F29.0)
361 FORMAT (39H          PRODUCTION THIS PERIOD (UNITS), F33.0)
362 FORMAT (1H1)
270 FORMAT (2H  )
    DO 2 JJJ=1,NCOPY
    WRITE(3,362)
    GO TO (281,282,283), K
281 WRITE(3,371)
    GO TO 284
282 WRITE(3,372)
```

```
      GO TO 284
283   WRITE(3,373)
284   WRITE(3,270)
273   WRITE(3,301)
      WRITE(3,302)  K, MTIME, MIND
      WRITE(3,303)
      WRITE(3,304)  COST(1)
      WRITE(3,305)  COST(2)
      A=0.0-COST(3)
      IF (COST(3)) 241,242,242
241   WRITE(3,2306)  A
      GO TO 243
242   WRITE(3,1306)  A
243   WRITE(3,1307)  COST(4)
      WRITE(3,308)
      WRITE(3,309)  COST(5)
      WRITE(3,310)
      WRITE(3,311)  COST(6)
      WRITE(3,312)  COST(7)
      WRITE(3,313)  COST(8)
      WRITE(3,314)  COST (9)
      WRITE(3,315)  COST(10)
      WRITE(3,316)  COST(11)
      WRITE(3,317)  COST(12)
      WRITE(3,318)  COST(13)
      WRITE(3,319)  COST(14)
      WRITE(3,320)  COST(15)
      WRITE(3,321)
      WRITE(3,307)  COST(16)
      WRITE(3,308)
      WRITE(3,322)  COST(17)
      WRITE(3,323)
      WRITE(3,324)  HIST(K,1)
      A=EINV(K,2)*EVAL(K,2)+EINV(K,4)*EVAL(K,4)
      WRITE(3,325)  A
      WRITE(3,308)
      A=A+HIST(K,1)
      WRITE(3,326)  A
      WRITE(3,327)  HIST(K,2)
      A=A-HIST(K,2)
      WRITE(3,308)
      WRITE(3,328)  A
      WRITE(3,329)
      IF (RM(K,1)) 213,213,212
212   WRITE(3,330)  RES(1,1)
213   IF (RM(K,2)) 215,215,214
```

```
214 WRITE(3,331)  RES(2,1)
215 WRITE(3,332)
    IF (RM(K,3)) 217,217,216
216 WRITE(3,333)
    WRITE(3,334)  RES(3,1), RES(3,2), RES(3,3)
217 IF (RM(K,4)) 219,219,218
218 WRITE(3,335)
    IA=MTIME+2
    WRITE(3,336)  IA, RES(4,1), RES(4,2), RES(4,3)
219 IF (RM(K,5)) 221,221,220
220 WRITE(3,338)  RES(5,1), RES(5,2), RES(5,3)
221 WRITE(3,337)
222 WRITE(3,339)  RES(6,1), RES(6,2), RES(6,3)
225 WRITE(3,362)
    WRITE(3,341)
    WRITE(3,342)
    WRITE(3,343)  SLS(K,1), SLS(K,2), SLS(K,3)
    WRITE(3,344)  SALES(1)
    I=1
210 WRITE(3,345)
    WRITE(3,346)  BVAL(I),BINV(I)
    WRITE(3,347)  EVAL(K,I), EINV(K,I)
    GO TO (200,202,201,2), I
200 WRITE(3,348)
    WRITE(3,349)  ORDER(3)
    WRITE(3,350)  SALES(3)
    WRITE(3,351)  PRICE(1)
    A=PRICE(1)*SALES(3)
    WRITE(3,352)  A
    I=3
    GO TO 210
201 WRITE(3,353)
    WRITE(3,349)  ORDER(2)
    WRITE(3,350)  SALES(2)
    WRITE(3,351)  PRICE(1)
    A=PRICE(1)*SALES(2)
    WRITE(3,354)  A
    I=2
    GO TO 210
202 WRITE(3,355)
    WRITE(3,356)  ORDER(5)
    WRITE(3,357)  SALES(5)
    WRITE(3,358)  PRICE(2)
    A=PRICE(2)*SALES(5)
    WRITE(3,359)  A
    WRITE(3,360)  ORDER(4)
```

```
      WRITE(3,361)  HIST(K,4)
      I=4
      GO TO 210
    2 CONTINUE
  168 CONTINUE
C
C   PRINT                    ANNUAL REPORT
C
      IF ((MTIME/4)*4-MTIME) 405,410,405
  410 DO 450 I=1,3
      WRITE(3,362)
      WRITE(3,301)
      WRITE(3,302)  I, MTIME, MIND
  364 FORMAT (37H A N N U A L   R E P O R T   (PERIODS,I3,2H -,I3,1H)//)
      II=MTIME-3
      WRITE(3,364)  II, MTIME
      DO 430 K=1,3
      WRITE(3,365)  K
  365 FORMAT (37H                                        FIRM,I2//)
      WRITE(3,366)  ZA(K,1)
      WRITE(3,367)  ZA(K,2)
  366 FORMAT (30H      SALES TO CONSUMER (UNITS),F42.0)
  367 FORMAT (27H      COMPANY NET PROFIT ($),F45.0/)
      WRITE(3,324)  HIST(K,1)
      A=EINV(K,2)*EVAL(K,2)+EINV(K,4)*EVAL(K,4)
      WRITE(3,325)  A
      WRITE(3,308)
      A=A+HIST(K,1)
      WRITE(3,326)  A
      WRITE(3,327)  HIST(K,2)
      A=A-HIST(K,2)
      WRITE(3,308)
      WRITE(3,328)  A
  430 CONTINUE
  450 CONTINUE
      DO 460 K=1,3
      DO 460 I=1,4
      ZA(K,I)=0.0
  460 CONTINUE
C
C   PUNCH NEW HISTORY
C
  405 MTIME=MTIME+1
      NPER=NPER-1
      IF (NPER) 240,240,16
  240 DO 230 K=1,3
  235 WRITE(2,9)  MTIME, K, MIND
      GO TO (741,742,743), K
  741 WRITE(2,371)
      GO TO 260
  742 WRITE(2,372)
      GO TO 260
  743 WRITE(2,373)
  260 DO 230 I=1,4
      WRITE(2,5)  EINV(K,I), EVAL(K,I), HIST(K,I), ZA(K,I)
  230 CONTINUE
      NOIND=NOIND-1
      IF (NOIND) 1300,1300,25
 1300 STOP
      END
```

APPENDIX 2 Response function forms used in the MARKSIM simulation

A simulation that is to be used only in a training function and not as an explanation of the real world allows the modeller to use any functions which have the desired general characteristics. The function does not have to explain or fit any existing data. Greenlaw [8] suggests that useful forms of equations for use in this type of simulation fall into four categories:

(i) Returns decreasing at a diminishing rate (as input increases).
(ii) Returns decreasing first at an increasing rate than at a diminishing rate.
(iii) Returns increasing at a diminishing rate.
(iv) Returns increasing first at an increasing rate than at a diminishing rate.

In our case 'National Advertising' and 'Retail Advertising Allowance' come under category (iv) and 'Price/Quality' comes under category (ii). The 'Quality' response function used for market segmentation is of another type and will be discussed later.

A single general form of parametric equation can represent all the above cases, and the parameters can be estimated easily by giving only two points for cases (i) and (iii) and three points for the curves with inflection (ii) and (iv).

This form is:

$$R = \left(C_1 + C_2 \left(\frac{C_3 + C_4^{\,n}}{C_5 + (D - C_6)^n} \right) \right) \qquad (1)$$

Where: R is response

D is decision or input

$C_1 \ldots C_6$, n are parameters

$R, D \geq 0$

The specific forms of the equation are:

(i) Decreasing returns at a diminishing rate.

$C_1 = \lim_{D \Rightarrow \infty} R$

$C_2 = 1$

$C_4 = 0$

$C_6 = 0$

$n = 1$

i.e.
$$R = C_1 + \frac{C_3}{C_5 + D} \qquad (2)$$

For any desired limit, C_1, of R, values of $C_3 + C_5$ may be determined so that the curve passes through two chosen points (D_1,R_1) and (D_2,R_2) by solving the simultaneous equations:

$$C_3 = (C_5 + D_1)(R_1 - C_1) \tag{3}$$

$$C_5 = \frac{D_2(C_1-R_2) + D_1(R_1-C_1)}{R_2 - R_1} \tag{4}$$

(ii) To convert this function to an S shaped decreasing return curve we need only adjust n to a value greater than 1. We can easily pick two points, (one of them being the desired inflection point) solve as above, then pick a third point and solve n for the third point. It is easiest to solve this when $R_1 = 1$, $D_1 = 0$ and $C_1 = 0$.

In this case $C_1 = C_5$ (from equation (3) above), and

$$C_5 = \frac{-R_2D_2}{R_2 - 1} = \frac{R_2D_2}{1 - R_2} \tag{5}$$

To reshape the curve so that it passes through a third point (D_3,R_3) we first need to define a new parameter C_{50} such that

$$R_2 = \frac{C_{50}}{C_{50} + D_2^{\,n}} \tag{6}$$

Substituting for R_2 in equation (5)

$$C_5 = \frac{C_{50}D_2}{D_2^{\,n}} \tag{7}$$

or

$$C_{50} = C_5\, D_2^{\,n-1} \tag{8}$$

So that the curve passes through the third specified point C_{50} must also satisfy:

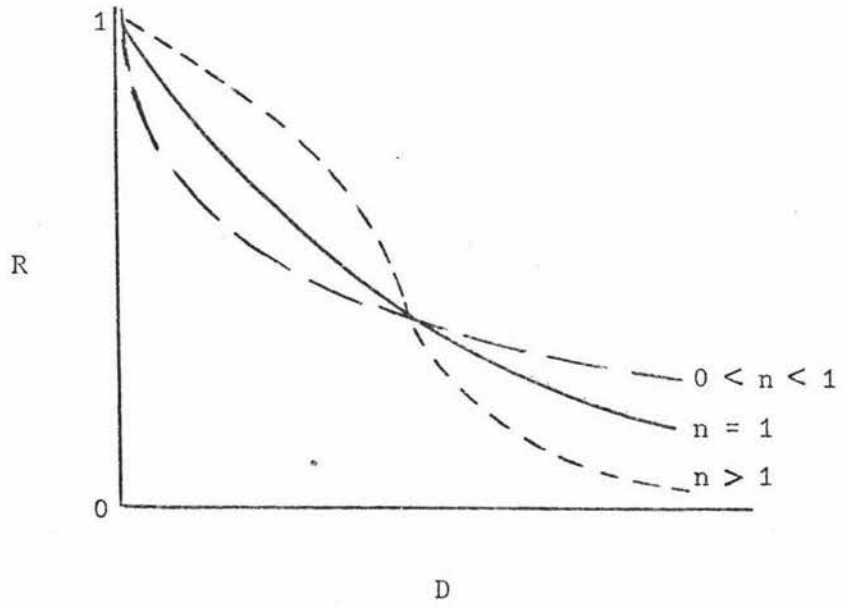
$$R_3 = \frac{C_{50}}{C_{50} + D_3^{\,n}} \tag{9}$$

Solving the pair of simultaneous equations (8) and (9) for n we get

$$n = \frac{\log D_2 - \log C_5 - \log(1-R_3) + \log R_3}{\log D_2 - \log D_3} \tag{10}$$

This same procedure can be used to change the rate of diminishing return for curves of category (i) by using $0 < n < 1$.

This is best shown in the following diagram which illustrates the family of X curves $R = C_1 + \frac{C_3}{C_5 + D^n}$



As mentioned it is easiest to determine n when $R_1 = 1$, $D_1 = 0$.

To shift the origin it is a simple matter of defining a new set of D and R values such that $d_1 = 0$, $r_1 = 1$. We use $C_6 = D_1$

i.e. $d = (D - C_6)$ and $r = \frac{C_{50}}{C_{50} + (D - C_6)^n}$

The response function used for Price/Quality ratio in the MARKSIM simulation is of form (ii), (i.e. $n > 1$) and illustrates this function.

The function is

$$R = \frac{1.5 \times 21.887}{21.887 + [D - 1]^{4.0707}}$$

where D is the ratio P/Q.

(iii) Diminishing increasing returns

In this case C_2 is - $\lim_{D \Rightarrow \infty} R$

$C_1 = 0$

$C_4 = D$

$C_6 = 0$

$n = 1$

i.e. $$R = C_2\left(\frac{C_3 + D}{C_5 + D}\right) \tag{11}$$

The two undefined parameters are easily solved:

$$C_3 = \frac{R_1C_5 + R_1D_1 - C_2D_1}{C_2} \tag{12}$$

$$C_5 = \frac{R_1D_1 - R_2D_2 - C_2D_1 + C_2D_2}{R_2 - R_1} \tag{13}$$

As in the decreasing returns case there are many curves which pass through these points and satisfy the above conditions. These are the family of curves.

$$R_2 = C_2\left(\frac{C_3 + D^n}{C_5 + D^n}\right) \tag{14}$$

or in the basic form passing through the origin;

$$C_2 = 1$$
$$R_1 = 0$$
$$D_1 = 0$$
$$C_3 = 0$$
$$C_4 = D$$

$$R = \frac{D^n}{C_5 + D^n} \tag{15}$$

All equations of this form will define curves passing through the origin and approaching a limit of R = 1.

Again, to shift the origin we first obtain C_5, letting n = 1

i.e. $$C_5 = \frac{D_2(1-R_2)}{R_2} \tag{16}$$

Then we generate the new parameter C_{50}, to replace C_5 when $(D_1,R,)$ is not at the origin. This is, as before:

$$C_{50} = C_5(D_2)^{n-1} \tag{17}$$

n is then solved for a third point as:

$$n = \frac{\log D_2 - \log C_5 + \log(1-R_3) - \log R_3}{\log D_2 - \log D_3} \tag{18}$$

For non zero origin and non unit limit the general form becomes:

$$R = C_1 + C_2 \left(\frac{(D-C_6)^n}{C_{50} + (D-C_6)^n} \right) \qquad (19)$$

Again to solve this we set up a new set of points with,

$$C_6 = D_1$$

$$C_1 = R_1$$

then, as in the case of decreasing returns we can solve for any origin and limit.

Functional form used for market segmentation response function in MARKSIM

The functional form is used for the response to quality of the product the retailer is selling. The response is of the type

$$R = C_1 X^{n-1} - C_2 X^n \qquad (20)$$

Where: R is the response

X is the actual quality level

C_1, C_2 and n are parameters.

Curves of this form first increase, then plateau at a maximum then decrease. Note that for MARKSIM market (1) as published, the curve does not reach its maximum in the allowable range.

These curves can be symmetrical or skewed depending on the parameters.

The solution of parameters is as follows:

$$n = \frac{X_2}{X_2 - X} \qquad (21)$$

where: X is the quality level at which R will be maximised

X_2 is the quality level greater than X for which R will equal 0.

$$C_2 = \frac{R \text{ max}}{X_2 X^{n-1} - X^n} \qquad (22)$$

where: R max is the maximum level of response (corresponding to X)

$$C_1 = C_2 X_2 \qquad (23)$$

If, as in the MARKSIM simulation, we want the curve to cross the X axis at 2 points, neither of which is the origin we can:

(i) define the paramaters as above, letting X_2 equal the difference between

the two points at which the curve will cross the X axis, and X_1 equal (the highest of the axis crossing values of X, minus the X value corresponding to R max.).

(ii) then modify the final parametric equation obtained by substituting (x-a) for X in the equation, where a is the lowest of the two axis crossing X values.)

Note Routines have to be included to test upper and lower limits of X to avoid producing negative response when using these functions in a computer application.

APPENDIX 3 MARKSIM Player Decision Form

MARKSIM
Decision form A
IBM 700/7000 SERIES

Period		Firm			Industry
1	2	4		6	7

OPERATING DECISIONS				
				National Advertising ($ Thousands)
10	11	12	13	
				Advertising Allowances to Retailers ($Thousands)
15	16	17	18	
				Quality ($)
21	22	23		
				Price ($)
26	27	28		
				Production (Thousands)
31	32	33		
				Shipments to Distribution Centers (Thousands)
36	37	38		
				Debt Payment ($ Thousands)
41	42	43	44	

MARKETING RESEARCH INFORMATION	
	(1 = Purchased; 0 = Not Purchased)
	Industry National Advertising
47	
	Industry Advertising Allowances to Retailers
48	
	Company Potential Sales for This Period
49	
	Market Potentials for Next Period
50	
	Own Share of Market
51	

APPENDIX 4 Questionnaires Administered to Players of MARKSIM

QUESTIONNAIRE FOR

300 LEVEL MARKETING STUDENTS

Q.1 Have you, as part of your course work at Massey, played the business game MARKSIM?

Yes ☐
No ☐

If Yes: Was it... this year ☐
last year ☐

Q.2 Have you played any other business game either inside or outside the university? (INCLUDE BOTH COMPUTERISED AND MANUALLY SCORED GAMES)

Yes ☐
No ☐

If Yes: Give details of what games and where played.

Q.3 What is your most prominent memory of any business games you have played? (EXPLAIN IN DETAIL)

Q.4 a) Do you think that business games of the MARKSIM type are a useful way to use some of the time allocated to courses in Marketing?

Yes ☐
No ☐

b) Why is that?

---

c) What percentage of the 300 level marketing course time should be allocated to.....

Lectures	____%
Business games	____%
Case studies	____%
Seminars	____%
Other (specify)	____% _____
	____% _____
	____% _____
	100%

d) What percentage of your final grade should come from ...

Playing business games	____%
Case studies	____%
Final exam	____%
Seminars	____%
Term exams	____%
Other (specify)	____% _____
	____% _____
	____% _____
	100%

Q.5 (ANSWER ONLY IF YOU HAVE PLAYED MARKSIM)

From what you remember of playing MARKSIM, which of the following modifications to the game would you consider beneficial for students playing the game at 300 level. (YOU MAY TICK MORE THAN ONE)

- ☐ Reduction of the scale of operations to that faced by New Zealand businesses
- ☐ A greater number of decisions to be made each period
- ☐ A smaller number of decisions to be made each period
- ☐ Shorter time between rounds of play
- ☐ More analysis and reporting between rounds
- ☐ Play on a 1-person per firm basis, rather than in teams
- ☐ Other (please describe)

_____

_____

_____

ALL ANSWER

Q.6 a) Do you think it would be useful to play a Marketing business game in 300 level courses?

Yes ☐ GO TO 6b)
No ☐ Why not? _____

_____

_____ GO TO Q.8

If YES:

b) What would be the main benefits of playing a game at 300 level?

_____

_____

_____

c) Do you think the MARKSIM game, as it has been played at 200 level, would satisfy this need?

Yes ☐
No ☐

d) Compared with MARKSIM, would you prefer (at 300 level) a game that was..... (YOU MAY TICK MORE THAN ONE)

☐ More Complex
☐ More Realistic
☐ Less time between rounds of play
☐ Other (please state)

_____

_____

_____

Q.8 What do you consider to be the most useful thing that can be learnt from playing business games?

_____

_____

_____

_____

QUESTIONNAIRE FOR

STUDENTS WHO PLAYED 'MARKSIM' GAME DURING 1976

ALL QUESTIONS REFER TO THE MARKSIM GAME AND YOUR EXPERIENCE WITH IT

Q.1 a) Would the game have benefited you more if you played it on a one individual per firm basis rather than the group basis used this year?

Prefer individual ☐
Prefer group ☐

b) Given a group basis, would you prefer functional positions like 'Advertising Manager' and 'Finance Controller' to be ....

TICK ONE

☐ Assigned to individuals by the lecturer in charge?

☐ Decided within the group?

☐ Rotated between periods of play?

Q.2 a) Did you find the basic period reports provid adequate information for your decision making procedures?

Yes ☐
No ☐

b) Can you suggest any improvements in the basic reports?

(STATE FULLY) _____

_____

_____

c) Which of the following apply to the optional Market Research reports? (YOU MAY TICK MORE THAN ONE)

Very useful ☐
Of little use ☐
Expensive ☐
Too cheap ☐
Unrealistically accurate ☐
Would prefer more options/ Different information ☐

d) Which piece(s) of Market Research did you find most useful? (YOU MAY TICK MORE THAN ONE)

Industry national advertising ☐
Industry Adv. Allowances to Ret. ☐
Co. potential sales for THIS period ☐
Market potentials for next period ☐
Own share of market ☐

e) Do you have any suggestions for additional <u>useful</u> pieces of Market Research? (PLEASE STATE)

---

f) Would you prefer the 'Annual Report' to include the industries other than that in which your firm is competing?

Yes ☐
No ☐
Irrelevant ☐

g) Would you like some other measure of your classmates performance, such as a 'Share Market' showing an index for each of the firms in each industry?

Yes ☐
No ☐
Don't know ☐

Q.3 a) Did you find the length of time between decisions...

too long? ☐
about right? ☐
too short? ☐
OK to start with but too long) once I was familiar with the game? ☐

b) What do you think the ideal period between decisions is?

---

c) 'Leapfrogging' describes a method of organising game play so that decisions are not delayed by clerical or computer turnaround problems. If 'leapfrogging', firms make the decision for period 3 while period 2 is being processed (ie, the last information they have is for period 1). They then receive the results of period 2 and make the decision for period 4 while period 3 is running. This has been described as a more realistic similation of real business decision making.

Do you think it is..

a good idea ☐
a bad idea ☐
unduly complicated ☐
other (please state) ☐ _____

_____

d) How many periods of play do you think one required to familiarise yourself with the game and its rules?

1 ☐
2 ☐
3-4 ☐
5-6 ☐
7-8 ☐
More ☐

e) How many periods of real play do you think would be ideal for the course you have just completed?

Less than we had ☐
About as many as we had ☐
More than we had ☐
Many more than we had ☐

Q.4 a) Was the relationship between the decision variables and the effect on your firm's sales....

obscure? ☐
obvious? ☐
reasonably clear? ☐
Other (please state) ☐ _____

_____

b) Do you think the game should be more complex in terms of having a greater number of decisions?

Yes ☐
No ☐

If YES; Should there be i) More general decisions, such as salesforce expenditure? ☐

or ii) More detailed decisions, such as Advertising Media Mix? ☐

c) How many years do you expect to pass before you take a real decision the same type as any one of the MARKSIM decisions? _____ years

d) If you were a Marketing Manager, do you think it would be feasible to fit a model, such as that used by MARKSIM, to your own industry and use it for strategy development?

Yes ☐
No ☐
Don't know ☐

Q.5 a) Did your MARKSIM firm achieve the objectives it set at the beginning of play?

Yes ☐
No ☐

If NO; What was the reason you did not achieve them?

---

b) Did you make a 'do or die' attempt in the last few periods of play?

Yes ☐
No ☐

If YES; What were you attempting to achieve?

Q.6 a) Do you think the game was 'realistic'?

Yes ☐
No ☐

b) Would you prefer it to be more realistic?

Yes ☐
No ☐

c) What suggestions do you have for making it more realistic?

---

d) Which of the following statements do you agree with most strongly?

I) "Students can often go away from a session of game play believing that the actual decisions they made during play have external validity in the real world. It is generally recognised that the more realistic the game is the higher the chance of this type of erroneous carryover taking place."

II) "The more precisely a game simulates the real world, the more effective it is in training students to make real decisions."

AGREE MORE WITH I ☐ (TICK ONE ONLY)
AGREE MORE WITH II ☐

Q.7 Did you experience trouble with any of the following administrative areas? (TICK AND COMMENT ON PROBLEM AREAS)

		Comments
Access to the game administrators	☐	
Understanding/Remembering the decision rules	☐	
Using the decision forms correctly	☐	
Understanding the objectives of the game	☐	
Finding time for your group to meet	☐	
Finding a place for your group to meet	☐	
Other	☐	

Q.8 a) Do you think that business games of the MARKSIM type are a useful way to use some of the time allocated to courses in Marketing?

Yes ☐
No ☐

b) Why is that?

_____

_____

_____

c) What percentage of the 300-level marketing course time should be allocated to.....

Lectures	☐ %	
Business games	☐ %	
Case studies	☐ %	
Seminars	☐ %	
Projects	☐ %	
Other (specify)	☐ %	_____
	☐ %	_____
	100%	

d) What percentage of your final grade should come from....

playing business games	☐ %	
case studies	☐ %	
final exam	☐ %	
seminars	☐ %	
term exams	☐ %	
projects	☐ %	
other (specify)	☐ %	_____
	☐ %	_____
	100%	

Q.9 What do you consider to be the most useful thing that can be learnt from playing business games?

_____

_____

_____

_____

APPENDIX 5

Details and Results of Surveys of 300 and 200 Level Students who had played MARKSIM

A5.1 Results of a survey of 300 level students carried out at the completion of their Bachelor degree studies.

These students had played MARKSIM in the Marketing Strategy course during the second year of their 3 year degree.

The questions asked, and their results, have been divided into the following logical sections:

A5.1.1 Gaming experience

A5.1.2 Gaming evaluation (general)

A5.1.3 Evaluation of MARKSIM in the content of marketing courses and suggested improvements

Questionnaires were completed by 26 of the 30 300 level students enrolled in 1976, and a copy of the questionnaire is included in Appendix 6.

A summary of the following results together with a summary of the results of a survey of 200 level students appears in Section 5.3.3.

A5.1.1 Gaming Experience

Q.1 "Have you, as part of your course work at Massey, played the business game MARKSIM?"

All 26 respondents had played MARKSIM.

Q.2 "Have you played any other business game either inside or outside the university? (INCLUDE BOTH COMPUTERISED AND MANUALLY SCORED GAMES)

Yes ☐
No ☐

If Yes: Give details of what games and where played."

12 (46%) of students had played other games.
14 (54%) of students had not played other games.

Of the 12 who had played other games;
- 7 had played the Inter-Secondary School business game
- 3 had played monopoly
- 2 had played a game in Ag-Hort. Prod. Systems courses at Massey
- 1 had played a game in Operations Research courses at Massey

A5.1.2 Gaming Evaluation (General)

Q.3 "What is your most prominent memory of any business games you have played?" (EXPLAIN IN DETAIL)
Answers were grouped as follows:

Answer	Number of students
No answer	11
The games were "interesting"	4
Existence of a strong profit motive	4
The games were "challenging"	2
There was not enough decision making	1
It was realistic	1
Effort put into group discussions	1
Effort put into analysing decisions	1
The experience was "useless"	1
	26

If it is assumed that those who did not answer the questions had neutral feelings about gaming experience these results could be summarized in the following manner;

Positive attitudes	13
Neutral attitudes	11
Negative attitudes	2
	26

Q.8 "What do you consider to be the most useful thing that can be learnt from playing business games?"

Answers were grouped as follows;

Answer	Number of Students
No answer	11
General experience in decision-making	5
Learning to use effective strategies	4
Practical application of theory	2
Coordination of the group for planning and analysis functions	2
Interrelationships of variables in the marketing mix	2

A5.1.3 Evaluation of MARKSIM in the content of marketing courses and suggested improvements in MARKSIM

Q.4 a) "Do you think that business games of the MARKSIM type are a useful way to use some of the time allocated to courses in Marketing?"

Yes ☐
No ☐

b) "Why is that?"

16(62%) of the 26 respondents answered "YES" to question 4a), and 14 of these gave reasons as follows:

Reasons	No. of students
A chance for "practical" application of theory	10
Leads to a better understanding of "Marketing"	3
As a demonstration of the need for planning	1
	14

Q.4 c) "What percentage of the 300 level marketing course time should be allocated to ...

Lectures	%
Business games	%
Case studies	%
Seminars	%
Other (specify)"	%
	% ----------
	% ----------
	% ----------
	100%

Consideration was only given to the percentage assigned to each activity. Some students did not complete the entire 100% assignment but assigned percentages only to the activities they regarded as important. The results are presented as a distribution of suggested time allotment for each activity.

Activity	Percentage of Time Allocated 0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	No. of Answers
Lectures	-	-	-	3	7	6	6	2	24
Business Games	-	11	5	3	-	-	-	-	19
Case Studies	-	7	12	2	2	-	-	-	23
Seminars	-	10	7	5	-	-	-	-	22
Other*	-	8	3	-	-	-	-	-	11

*Individual projects and guest speakers from industry.

It appears that these 300 level students place approximately the same weight on business games and seminars, but slightly more weight on the traditional form of simulation, the case study.

d) "What percentage of your final grade should come from:

Playing Business Games ___ %
Case studies ___ %
Final exam ___ %
Seminars ___ %
Term exams ___ %
Other (specify)" ___ %
___ % _____
___ % _____
___ % _____
100%

For this question blank boxes were assumed to indicate 0% rather than a non-response.

Activity	Percentage of final course grade allocated 0-10	11-20	21-30	31-40	41-50	51-60	61-70	No. of Answers
Business Games	10	6	7	3	-	-	-	26
Case Studies	6	8	5	4	2	-	1	26
Final Exams.	2	2	2	8	7	3	2	26
Seminars	5	7	11	3	-	-	-	26
Term Exams.	11	7	7	1	-	-	-	26
Other*	20	2	1	2	1	-	-	26

*Individual Projects.

Q.6 a) "Do you think it would be useful to play a Marketing business game in 300 level courses?"

Yes ☐
No ☐

Answer	Number of Respondents
Yes	14
No	6
No answer	6
	26

If Yes to 6a).

b) "What would be the main benefits of playing a game at 300 level?"

Benefit	No. of Students
Practical application of theory, (especially if specialized games were used for commodity marketing and international marketing courses)	9
Further experience in decision making process	4
No answer	1
	14

If No to 6a)

"Why would it not be useful to play a business game at 300 level?"

Reason	No. of Students
Takes too much time	2
200 level course covers experience adequately	2
More benefit from individual projects	1
No reason	1
	6

c) "Do you think the MARKSIM game, as it has been played at 200 level, would satisfy this need?"

	No. of students
Yes	2
No	5
No reply	7
	14

d) "Compared with MARKSIM, would you prefer (at 300 level) a game that was .... (YOU MAY TICK MORE THAN ONE)

☐ More Complex

☐ More Realistic

☐ Less time between rounds of play

☐ Other (please state)"

Changes	No. of Students
More complex	4
More realistic	6
Less time between rounds of play	1
Other	-
	11

Q.5 (ANSWER ONLY IF YOU HAVE PLAYED MARKSIM)

"From what you remember of playing MARKSIM, which of the following modifications to the game would you consider beneficial for students playing the game at 300 level". (YOU MAY TICK MORE THAN ONE)

☐ Reduction of the scale of operations to that faced by New Zealand businesses

☐ A greater number of decisions to be made each period

☐ A smaller number of decisions to be made each period

☐ Shorter time between rounds of play

☐ More analysis and reporting between rounds

☐ Play on a 1-person per firm basis, rather than in teams

☐ Other (please describe)_____
_____

Specific changes to MARKSIM for 300 level use	No. of students
Reduction of the scale of operations*	5
Greater number of decisions each period	5
Smaller number of decisions each period	2
Shorter time between rounds of play	3
More analysis and reporting between rounds	4
Play on a 1-person per firm basis	2
Other ("Greater discussion with lecturers about business trends")	1

*These students played the original U.S.A. scale version of MARKSIM whereas the students surveyed at 200 level played a reduced scale version.

The results of questions 6d) and 5 are consistent in their appeal for a game which is more realistic and more complex than the game MARKSIM, currently used only at 200 level.

A5.2 Results of a survey of 200 level students carried out at the completion of MARKSIM play.

These students played the modified version of MARKSIM with scale reduced by a factor of 10 to resemble the New Zealand scale of business, and also with market segmentation altered to better reflect marketing theory.

The questionnaire was completed by 15 of 20 200 level students who played the game in 1976. A copy of the questionnaire is included in Appendix VI.

The questions asked have been divided into the following logical sections.

A5.2.1 Evaluation of MARKSIM in the content of the course 'Marketing Strategy'

A5.2.2 Group dynamics

A5.2.3 Reports and output options

A5.2.4 Aspects of timing

A5.2.5 Decisions and the model

A5.2.6 Other problems

A5.2.7 Aspects of Realism

A summary of the following results together with a summary of the results of the survey of 300 level students appears in section 5.3.

A5.2.1 Evaluation of MARKSIM in the content of the course 'Marketing Strategy'.

Q.8 (a) Do you think that business games of the MARKSIM type are a useful way to use some of the time allocated to courses in Marketing?

(b) Why is that?

All 15 respondents agreed that business games of this type were useful allocations of course time.

Reasons were given as follows:

Reasons	No. of Students
Practical experience is not available from other exercises	9
Specifically, "experience at decision making"	2
Appreciation of Co's position when making decisions	1
Appreciation of inventory management	1
Appreciation of complexity of decision making	1
Adds variety to course	1
	15

8. (c) What percentage of the 300 level marketing course time should be allocated to .....

Lectures	%
Business games	%
Case studies	%
Seminars	%
Projects	%
Other (specify)	%
	100%

Not all students allocated 100% of course time so a distribution of percentages assigned to each activity is presented.

Percentages of course time

Activities	0-10	11-20	21-30	31-40	41-50	51-60	No. of students replying
Lectures	3	-	1	3	7	1	15
Business games	5	2	4	3	1	-	15
Case studies	5	8	1	1	-	-	15
Seminars	5	8	2	-	-	-	15
Projects	3	4	5	2	1	-	15
Other	13	1	1	-	-	-	15

8. (d) What percentage of your final grade should come from .....

Playing business games	%
Case studies	%
Final exam	%
Seminars	%
Term exams	%
Projects	%
Other (specify)	%
	%

100%

Percentage of final grade

Activities	0-10	11-20	21-30	31-40	41-50	51-60	61-70	No. of Replies
Business games	4	2	3	4	2	-	-	15
Case studies	6	3	5	-	1	-	-	15
Final examination	4	-	2	5	3	-	1	15
Seminars	7	6	1	1	-	-	-	15
Terms examinations	6	3	5	1	-	-	-	15
Projects	9	2	3	-	1	-	-	15
Other	15	-	-	-	-	-	-	15

By inspection of the distribution of answers to question 8 (c), this group of 200 level students allocated course time to activities in three classes:

Primary - Lectures

Secondary - Business games and projects

Tertiary - Case studies and seminars

Allocation of final grade influence amongst activities can be summarized in a similar fashion by ranking the activities by the number of students who allocated greater than 20% to each.

This ranking is as follows:

Rank	Activity	No. of students allocating greater than 20% of grade
1	Final examination	11
2	Business games	9
3=	Case studies	6
3=	Terms examinations	6
5	Projects	4
6	Seminars	2

Q.9 What do you consider to be the most useful thing that can be learnt from playing business games?

Statement	No. of students
No response	3
General business experience	3
Take all variables into account	2
Observe interaction of variables	2
Group dynamics	2
Allow for contingent outcomes	1
Harder than expected to make profits	1
Competitive environment	1
	15

Q.4 (c) How many years do you expect to pass before you take a real decision the same type as any one of the MARKSIM decisions? _____ years

Answer	No. of students
Don't know	4
2 years	2
3 years	1
4 years	5
5 years	1
8 years	2
	15

Q.4 (d) If you were a Marketing Manager, do you think it would be feasible to fit a model, such as that used by MARKSIM, to your own industry and use it for strategy development?

Answer	No. of students
Yes	8
No	1
Don't know	6
	15

A5.2.2 Group dynamics

Q.1 (a) Would the game have benefited you more if you played it on a one individual per firm basis rather than the group basis used this year?

	No. of students
Prefer individual	5
Prefer group	10
	15

(b) Given a group basis, would you prefer functional positions like 'Advertising Manager' and 'Finance Controller' to be ...

TICK ONE

☐ Assigned to individuals by the lecturer in charge?

☐ Decided within the group?

☐ Rotated between periods of play?

	No. of students
Assigned to individuals by the lecturer in charge	2
Decided within the group	2
Rotated between periods of play	11
	15

A5.2.3 Reports and output options

Q.2 (a) Did you find the basic period reports provide adequate information for your decision making procedures?

Yes ☐

No ☐

Answers	No. of students
Yes	12
No	3

Q.2 (b) Can you suggest any improvements in the basic reports? (STATE FULLY)

Only two suggestions were recorded. These were:

(i) Market Research should be free

(ii) More information on competitors should be available.

The first of these is obviously unrealistic but the second is realistic and feasible.

(c) Which of the following apply to the optional Market Research reports? (YOU MAY TICK MORE THAN ONE)

Very useful	☐
Of little use	☐
Expensive	☐
Too cheap	☐
Unrealistically accurate	☐
Would prefer more options/different information	☐

Attribute	No. of students responding positively to attribute
Very useful	11
Of little use	1
Expensive	1
Too cheap	1
Unrealistically accurate	2
Would prefer more or different information	7

Q.2 (d) Which piece(s) of Market Research did you find most useful?
(YOU MAY TICK MORE THAN ONE)

Industry national advertising ☐
Industry advertising allowances to retailers ☐
Company potential sales for THIS period ☐
Market potentials for next period ☐
Own share of market ☐

M.R. Item	No. of students responding
Industry national advertising	5
Industry advertising allowances to retailers	5
* Company potential sales for THIS period (DEMAND)	3
** Market potentials for next period	9
Own share of market	12

* Some perceptive students have recognised that this item can be calculated in total (not by market segments) from retailers' orders from distribution centres and wholesalers, which are designed to bring ending inventory up to 1.2 times this total demand.

** During the course of game play some emphasis is placed on cyclical fluctations in demand and ad hoc major changes in the relative demand in the market segments. Students are therefore especially aware of total industry demand fluctations.

Q.2. (e) Do you have any suggestions for additional <u>useful</u> pieces of Market Research? (PLEASE STATE)

6 of the 15 students had suggestions for additional useful pieces of information as follows:

*Individual competitors advertising expenditure	(2 students)
A stock exchange or some similar inter-industry comparison	(1 student)
** Quality of competitors retail stock	(1 student)
*** Accurate sales potentials	(1 student)
**** Long range market growth trends	(1 student)

* Advertising wars and price wars often occur and at times lead a whole industry to hopeless profitability.

** This item would be known in the real world on the same "free" basis as competitors' prices. If supplied to game players it would however make identification of the market segmentation response curves a relatively straightforward exercise.

*** Sales potentials are accurate. This response probably comes from a lack of understanding of the method of sales generation (which is explained in course handouts).

**** It is surprising that only one student suggested this item as the emphasis placed on demand fluctuation and changing relative sizes of market segments makes this information especially valuable.

Q.2. (f) Would you prefer the 'Annual Report' to include the industries other than that in which your firm is competing?

Yes	☐
No	☐
Irrelevant	☐

This question refers to an alternative to the "share market" concept of inter industry comparison.

Response	No. of students
Yes	5
No	4
Irrelevant	6
	15

Q.2 (g) Would you like some other measure of your classmates performance, such as a 'Share Market' showing an index for each of the firms in each industry?

Yes ☐
No ☐
Don't know ☐

Response	No. of students
Yes	12
No	1
Don't know	2
	15

Answers to these two questions are inconsistent. 6 students thought the 'Annual Report' comparison irrelevant while only 3 did not think the 'share market' comparison a good idea.
Taking into account the slight ambiguity as to the subject of the 'irrelevance' in Q.2 (f) (whether it is the Annual Reports or the implied inter-industry comparison which is irrelevant) the answers to Q.2 (g) have been given a higher reliability. The conclusion drawn is that a majority of students would like some form of inter-industry comparison and that a share market index would satisfy this requirement.

A5.2.4 Aspects of timing

Q.3 (a) Did you find the length of time between decisions .....

too long? ☐
about right? ☐
too short? ☐
OK to start with but too long once I was familiar with the game? ☐

Answer	No. of students
Too long	4
About right	8
Too short	1
OK to start with but too long ...	2
	15

(These students made an average of 2 decisions per week)

Q.3 (b) What do you think the ideal period between decisions is?

Answer	No. of students
No response	2
1 day	2
2 days	5
3 days	3
* 1 week	3
	15

* Motivation for 1 week was ease of scheduling meeting of group and time for analysis if decision was due on same day each week.

Q.3 (c) 'Leapfrogging' describes a method of organising game play so that decisions are not delayed by clerical or computer turnaround problems. If 'leapfrogging', firms make the decision for period 3 while period 2 is being processed (i.e. the last information they have is for period 1). They then receive the results of period 2 and make the decision for period 4 while period 3 is running. This has been described as a more realistic simulation of real business decision making.

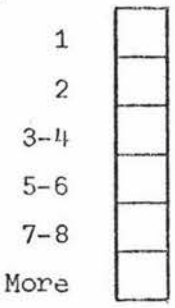
Do you think it is .....

a good idea ☐
a bad idea ☐
unduly complicated ☐
other (please state) ☐

Responses	No. of students
a good idea	8
a bad idea	4
unduly complicated	2
* a good variation part way through the session	1
	15

* This view coincides with that of the game administrator.

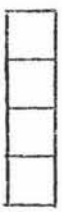
Q.3 (d) How many periods of play do you think one requires to familiarise oneself with the game and its rules?



Number of periods	No. of students
1	1
2	1
3-4	5
5-6	4
7-8	4
	15

These students had experienced 5 periods of introductory play before commencing the main run.

(e) How many periods of real play do you think would be ideal for the course you have just completed?



These students had experienced 16 periods (4 years) of real play.

Answer	No. of students
Less than we had (16)	1
About as many as we had (16)	2
More than we had (16)	10
Many more than we had (16)	2
	15

A5.2.5 Decisions and the model itself

Q.4 (a) Was the relationship between the decision variables and the effect on your firm's sales .....

obscure? ☐
obvious? ☐
reasonably clear? ☐
other (please state) ☐

Answer	No. of students
obscure	4
obvious	3
reasonably clear	8
	15

(b) Do you think the game should be more complex in terms of having a greater number of decisions?

Yes ☐
No ☐

If Yes, should there be (i) more general decisions, such as salesforce expenditure? ☐

or (ii) more detailed decisions, such as advertising media mix? ☐

Answer	No. of students
Yes	12
No	3
	15

Of the 12 students who replied Yes:

5 wanted more 'general' decisions,
4 " " 'detailed' " ,
and 3 " " of both types of decision.

A5.2.6 Other problems with game play

Q.7. Did you experience trouble with any of the following administrative areas? (TICK AND COMMENT ON PROBLEM AREAS)

Area	No. of students experiencing problems
Access to the game administrators	-
Understanding/remembering the decision rules	3
Using the decision forms correctly	2
Understanding the objectives of the game	1
Finding time for your group to meet	7
Finding a place for your group to meet	4
* Other	3

* These problems were:

(i) Understanding the impact of information bulletins circulated by the game administrator (these were simulated information items covering macro events which were to have an effect on the total simulated economy, e.g. changes in hire purchase regulations).

(ii) Getting a lazy group member to pull his weight.

(iii) Defining the inputs of group members to annual reports was difficult and often led to overlap of work done.

From the comments accompanying the answers to this question the total of 20 recorded problems can be summarized as follows:

(1) problems of apathy, laziness or lack of diligence - 7

(2) problems of group dynamics - 2

(3) problems of assembling the management group - 11

This last problem affected at least half the respondents and has already been recorded as a serious concern of the game administrator.

Q.5. (a) Did your MARKSIM firm achieve the objectives it set at the beginning of play?

Answer	No. of students
Yes	7
No	8

If No, What was the reason you did not achieve them?

Of the 8 who did not achieve their company objectives the following primary reasons were given:

(i) Competitors action leading to unprofitability (4 students)
(ii) Mismanagement of inventory (2 students)
(iii) Mismanagement of production (1 student)
(iv) Lack of accurate demand forecasting (1 student)

Secondary reasons were given by three students. These were
(i) Difficulty and lack of knowledge in setting company objectives (2 students)
(ii) Lack of demand forecasting (1 student)

Q.5 (b) Did you make a 'do or die' attempt in the last few periods of play?

Answer	No. of students
Yes	4
No	11
	15

If Yes, What were you attempting to achieve?

The 4 who made 'do or die' attempts all did so to achieve profitability. (This phenomenon is referred to as the "end effect" in chapter 2 of this thesis).

A5.2.7 Aspects of realism

Q.6 (a) Do you think the game was 'realistic'?

Answer	No. of students
Yes	10
No	5
	15

Q.6 (b) Would you prefer it to be more realistic?

Answer	No. of students
Yes	12
No	2
No response	1
	15

Q.6 (c) What suggestions do you have for making it more realistic?

11 students made suggestions for increased realism. These were:

(i) An increased number of variables (4 students)
(ii) More fluctuations in the simulated economy
(iii) More firms per industry
(iv) Students be required to present a promotion campaign in detail
(v) Firms to manufacture more than one product
(vi) More market research options
(vii) Possibility of buying out competitors
(viii) More inter-firm performance comparison

Q.6. (d) Which of the following statements do you agree with most strongly?

(I) "Students can often go away from a session of game play believing that the actual decisions they make during play have external validity in the real world. It is generally recognised that the more realistic the game is the higher the chance of this type of erroneous carryover taking place."

(II) "The more precisely a game simulates the real world, the more effective it is in training students to make real decisions."

AGREE MORE WITH I ☐ (Tick one only)

AGREE MORE WITH II ☐

14 students agreed with statement II. 1 student could not decide.

This suggests that none of the students considered the danger of erroneous carryover to be serious, concurring with the game administrator's point of view.

APPENDIX 6 Improved MARKSIM Computer Program

```
      FILE  1=FILE1,UNIT=DISK,RECORD=14,BLOCKING=30
      FILE  2=FILE2,UNIT=DISK,RECORD=14,BLOCKING=30,SAVE=999,AREA=150*1
      FILE  3=FILE3,UNIT=PRINTER
      FILE  4=FILE4,UNIT=DISK,RECORD=14,BLOCKING=30
      FILE  7=FILE7,UNIT=DISK,RECORD=14,BLOCKING=30
C
C     FOR 700 - 7000 SERIES COMPUTER
C     SEE GREENLAW AND KNIEFIN,'MARKSIM' FOR PROGRAM WRITEUP
C
      DIMENSION EVAL(3,2,4),HIST(3,2,4),ORDER(2,5),ZA(3,2,4),PRICE(2,2)
      DIMENSION T(16),U(16),V(16),W(16),X(16),Y(16),Z(16)
      DIMENSION BINV(2,4),BVAL(2,4),DCA(3),DPI(3),DQ(3,2),DPRI(3,2)
      DIMENSION PSLS(3,2,16),RES(15,3),RM(3,15),SALES(2,5),SLS(3,2,16)
      DIMENSION DPROD(3,2),DSHEW(3,2),DPA(3),COST(2,16),DMD(2,16)
      DIMENSION EINV(3,2,4),TMP(34,16),B(9)
      DIMENSION SPSLS(3,2),SSLS(2,16),STA(2,16),TSLS(3,2),TA(3,2,16)
      DIMENSION DCAE(3),DPAE(3),SRI(3),SPI(3),SII(3),SGI(3),SHARE(9,3)
      DIMENSION EDPRI(2),EDQ(2),DINV(3),INREV(3),AVGS1(18),A(9)
    5 FORMAT (F10.0,F10.5,F10.0,F10.0,F10.0,F10.0,F10.0)
    9 FORMAT (I10,I10,I10,I10,I10,I10,I10)
   10 FORMAT (10X,4F10.0,3F7.0)
   11 FORMAT (E10.0,E10.0,E10.0,E10.0,E10.0,E10.0,E10.0)
  372 FORMAT (72X)
C
C     READ PARAMETER CARDS
C
      DO 30 J=1,13
      READ(4,11) T(J),U(J),V(J),W(J),X(J),Y(J),Z(J)
   30 CONTINUE
      DO 37 I=1,34
      READ(4,10)  TMP(I,1),TMP(I,2),TMP(I,3),TMP(I,4),TMP(I,5),TMP(I,6),
     1TMP(I,7)
   37 CONTINUE
      READ(1,9) NOIND,NCOPY,NOPER
C
C     READ HISTORY CARDS
C
   25 DO 26 K=1,3
      READ(7,9) MTIME,MFIRM,MIND
C     CHECK HISTORY IN CORRECT ORDER OF FIRM
      IF (MFIRM-K)14460,1291,14460
 1291 GO TO (291,292,293),K
  291 READ(7,372)
      GO TO 23
  292 READ(7,372)
      GO TO 23
```

```
  293 READ(7,372)
   23 DO 26 J=1,2
      DO 26 I=1,4
      READ(7,5) EINV(K,J,1),EVAL(K,J,1),HIST(K,J,1),ZA(K,J,I)
   26 CONTINUE
      NPER=NOPER
C
C  INITIALIZE
C
   16 DO 776 K=1,3
      DO 1776 J=1,2
      SPSLS(K,J)=0.0
      TSLS(K,J)=0.0
 1776 CONTINUE
  776 CONTINUE
      DO 1777 J=1,2
      DO 777 M=1,5
      SSLS(J,M)=0.0
      STA(J,M)=0.0
  777 CONTINUE
 1777 CONTINUE
C
C  READ DECISION CARDS
C
      DO 19 K=1,3
    1 FORMAT (3I2,-3P2F5.0,0P4F3.0,-3P4F4.0,I7,0,F3.0,0P15F1.0)
      READ(1,1) J,M,N,DCA(K),DPA(K),DQ(K,1),DQ(K,2),DPRI(K,1),DPRI(K,2),
     1DPROD(K,1),DPROD(K,2),DSHFW(K,1),DSHFW(K,2),DPT(K),QINV(K),(RM(K,
     11),I=1,12),DCAE(K),DPAE(K),SRI(K)
      RM(K,13)=1
      RM(K,14)=1
      IF (DCAE(K)) 1046,1046,1047
 1046 DCAE(K)=5.0
 1047 IF (DPAE(K)) 1048,1048,1049
 1048 DPAE(K)=5.0
 1049 IF (SRI(K)) 1050,1050,1051
 1050 SRI(K)=5.0
C     CHECK DECISION CARDS COMPATABLE WITH HISTORY CARDS
 1051 IF (M-K)14460,5018,14460
 5018 IF (MTIME-J)14460,6018,14460
 6018 IF (MIND-N)14460,7018,14460
 7018 IF (DQ(K,1)-T(1))  15,15,1019
   15 DQ(K,1)=T(1)
 1019 IF (DQ(K,2)-T(9)) 1018,1018,19
 1018 DQ(K,2)=T(9)
   19 CONTINUE
C
C  COMPUTE ATTRACTIVENESS OF EACH FIRMS ADVERTISING ALLOWANCE,
C  NATIONAL ADVERTISING,QUALITY, AND PRICE-QUALITY RATIO
C
      DO 60 K=1,3
      EDCA=T(4)*(DCA(K)**T(5))/(T(6)+(DCA(K)**T(5)))
      EDCA=EDCA*(DCAE(K)+T(8))/(T(8)+2.0)
      HIST(K,1,3)=T(7)*EDCA+(1.0-T(7))*HIST(K,1,3)/1000.
      EDPA=U(4)*(DPA(K)**U(5))/(U(6)+(DPA(K)**U(5)))
      EDPA=EDPA*(DPAE(K)+W(8))/(W(8)+2.0)
      DO 60 J=1,2
      A(J)=DPRI(K,J)/EVAL(K,J,1)
      IF (A(J)-V(7)) 46,44,44
   46 A(J)=V(7)
   44 EDPRI(J)=(V(4)*V(5))/(V(5)+(A(J)-V(7))**V(6))
```

```
      IF (V(8)-A(J)) 48,43,43
   48 EDPRI(J)=0.2
   43 IF (Z(6)-DPRI(K,J)) 42,49,49
   42 EDPRI(J)=0.2
      IF (J-1) 49,49,2049
   49 DO 60 M=1,3
      GO TO 9049
 2049 DO 60 M=9,11
 9049 A(J)=EVAL(K,J,1)
      IF(Z(M)-EVAL(K,J,1)) 54,55,55
   54 A(J)=Z(M)
   55 IF (EVAL(K,J,1)-T(M)) 57,56,56
   57 EDQ(J)=0.1
      GO TO 58
   56 EDQ(J)=U(M)*((A(J)-V(M))**W(M))-(X(M)*((A(J)-V(M))**Y(M)))
   58 TA(K,J,M)=HIST(K,J,3)*EDPA*EDPRI(J)*EDQ(J)
      STA(J,M)=STA(J,M)+TA(K,J,M)
   60 CONTINUE
C
C  COMPUTE SALES FOR EACH FIRM IN EACH MARKET
C
      DO 79 K=1,3
      HIST(K,1,3)=HIST(K,1,3)*1000
      DO 72 J=1,2
      IF (J-1) 1060,1060,1061
 1060 DO 72 M=1,3
      GO TO 1062
 1061 DO 72 M=9,11
 1062 DMD(J,M)=TMP(MTIME,M)*((3.0+STA(J,M))/6.0)
      IF (STA(J,M)) 68,68,70
   68 PSLS(K,J,M)=0.0
      GO TO 71
   70 PSLS(K,J,M)=DMD(J,M)*TA(K,J,M)/STA(J,M)
   71 SPSLS(K,J)=SPSLS(K,J)+PSLS(K,J,M)
   72 CONTINUE
      DO 79 J=1,2
      IF (J-1) 1072,1072,1073
 1072 DO 79 M=1,3
      GO TO 1074
 1073 DO 79 M=9,11
 1074 SLS(K,J,M)=PSLS(K,J,M)
      IF (EINV(K,J,1)-SPSLS(K,J)) 76,77,77
   76 SLS(K,J,M)=EINV(K,J,1)*PSLS(K,J,M)/SPSLS(K,J)
   77 TSLS(K,J)=TSLS(K,J)+SLS(K,J,M)
      SSLS(J,M)=SSLS(J,M)+SLS(K,J,M)
   79 CONTINUE
C
      DO 168 K=1,3
C
C  INITIALIZE SOME MORE
C
      DO 203 J=1,2
      DO 203 I=1,18
      COST(J,I)=0.0
  203 CONTINUE
      DO 779 M=1,3
      RES(1,M)=0.0
      RES(2,M)=0.0
  779 CONTINUE
      DO 90 J=1,2
      DO 90 I=1,4
```

```
      BINV(J,I)=EINV(K,J,1)
      BVAL(J,I)=EVAL(K,J,1)
   90 CONTINUE
C
C  DETERMINE IF PRODUCTION DECISION IS WITHIN ALLOWABLE RA
C
      DO 1103 J=1,2
      A(1)=Z(7)*HIST(K,J,4)
      IF (A(1)-Z(6)) 83,84,84
   83 A(1)=Z(6)
   84 IF (A(1)-DPROD(K,J)) 85,86,86
   85 DPROD(K,J)=A(1)
   86 HIST(K,J,4)=DPROD(K,J)
      COST(J,2)=DPROD(K,J)*DQ(K,J)
      EINV(K,J,4)=EINV(K,J,4)+DPROD(K,J)
      IF (EINV(K,J,4)) 100,100,102
  100 EVAL(K,J,4)=0.0
      GO TO 103
  102 EVAL(K,J,4)=(BINV(J,4)*BVAL(J,4)+COST(J,2))/EINV(K,J,4)
  103 ORDER(J,1)=SPSLS(K,J)
      SALES(J,1)=TSLS(K,J)
      EINV(K,J,1)=EINV(K,J,1)-SALES(J,1)
 1103 CONTINUE
C
C  COMPUTE RETAILERS ORDERS FROM DIST CENTER AND FROM WHOLESALER
C
      T(14)=TMP(MTIME,4)/100
      T(15)=(1.0-T(14))
      DO 110 J=1,2
      DO 110 I=1,2
      L=I+1
      ORDER(J,L)=T(I+13)*(U(7)*ORDER(J,1)+SALES(J,1)-BINV(J,1))
      IA=I+3
      IF(ORDER(J,L)-W(IA)) 91,91,92
   91 ORDER(J,L)=W(IA)
   92 SALES(J,L)=ORDER(J,L)
      IF (EINV(K,J,L)-ORDER(J,L)) 104,105,105
  104 SALES(J,L)=EINV(K,J,L)
  105 EINV(K,J,L)=EINV(K,J,L)-SALES(J,L)
      EVAL(K,J,1)=(EVAL(K,J,1)*EINV(K,J,1)+SALES(J,L)*EVAL(K,J,L))
      EINV(K,J,1)=EINV(K,J,1)+SALES(J,L)
      IF (EINV(K,J,1)) 106,106,108
  106 EVAL(K,J,1)=0.0
      GO TO 110
  108 EVAL(K,J,1)=EVAL(K,J,1)/EINV(K,J,1)
  110 CONTINUE
C
C  COMPUTE ORDERS AND SALES BETWEEN DIST CENTER AND FACTORY WAREHOUSE
C  COMPUTE SALES AND ORDERS BETWEEN WHOLESALER AND FACTORY WAREHOUSE
C
      DO 1111 J=1,2
      ORDER(J,4)=USHFW(K,J)
 1111 ORDER(J,5)=U(8)*ORDER(J,3)+SALES(J,3)-BINV(J,3)
      DO 120 J=1,2
      DO 120 I=2,3
      L=I+2
      IA=I+4
      IF (ORDER(J,L)-W(IA)) 111,111,112
  111 ORDER(J,L)=W(IA)
  112 SALES(J,L)=ORDER(J,L)
      IF (EINV(K,J,4)-ORDER(J,L)) 114,115,115
```

```
  114 SALES(J,L)=EINV(K,J,4)
  115 EINV(K,J,4)=EINV(K,J,4)-SALES(J,L)
      EVAL(K,J,I)=EVAL(K,J,I)*EINV(K,J,I)+SALES(J,L)*EVAL(K,J,4)
      EINV(K,J,I)=EINV(K,J,I)+SALES(J,L)
      IF (EINV(K,J,I)) 118,116,116
  116 EVAL(K,J,1)=0.0
      GO TO 120
  118 EVAL(K,J,I)=EVAL(K,J,1)/EINV(K,J,I)
  120 CONTINUE
      DO 125 J=1,2
      DO 125 I=1,4
      IF (EINV(K,J,I)) 124,124,125
  124 EVAL(K,J,1)=0.0
  125 CONTINUE
C
C   COMPUTE COSTS FOR THE PERIOD
C
      DO 1125 J=1,2
      PRICE(J,1)=X(4)*DPRI(K,J)
      PRICE(J,2)=X(5)*DPRI(K,J)
      COST(J,1)=PRICE(J,1)*SALES(J,2)+PRICE(J,2)*SALES(J,5)
      COST(J,9)=X(6)*EINV(K,J,4)*EVAL(K,J,4)
      COST(J,10)=X(7)*EINV(K,J,2)*EVAL(K,J,2)
      COST(J,6)=Y(4)*SALES(J,2)
      COST(J,7)=Y(5)*SALES(J,4)
 1125 COST(J,8)=Y(5)*SALES(J,5)
      COST(11,1)=DPA(K)
      DO 1126 J=1,2
      COST(J,3)=EVAL(K,J,2)*EINV(K,J,2)+EVAL(K,J,4)*EINV(K,J,4)
      COST(J,3)=COST(J,3)-BINV(J,2)*BVAL(J,2)-BINV(J,4)*BVAL(J,4)
      COST(J,4)=COST(J,2)-COST(J,3)
 1126 COST(J,5)=COST(J,1)-COST(J,4)
      DO 135 I=1,12
      COST(13,1)=COST(13,1)+Y(7)*RM(K,I)
  135 CONTINUE
      IF (HIST(K,1,1)-QINV(K)) 1135,1136,1136
 1135 HIST(K,1,2)=HIST(K,1,2)+QINV(K)-HIST(K,1,1)
 1136 INREV(K)=QINV(K)*Y(6)
      IF (HIST(K,1,2)-DPT(K)) 136,137,137
  136 DPT(K)=HIST(K,1,2)
  137 HIST(K,1,2)=HIST(K,1,2)-DPT(K)
      COST(12,1)=DCA(K)
      COST(15,1)=Z(5)
      DO 1147 I=1,10
 1147 CQST(I)=COST(1,I)+COST(2,I)
      CQST(5)=CQST(5)+INREV(K)
      DO 147 I=6,10
      COST(16,1)=COST(16,1)+CQST(I)
  147 CONTINUE
      DO 1148 I=11,15
 1148 COST(16,1)=COST(16,1)+CQST(I,1)
      COST(17,1)=COST(5)-COST(16,1)
      HIST(K,1,1)=HIST(K,1,1)+COST(17,1)-COST(3)-DPT(K)
      IF (HIST(K,1,1)) 138,138,139
  138 HIST(K,1,2)=HIST(K,1,2)-HIST(K,1,1)
      HIST(K,1,1)=0.0
      GO TO 140
  139 COST(14,1)=HIST(K,1,2)*Z(4)
      A(1)=HIST(K,1,1)-COST(14,1)
      IF(A(1)) 140,141,141
  140 COST(14,1)=(HIST(K,1,2)-HIST(K,1,1))*(1.0/(1.0-Z(4))-1.0)
```

```
      HIST(K,1,2)=HIST(K,1,2)+COST(14,1)-HIST(K,1,1)
      HIST(K,1,1)=0.0
      GO TO 142
  141 HIST(K,1,1)=A(1)
  142 COST(16,1) = COST(16,1)+COST(14,1)
      COST(17,1)=COST(17,1)-COST(14,1)
      LL=MTIME+2
      DO 156 I=1,3
      RES(1,I)=RES(1,1)+DCA(I)
      RES(2,I)=RES(2,1)+DPA(I)
      RES(3,I)=PSLS(K,1,I)
      RES(5,I)=TMP(LL,I)
      IF (SSLS(1,1)) 143,143,144
  143 RES(7,I)=0.0
      GO TO 145
  144 RES(7,I)=(SLS(K,1,1)/SSLS(1,1))*100.0
  145 RES(13,I)=DPRI(1,1)
  156 CONTINUE
      DO 1156  I=1,3
      RES(4,I)=PSLS(K,2,1)
      RES(6,I)=TMP(LL,I+4)
      IF (SSLS(2,1)) 1143,1143,1144
 1143 RES(8,I)=0.0
      GO TO 1145
 1144 RES(8,I)=SLS(K,2,1)/SSLS(2,1)*100.0
 1145 RES(14,I)=DPRI(1,2)
 1156 CONTINUE
      IF (K-1) 1157,1157,1158
 1157 RES(9,1)=0.0
      RES(10,1)=0.0
      RES(11,1)=0.0
      RES(12,1)=0.0
 1158 RES(9,1)=RES(9,1)+EINV(K,1,1)
      RES(10,1)=RES(10,1)+EINV(K,2,1)
      RES(11,1)=RES(11,1)+EINV(K,1,2)
      RES(12,1)=RES(12,1)+EINV(K,2,2)
C   UPDATE INFO FOR ANNUAL REPORT
C
      ZA(K,1,1)=ZA(K,1,1)+SALES(1,1)
      ZA(K,2,1)=ZA(K,2,1)+SALES(2,1)
      ZA(K,1,2)=ZA(K,1,2)+COST(17,1)
C     CALCULATE SHARE MARKET VALUE FOR FIRM
      IF (SRI(K))1300,1300,1301
 1300 SRI(K)=5.00
 1301 SPI(K)=COST(17,1)/(EINV(K,1,2)*EVAL(K,1,2)+EINV(K,2,2)*EVAL(K,2,2
     1)+EINV(K,1,4)*EVAL(K,1,4)+EINV(K,2,4)*EVAL(K,2,4))
      SPI(K)=I(12)*ABS(SPI(K))**Z(12)+U(12)
      IF(SPI(K)-V(12)) 1302,1303,1303
 1302 SPI(K)=V(12)
 1303 SII(K)=5.00
      IF (EINV(K,1,2)-(W(12)*(PSLS(K,1,1)+PSLS(K,1,2)+PSLS(K,1,3))))1304
     1,1304,1310
 1304 IF (EINV(K,2,2)-(W(12)*(PSLS(K,2,1)+PSLS(K,2,2)+PSLS(K,2,3))))1305
     1,1305,1310
 1305 IF (EINV(K,1,4)-(W(12)*(PSLS(K,1,1)+PSLS(K,1,2)+PSLS(K,1,3))))9306
     1,9306,1310
 9306 IF (EINV(K,2,4)-(W(12)*(PSLS(K,2,1)+PSLS(K,2,2)+PSLS(K,2,3))))9307
     1,9307,1310
 1310 SII(K)=X(12)
      GO TO 1313
 9307 IF (EINV(K,1,2)-ORDER(1,2))1312,1308,1308
```

```
 1308 IF (EINV(K,2,2)-ORDER(2,2))1312,1309,1309
 1309 IF (EINV(K,1,4)-ORDER(1,4))1312,1311,1311
 1311 IF (EINV(K,2,4)-ORDER(2,4))1312,1313,1313
 1312 SII(K)=Y(12)
 1313 SGI(K)=-(HIST(K,2,1)-5.00)
      HIST(K,2,2)=HIST(K,2,1)
      HIST(K,2,1)=T(13)*SPI(K)+U(13)*SRI(K)+V(13)*SII(K)+W(13)*SGI(K)
      SHARE(MIND,K)=HIST(K,2,1)
C  PRINT OUT RESULTS
C
  301 FORMAT (55H                                                    MARKSIM
     1 /)
  302 FORMAT (34H                                          FIRM,I4,10H    PERIOD,
     1I4,12H    INDUSTRY,I4//)
  303 FORMAT (32H I N C O M E   S T A T E M E N T/)
11303 FORMAT (18H INVESTMENT INCOME,F24.0)
  304 FORMAT (14H SALES REVENUE,F58.0)
  305 FORMAT (23H      COST OF PRODUCTION,F39.0)
 1306 FORMAT (34H      MINUS, INCREASE IN INV. VALUE,F28.0)
 2306 FORMAT (33H      PLUS, DECREASE IN INV. VALUE,F29.0)
 1307 FORMAT (27H           COST OF GOODS SOLD,F45.0)
  307 FORMAT (F72.0)
  308 FORMAT (72H
     1           ---------)
  309 FORMAT (13H GROSS PROFIT,F59.0)
  310 FORMAT (41H      LESS, SELLING, ADM. AND GENERAL EXP.)
  311 FORMAT (28H           TRANS. TO RETAILERS,F34.0)
  312 FORMAT (39H           TRANS. TO DISTRIBUTION CENTERS,F23.0)
  313 FORMAT (30H           TRANS TO WHOLESALERS,F32.0)
  314 FORMAT (38H           INV. COSTS, FACTORY WAREHOUSE,F24.0)
  315 FORMAT (41H           INV. COSTS, DISTRIBUTION CENTERS,F21.0)
  316 FORMAT (37H           ADV. ALLOWANCES TO RETAILERS,F25.0)
  317 FORMAT (29H           NATIONAL ADVERTISING,F33.0)
  318 FORMAT (27H           MARKETING RESEARCH,F35.0)
  319 FORMAT (25H           INTEREST CHARGES,F37.0)
  320 FORMAT (22H           FIXED EXPENSE,F40.0)
  321 FORMAT (62H
     1        --------)
  322 FORMAT (11H NET PROFIT,F61.0//)
  323 FORMAT (38H F I N A N C I A L   S T A T E M E N T/)
  324 FORMAT (24H      ENDING CASH BALANCE,F48.0)
  325 FORMAT (27H      ENDING INVENTORY VALUE,F45.0)
  326 FORMAT (21H           TOTAL ASSETS,F51.0)
  327 FORMAT (15H      LESS, DEBT,F57.0)
  328 FORMAT (26H           OWNERS INVESTMENT,F46.0)
  329 FORMAT (36H M A R K E T I N G   R E S E A R C H/)
  330 FORMAT (34H      INDUSTRY NATIONAL ADVERTISING,F38.0)
  331 FORMAT (37H      INDUSTRY ALLOWANCES TO RETAILERS,F35.0)
  332 FORMAT (92H                                                    MARKET 1
     1          MARKET 2                MARKET 3    )
11332 FORMAT (97H                                                    REEL      ROTAR
     1Y    REEL       ROTARY    REEL       ROTARY    )
  333 FORMAT (32H      COMPANY POTENTIAL SALES FOR)
  334 FORMAT (30H           THIS PERIOD (IN UNITS),F15.0,F20.0,F20.0)
11334 FORMAT (30H           THIS PERIOD (IN UNITS),F27.0,F20.0,F20.0)
  335 FORMAT (34H      INDUSTRY MARKET POTENTIAL FOR)
  336 FORMAT (14H           PERIOD,I3,11H (IN UNITS),F17.0,F20.0,F20.0)
11336 FORMAT (14H           PERIOD,I3,11H (IN UNITS),F29.0,F20.0,F20.0)
  337 FORMAT (72H                                                    FIRM 1
     1 FIRM 2    FIRM 3)
  338 FORMAT (33H      SHARE OF MARKET (IN PERCENT),F12.0,F20.0,F20.0)
```

```
11338 FORMAT (33H      SHARE OF MARKET (IN PERCENT),F24.0,F20.0,F20.0)
  339 FORMAT (38H      PRICES OF COMPETITORS ($)    REEL,F14.0,F10.0,F10.
     10)
11339 FORMAT (38H                                   ROTARY,F14.0,F10.0,F10.
     10/)
12339 FORMAT (41H      INDUSTRY STOCK LEVELS  RETAIL REEL  ,F14.0)
13339 FORMAT (41H      INDUSTRY STOCK LEVELS  RETAIL ROTARY,F14.0)
14339 FORMAT (41H      INDUSTRY STOCK LEVELS  W/SALE REEL  ,F14.0)
15339 FORMAT (41H      INDUSTRY STOCK LEVELS  W/SALE ROTARY,F14.0)
16339 FORMAT (32H      SHARE PRICE-LAST PERIOD ($),F14.0)
17339 FORMAT (32H                  -THIS PERIOD ($),F14.0)
  341 FORMAT (94H S A L E S  I N F O R M A T I O N
     1 REEL                                  ROTARY/)
  342 FORMAT (14H      RETAILERS/)
  343 FORMAT (25H           SALES (IN UNITS),F27.0,F10.0,F10.0,F10.0,F10.0
     1,F10.0)
  344 FORMAT (35H           TOTAL RETAIL SALES (UNITS),F37.0,F36.0)
  345 FORMAT(107H                                                  UNIT VAL
     1UE              UNITS                UNIT VALUE              UNITS)
  346 FORMAT (28H           BEGINING INVENTORY,F29.0,F15.0,F21.0,F15.0)
  347 FORMAT (25H           ENDING INVENTORY,F32.0,F15.0,F21.0,F15.0)
  348 FORMAT (16H      WHOLESALERS/)
  349 FORMAT (38H           ORDERS FROM RETAILERS (UNITS),F34.0,F36.0)
  350 FORMAT (40H           DELIVERIES TO RETAILERS (UNITS),F32.0,F36.0)
  351 FORMAT (39H           SELLING PRICE TO RETAILERS ($),F33.0,F36.0)
  352 FORMAT (39H              RECEIPTS FROM RETAILERS ($),F33.0,F36.0)
  353 FORMAT (25H      DISTRIBUTION CENTRES/)
  354 FORMAT (42H           COMPANY SALES TO RETAILERS ($),F30.0,F36.0)
  355 FORMAT (22H      FACTORY WAREHOUSE/)
  356 FORMAT (40H           ORDERS FROM WHOLESALERS (UNITS),F32.0,F36.0)
  357 FORMAT (42H           DELIVERIES TO WHOLESALERS (UNITS),F30.0,F36.0)
  358 FORMAT (41H           SELLING PRICE TO WHOLESALERS ($),F31.0,F36.0)
  359 FORMAT (44H              COMPANY SALES TO WHOLESALERS ($),F28.0,F36.
     10)
  360 FORMAT (43H           SHIPMENTS TO DIST. CENTRES (UNITS),F29.0,F36.0
     1)
  361 FORMAT (39H           PRODUCTION THIS PERIOD (UNITS),F33.0,F36.0)
  362 FORMAT (1H1)
  270 FORMAT (2H  )
      DO 2 JJJ=1,NCOPY
      WRITE(3,362)
      GO TO (281,282,283), K
  281 WRITE(3,372)
      GO TO 284
  282 WRITE(3,372)
      GO TO 284
  283 WRITE(3,372)
  284 WRITE(3,270)
  273 WRITE(3,301)
      WRITE(3,302)  K, MTIME, MIND
      WRITE(3,303)
      WRITE(3,11303) INREV(K)
      WRITE(3,304) COST(1)
      WRITE(3,305) COST(2)
      A(1)=0.0-COST(3)
      IF (COST(3)) 241,242,242
  241 WRITE(3,2306)  A
      GO TO 243
  242 WRITE(3,1306)  A
  243 WRITE(3,1307) COST(4)
      WRITE(3,306)
```

```
      WRITE(3,309)  COST(5)
      WRITE(3,310)
      WRITE(3,311)  COST(6)
      WRITE(3,312)  COST(7)
      WRITE(3,313)  COST(8)
      WRITE(3,314)  COST(9)
      WRITE(3,315)  COST(10)
      WRITE(3,316)  COST(11,1)
      WRITE(3,317)  COST(12,1)
      WRITE(3,318)  COST(13,1)
      WRITE(3,319)  COST(14,1)
      WRITE(3,320)  COST(15,1)
      WRITE(3,321)
      WRITE(3,307)  COST(16,1)
      WRITE(3,308)
      WRITE(3,322)  COST(17,1)
      WRITE(3,323)
      WRITE(3,324)  HIST(K,1,1)
      A(1)=EINV(K,1,2)*EVAL(K,1,2)+EINV(K,1,4)*EVAL(K,1,4)+EINV(K,2,2)*E
     1VAL(K,2,2)+EINV(K,2,4)*EVAL(K,2,4)
      WRITE(3,325)  A(1)
      WRITE(3,308)
      A(1)=A(1)+HIST(K,1,1)
      WRITE(3,326)  A(1)
      WRITE(3,327)  HIST(K,1,2)
      A(1)=A(1)*HIST(K,1,2)
      WRITE(3,308)
      WRITE(3,326)  A(1)
      WRITE(3,362)
      WRITE(3,329)
      IF (RM(K,1)) 213,213,212
  212 WRITE(3,330)  RES(1,1)
  213 IF (RM(K,2)) 215,215,214
  214 WRITE(3,331)  RES(2,1)
  215 WRITE(3,332)
      WRITE(3,11332)
      IF (RM(K,3)) 217,217,216
  216 WRITE(3,333)
      WRITE(3,334)  RES(3,1), RES(3,2), RES(3,3)
  217 IF (RM(K,4)) 219,219,218
  218 WRITE(3,333)
      WRITE(3,11334) RES(4,1),RES(4,2),RES(4,3)
  219 IF (RM(K,5)) 221,221,220
  220 WRITE(3,335)
      IA=MTIME+2
      WRITE(3,336) IA,RES(5,1),RES(5,2),RES(5,3)
  221 IF (RM(K,6)) 223,223,222
  222 WRITE(3,335)
      IA=MTIME+2
      WRITE(3,11336) IA,RES(6,1),RES(6,2),RES(6,3)
  223 IF (RM(K,7))11223,11223,11220
11220 WRITE(3,338) RES(7,1),RES(7,2),RES(7,3)
11223 IF (RM(K,8))11225,11225,11224
11224 WRITE(3,11338) RES(8,1),RES(8,2),RES(8,3)
11225 IF (RM(K,9))11227,11227,11226
11226 WRITE(3,12339) RES(9,1)
11227 IF (RM(K,10))11229,11229,11228
11228 WRITE(3,13339) RES(10,1)
11229 IF (RM(K,11))11331,11331,11330
11330 WRITE(3,14339) RES(11,1)
11331 IF (RM(K,12))14333,14333,14332
```

```
14332 WRITE(3,15339) RES(12,1)
14333 WRITE(3,339) RES(13,1),RES(13,2),RES(13,3)
      WRITE(3,11339) RES(14,1),RES(14,2),RES(14,3)
      WRITE(3,270)
      WRITE(3,16339) HIST(K,2,2)
      WRITE(3,17339) HIST(K,2,1)
  225 WRITE(3,362)
      WRITE(3,341)
      WRITE(3,342)
      WRITE(3,343) SLS(K,1,1),SLS(K,1,2),SLS(K,1,3),SLS(K,2,1),SLS(K,2,2
     1),SLS(K,2,3)
      WRITE(3,344) SALES(1,1),SALES(2,1)
      I=1
  210 WRITE(3,345)
      WRITE(3,346) BVAL(1,I),BINV(1,I),BVAL(2,I),BINV(2,I)
      WRITE(3,347) EVAL(K,1,I),EINV(K,1,I),EVAL(K,2,I),EINV(K,2,I)
      GO TO (200,202,201,2), I
  200 WRITE(3,348)
      WRITE(3,349) ORDER(1,3),ORDER(2,3)
      WRITE(3,350) SALES(1,3),SALES(2,3)
      WRITE(3,351) PRICE(1,1),PRICE(2,1)
      A(1)=PRICE(1,1)*SALES(1,3)
      B(1)=PRICE(2,1)*SALES(2,3)
      WRITE(3,352) A(1),B(1)
      I=3
      GO TO 210
  201 WRITE(3,353)
      WRITE(3,349) ORDER(1,2),ORDER(2,2)
      WRITE(3,350) SALES(1,2),SALES(2,2)
      WRITE(3,351) PRICE(1,1),PRICE(2,1)
      A(1)=PRICE(1,1)*SALES(1,2)
      B(1)=PRICE(2,1)*SALES(2,2)
      WRITE(3,354) A(1),B(1)
      I=2
      GO TO 210
  202 WRITE(3,355)
      WRITE(3,356) ORDER(1,5),ORDER(2,5)
      WRITE(3,357) SALES(1,5),SALES(2,5)
      WRITE(3,358) PRICE(1,2),PRICE(2,2)
      A(1)=PRICE(1,2)*SALES(1,5)
      B(1)=PRICE(2,2)*SALES(2,5)
      WRITE(3,359) A(1),B(1)
      WRITE(3,360) ORDER(1,4),ORDER(2,4)
      WRITE(3,361) HIST(K,1,4),HIST(K,2,4)
      I=4
      GO TO 210
    2 CONTINUE
  166 CONTINUE
C
C   PRINT                ANNUAL REPORT
C
      IF ((MTIME/4)*4-MTIME) 405,410,405
      DO 450 JJ=1,NCOPY
  410 DO 450 I=1,3
      WRITE(3,362)
      WRITE(3,301)
      WRITE(3,302)  I, MTIME, MIND
  364 FORMAT (37H A N N U A L   R E P O R T   (PERIODS,I3,2H -,I3,1H)//)
      II=MTIME-3
      WRITE(3,364)  II, MTIME
      DO 430 K=1,3
```

```
      WRITE(3,365)  K
  365 FORMAT (37H                                        FIRM,I2//)
      WRITE(3,366) ZA(K,1,1)
      WRITE(3,1366) ZA(K,2,1)
      WRITE(3,367) ZA(K,1,2)
  366 FORMAT (37H      SALES TO CONSUMER (UNITS)=REEL  ,F35.0)
 1366 FORMAT (37H                               =ROTARY,F35.0)
  367 FORMAT (27H      COMPANY NET PROFIT ($),F45.0//)
      WRITE(3,324)  HIST(K,1,1)
      A(1)=EINV(K,1,2)*EVAL(K,1,2)+EINV(K,1,4)*EVAL(K,1,4)+EINV(K,2,2)*E
     1VAL(K,2,2)+EINV(K,2,4)*EVAL(K,2,4)
      WRITE(3,325)  A(1)
      WRITE(3,308)
      A(1)=A(1)+HIST(K,1,1)
      WRITE(3,326)  A(1)
      WRITE(3,327) HIST(K,1,2)
      A(1)=A(1)-HIST(K,1,2)
      WRITE(3,308)
      WRITE(3,328)  A(1)
  430 CONTINUE
  450 CONTINUE
      DO 460 K=1,3
      DO 460 J=1,2
      DO 460 I=1,4
      ZA(K,J,1)=0.0
  460 CONTINUE
C
C     PRINT SHARE SUMMARY
      DO 13460 J=1,(3*NOIND+1 )
10460 FORMAT   (26H1     SHARE LISTINGS-PERIOD,I2)
11460 FORMAT   (13H      INDUSTRY,I3,7H   FIRM,I3,5H  ($),F6.2)
      WRITE(3,10460)   MTIME
      WRITE(3,270)
      DO 12460 MIND=1,NOIND
      DO 12460 K=1,3
      WRITE(3,11460) MIND,K,SHARE(MIND,K)
12460 CONTINUE
13460 CONTINUE
      GO TO 405
C     PRINT ERROR MESSAGE
94460 FORMAT (93H1 DECISION DECK DOES NOT AGREE WITH HISTORY DECK -CHECK
     1PERIOD,ORDER OF FIRM,ORDER OF INDUSTRY)
14460 WRITE(3,94460)
      GO TO 1300
C  PUNCH NEW HISTORY
C
  405 MTIME=MTIME+1
      NPER=NPER-1
      IF (NPER) 240,240,16
  240 DO 230 K=1,3
  235 WRITE(2,9)  MTIME, K, MIND
      GO TO (741,742,743), K
  741 WRITE(2,372)
      GO TO 260
  742 WRITE(2,372)
      GO TO 260
  743 WRITE(2,372)
  260 DO 230 J=1,2
      DO 230 I=1,4
      WRITE(2,5) EINV(K,J,I),EVAL(K,J,I),HIST(K,J,I),ZA(K,J,I)
  230 CONTINUE


      NOIND=NOIND-1
      IF (NOIND) 8300,8300,25
 8300 LOCK 2
      END
```

APPENDIX 7 Improved MARKSIM Decision Form

I.D. Period 1 [ ][ ]

Firm 3 [ ][ ]

Industry 5 [ ][ ]

Operating Decisions

National Advertising 7 [ ][ ][ ].[ ]

Advertising Allowance to Retailers ($000) 12 [ ][ ][ ].[ ]

	Reel Mowers	Rotary Mowers
Quality of Factory Production ($/unit)	17 [ ][ ][ ]	20 [ ][ ][ ]
Retail Price this Period ($/unit)	23 [ ][ ][ ]	26 [ ][ ][ ]
Production this Period (000 units)	29 [ ][ ].[ ]	33 [ ][ ].[ ]
Shipments to Distn. Centres (000 units)	37 [ ][ ].[ ]	41 [ ][ ].[ ]

Debt Repayment ($000) 45 [ ][ ][ ].[ ][ ][ ]

Quarterly Investment at 16% p.a. ($000) 52 [ ][ ][ ]

Marketing Research Decisions

(1 = Purchase, 0 = Not Purchase)

Item	Purchase Decision
Industry National Advertising	55 [ ]
Industry Advertising Allowance to Retailers	56 [ ]
Company Potential Sales this Period (Reel)	57 [ ]
Company Potential Sales this Period (Rotary)	58 [ ]
Market Potential two periods hence (Reel)	59 [ ]
Market Potential two periods hence (Rotary)	60 [ ]
Own Share of Market this Period (Reel)	61 [ ]
Own Share of Market this Period (Rotary)	62 [ ]
Total Units of Retail Inventory this Period (Reel)	63 [ ]
Total Units of Retail Inventory this Period (Rotary)	64 [ ]
Total Units of Wholesale Inventory this Period (Reel)	65 [ ]
Total Units of Wholesale Inventory this Period (Rotary)	66 [ ]

Administrator Inputs (optional)

National Advertising efficiency (Range 1-9) 67 [ ]

Advertising Allowance to Retailers efficiency (Range 1-9) 68 [ ]

Effect of last Annual Report on Share Price (Range 1-9) 69 [ ]

APPENDIX 8 Definition of Improved Game Variables

A(J)		DUMMY VARIABLE
B(J)		DUMMY VARIABLE
BINV(J,1)		RETAILERS BEGINNING INVENTORY IN UNITS, PRODUCT J
BINV(J,2)		DISTRIBUTION CENTRES BEGINNING INVENTORY IN UNITS, PRODUCT J
BINV(J,3)		WHOLESALERS BEGINNING INVENTORY IN UNITS, PRODUCT J
BINV(J,4)		FACTORY WAREHOUSE BEGINNING INVENTORY IN UNITS, PRODUCT J
BVAL(J,1)		PER UNIT QUALITY OF PRODUCT J, RETAILERS BEGINNING INVENTORY
BVAL(J,2)		PER UNIT QUALITY OF PRODUCT J, DIST. CENTRES BEGINNING INVENTORY
BVAL(J,3)		PER UNIT QUALITY OF PRODUCT J, WHOLESALERS BEGINNING INVENTORY
BVAL(J,4)		PER UNIT QUALITY OF PRODUCT J, FACTORY WAREHOUSE BEGINNING INVENTORY
COST(J,1)		TOTAL SALES REVENUE, PRODUCT J
COST(J,2)		COST OF PRODUCTION, PRODUCT J
COST(J,3)		NET CHANGE IN TOTAL INVENTORY VALUE, PRODUCT J
COST(J,4)		COST OF GOODS SOLD, PRODUCT J
COST(J,5)		GROSS PROFIT, PRODUCT J
COST(J,6)		TRANSPORT COSTS, DIST. CENTRE TO RETAIL, PRODUCT J
COST(J,7)		TRANSPORT COSTS, FACT. WAREHOUSE TO DIST. CENTRE, PRODUCT J
COST(J,8)		TRANSPORT COSTS, FACT. WAREHOUSE TO WHOLESALER, PRODUCT J
COST(J,9)		INVENTORY COSTS, FACTORY WAREHOUSE, PRODUCT J
COST(J,10)		INVENTORY COSTS, DIST. CENTRE, PRODUCT J
CQST(n)	=	COST(1,n) + COST(2,n) , $1 \leq n \leq 10$
COST(1,11)		ADVERTISING ALLOWANCE TO RETAILERS
COST(1,12)		NATIONAL ADVERTISING EXPENDITURE
COST(1,13)		COST OF MARKET RESEARCH
COST(1,14)		INTEREST CHARGES
COST(1,15)		FIXED EXPENSE
COST(1,16)		TOTAL SELLING, ADM., AND GENERAL EXPENSE
COST(1,17)		NET PROFIT
DCA(K)		NATL. ADV. DECISION, FIRM K
DCAE(K)		EFFICIENCY OF NATL. ADV., FIRM K
DMD(M)		TOTAL DEMAND FOR ALL FIRMS IN MARKET SEGMENT M
DPA(K)		ADVERTISING ALLOWANCES TO RET. DECISION, FIRM K
DPAE(K)		EFFICIENCY OF ADV. ALLOW., FIRM K
DPRI(K,J)		RETAIL PRICE DECISION, FIRM K, PRODUCT J
DPROD(K,J)		PRODUCTION DECISION, FIRM K, PRODUCT J
DPT(K)		DEBT PAYMENT DECISION, FIRM K
DQ(K,J)		PRODUCTION QUALITY DECISION, FIRM K, PRODUCT J
DSHFW(K,J)		UNITS SHIPPED TO DISTN. CENT. DECISION, FIRM K, PRODUCT J
EDCA		ATTRACTIVENESS OF CURRENT NATL. ADV.
EDPA		ATTRACTIVENESS OF CURRENT ADV. ALL. TO RETAILERS
EDPRI(J)		ATTRACTIVENESS OF FIRMS PRICE/QUALITY RATIO, PRODUCT J
EDQ(J)		ATTRACTIVENESS OF QUALITY OF RETAILERS BEG. INVENTORY, PRODUCT J

EINV(K,J,1-4) AND EVAL(K,J,1-4) WHICH FOLLOW ARE READ IN EACH PERIOD AS BEGINNING INVENTORY UNITS AND UNIT VALUE RESPECTIVELY, UPDATED AND PRINTED OUT AS ENDING ENVENTORY FIGURES. THE READ IN VALUES OF EINV(K,J,1-4) AND EVAL(K,J,1-4) ARE SAVED IN THE COMPUTATIONS BY SETTING BINV(J,1-4) AND BVAL(J,1-4) RESPECTIVELY EQUAL TO THEM.

EINV(K,J,1)	RETAILERS INVENTORY IN UNITS FOR ANY FIRM(K)
EINV(K,J,2)	DIST. CENTRES INVENTORY IN UNITS FOR ANY FIRM(K)
EINV(K,J,3)	WHOLESALERS INVENTORY IN UNITS FOR ANY FIRM(K)
EINV(K,J,4)	FACTORY WHSE. INVENTORY IN UNITS FOR ANY FIRM(K)
EVAL(K,J,1)	PER UNIT QUALITY RETAILERS INVENTORY FOR ANY FIRM(K)
EVAL(K,J,2)	PER UNIT QUALITY DIST. CENTRES INV. FOR ANY FIRM(K)
EVAL(K,J,3)	PER UNIT QUALITY WHOLESALERS INVENTORY FOR ANY FIRM(K)
EVAL(K,J,4)	PER UNIT QUALITY FACT. WHSE. INVENTORY FOR ANY FIRM(K)
HIST(K,1,1)	CASH BALANCE FOR ANY FIRM(K)
HIST(K,1,2)	OUTSTANDING DEBT FOR ANY FIRM(K)
HIST(K,2,1)	SHARE PRICE IN PREVIOUS PERIOD, FIRM(K)
HIST(K,1,3)	ATTRACTIVENESS OF PAST AND PRESENT NATL. ADV., FIRM(K)
HIST(K,J,4)	PRODUCTION LAST PERIOD OF ANY FIRM(K)
IA	DUMMY VARIABLE
J	INDEXES SUBSCRIPTED VARIABLES BY PRODUCT - 1 = REEL MOWERS 2 = ROTARY MOWERS
K	INDEXES SUBSCRIPTED VARIABLES BY FIRM NUMBER
M	INDEXES SUBSCRIPTED VARIABLES BY MARKET SEGMENT NUMBER (1-3) REEL AND (9-11) ROTARY
MFIRM	FIRM NUMBER, IDENTIFIES HISTORY DECK
MIND	INDUSTRY NUMBER, IDENTIFIES HISTORY DECK
MTIME	THE CURRENT PERIOD
NCOPY	NO. OF PRINTOUT COPIES DESIRED
NOIND	INDUSTRY NUMBER, IDENTIFIES PARAMETER DECK
NOPER	NO. OF PERIODS RESULTS TO BE COMPUTED IN RUN
NPER	NO. OF PERIODS RESULTS MUST YET BE COMPUTED IN RUN
ORDER(J,1)	SUM OF FIRM'S POTENTIAL SALES FOR ALL 3 MARKETS
ORDER(J,2)	RETAILERS ORDERS FROM A FIRM'S DISTRIBUTION CENTRES
ORDER(J,3)	RETAILERS ORDERS FROM A FIRM'S WHOLESALERS
ORDER(J,4)	NO. OF UNITS SHIPPED BY A FIRM TO ITS DIST. CENTRES
ORDER(J,5)	WHOLESALERS ORDERS FROM A FIRM'S FACTORY WHSE.
PRICE(J,1)	A FIRM'S SELLING PRICE TO RETAILERS
PRICE(J,2)	A FIRM'S SELLING PRICE TO WHOLESALERS
PSLS(K,J,M)	POTENTIAL SALES OF ANY FIRM(K) IN ANY MARKET SEGMENT(M)
QINV(K)	QUARTERLY INVESTMENT DECISION, FIRM(K)
RES(1,1)	TOTAL INDUSTRY NATIONAL ADVERTISING
RES(1,2)	(NOT USED)
RES(1,3)	(NOT USED)
RES(2,1)	TOTAL INDUSTRY ADVERTISING ALLOWANCES TO RETAILERS
RES(2,2)	(NOT USED)
RES(2,3)	(NOT USED)
RES(3,M)	POTENTIAL REEL MOWER SALES IN SEGMENT M
RES(4,M)	POTENTIAL ROTARY MOWER SALES IN SEGMENT M
RES(5,M)	MARKET POTENTIAL 2 PERIODS HENCE, REEL MOWERS
RES(6,M)	MARKET POTENTIAL 2 PERIODS HENCE, ROTARY MOWERS
RES(7,M)	SHARE OF REEL MARKET IN EACH SEGMENT
RES(8,M)	SHARE OF ROTARY MARKET IN EACH SEGMENT

RES(9,1)	REEL MOWERS IN TOTAL RETAIL INVENTORY
RES(10,1)	ROTARY MOWERS IN TOTAL RETAIL INVENTORY
RES(11,1)	REEL MOWERS IN TOTAL WHOLESALE INVENTORY
RES(12,1)	ROTARY MOWERS IN TOTAL WHOLESALE INVENTORY
RES(13,K)	RETAIL CUT PRICE OF REEL MOWERS, FIRM K
RES(14,K)	RETAIL CUT PRICE OF ROTARY MOWERS, FIRM K
RM(K,n)	DECISION OF FIRMK TO PURCHASE RES(n,M)
SALES(J,1)	FIRM'S CONSUMER SALES IN ALL 3 MARKET SEGMENTS, PRODUCT J
SALES(J,2)	SALES TO RETAILERS FROM A FIRM'S DIST. CENTRES, PRODUCT J
SALES(J,3)	SALES TO RETAILERS BY A FIRM'S WHOLESALERS, PRODUCT J
SALES(J,4)	SHIPMENTS FROM FACTORY WAREHOUSE TO DIST. CENTRES, PRODUCT J
SALES(J,5)	SALES TO WHOLESALERS FROM A FIRM'S FACTORY WAREHOUSE, PRODUCT J
SLS(K,J,M)	ACTUAL SALES OF ANY FIRM(K) IN ANY MARKET SEGMENT(M), PRODUCT J
SPSLS(K,J)	POTENTIAL SALES IN ALL 3 MARKET SEGMENTS FOR ANY FIRM(K), PRODUCT J
SSLS(J,M)	TOTAL SALES OF ALL 3 FIRMS IN ANY MARKET SEGMENT(M), PRODUCT J
STA(J,M)	TOTAL ATTRACTIVENESS OF ALL FIRMS IN ANY SEGMENT(M), PRODUCT J
SRI(K)	SHARE INFLUENCE - ANNUAL REPORT
SPI(K)	SHARE INFLUENCE - ROI
SII(K)	SHARE INFLUENCE - INVENTORY MANAGEMENT
SGI(K)	SHARE INFLUENCE - SHARE PRICE LAST PERIOD
TA(K,J,M)	TOTAL ATTRACTIVENESS OF ANY FIRM(K) IN ANY SEGMENT(M), PRODUCT J
TMP(MTIME,M)	MARKET POTENTIAL IN ANY CURRENT PERIOD(MTIME) IN ANY SEGMENT(M)
TMP(MTIME,4)	PARAMETER DEFINING PERCENT RETAIL ORDERS GOING TO DIST. CENTRES
TSLS(K,J)	TOTAL SALES OF ANY FIRM(K) IN ALL MARKET SEGMENTS, PRODUCT J
T(M)	NO SALES IN ANY SEGMENT(M=1-3) IF QUALITY FALLS BELOW T(M)
T(4)	USED IN EDCA EQUATION
T(5)	USED IN EDCA EQUATION
T(6)	USED IN EDCA EQUATION
T(7)	DEFINES IMPACT OF CURRENT NATL. ADVERTISING IN HIST(K,1,3)
T(8)	PARAMETER USED IN CALC.OF EFFICIENCY OF NATL. ADV.
T(M)	NO SALES IN ANY SEGMENT (M=9-11) IF QUALITY BELOW T(M)
T(12)	USED IN ROI EQUATION
T(13)	WEIGHT OF ROI ON SHARE PRICE
T(14)	EQUALS TMP(MTIME,4) DIVIDED BY 100
T(15)	EQUALS 1.0 - T(14)
U(M)	USED IN CALCULATION OF EDQ FOR EACH SEGMENT(M=1-3)
U(4)	USED IN EDPA EQUATION
U(5)	USED IN EDPA EQUATION
U(6)	USED IN EDPA EQUATION
U(7)	PARAMETER DEFINING RETAILERS ORDERING RULE
U(8)	PARAMETER DEFINING WHOLESALERS ORDERING RULE
U(M)	AS ABOVE,(M=9-11)
U(12)	USED IN ROI EQUATION
U(13)	WEIGHT OF ANNUAL REPORT ON SHARE PRICE

V(M)	USED IN CALCULATION OF EDQ FOR EACH SEGMENT(M=1-3)
V(4)	USED IN CALCULATION OF EDPRI
V(5)	USED IN CALCULATION OF EDPRI
V(6)	USED IN CALCULATION OF EDPRI
V(7)	LIMIT BELOW WHICH FURTHER DECREASE IN PRICE/QUAL. HAS NO EFFECT
V(8)	IF PRICE/QUALITY EXCEEDS V(8), RESULTS IN REDUCED SALES
V(M)	AS ABOVE, (M=9-11)
V(12)	LOWER LIMIT OF SPI(K)
V(13)	WEIGHT OF INVENTORY CONTROL ON SHARE PRICE
W(M)	USED IN CALCULATION OF EDQ FOR EACH SEGMENT(M=1-3)
W(4)	MINIMUM RETAILERS ORDER FROM DIST. CENTRES (SET AT ZERO)
W(5)	MINIMUM RETAILERS ORDER FROM WHOLESALERS (SET AT ZERO)
W(6)	MINIMUM DIST. CENTRES FROM FACT. WHSE. (SET AT ZERO)
W(7)	MINIMUM WHOLESALERS ORDER FROM FACT. WHSE. (SET AT ZERO)
W(8)	EFFICIENCY OF ADVERTISING ALLOWANCE TO RET. EXPENDITURE
W(M)	AS ABOVE, (M=9-11)
W(12)	UPPER INVENTORY RATIO PENALTY THRESHOLD
W(13)	WEIGHT OF LAST SHARE PRICE ON SHARE PRICE
X(M)	USED IN CALCULATION OF EDQ FOR EACH SEGMENT(M=1-3)
X(4)	SELLING PRICE TO RETAILERS AS PERCENT OF RETAIL LIST PRICE
X(5)	SELLING PRICE TO WHOLESALERS AS PERCENT OF RETAIL LIST PRICE
X(6)	PERCENTAGE INVENTORY CARRYING COST, FACT. WHSE.
X(7)	PERCENTAGE INVENTORY CARRYING COST, DIST. CENTRES
X(8)	(NOT USED)
X(M)	AS ABOVE, (M=9-11)
X(12)	LOW INVENTORY PENALTY
Y(M)	USED IN CALCULATION OF EDQ FOR EACH SEGMENT(M=1-3)
Y(4)	PER UNIT TRANSPORTATION COST TO RETAILERS
Y(5)	PER UNIT TRANSPORTATION COST TO DIST. CENTRES
Y(6)	PER UNIT TRANSPORTATION COST TO WHOLESALERS
Y(7)	COST PER ITEM OF MARKETING RESEARCH
Y(8)	RETURN ON QUARTERLY INVESTMENT
Y(M)	AS ABOVE, (M=9-11)
Y(12)	HIGH INVENTORY PENALTY
Z(M)	QUALITY GREATER THAN Z(M) HAS NO FURTHER EFFECT IN ANY SEGMENT(M)
Z(4)	INTEREST RATE CHARGED ON OUTSTANDING DEBT
Z(5)	FIXED EXPENSE
Z(6)	LIMIT ABOVE WHICH PRICE MAY NOT GO, OR ZERO SALES
Z(7)	MAXIMUM RATIO BETWEEN THIS AND LAST PERIOD'S PRODUCTION
Z(8)	THE LIMIT BELOW WHICH THE PRODUCTION LIMITATION DOES NOT HOLD
Z(M)	AS ABOVE, (M=9-11)
Z(12)	EXPONENT IN ROI EQUATION
ZA(K,1,1)	FIRM'S YEARLY CUMULATIVE RETAIL REEL SALES
ZA(K,2,1)	FIRM'S YEARLY CUMULATIVE RETAIL ROTARY SALES
ZA(K,1,2)	FIRM'S YEARLY CUMULATIVE PROFITS

APPENDIX 9 Improved MARKSIM Parameter Deck (FILE 4)

```
.30000E+02.56880E-02.00000E+00.16066E+01.71100E-04.26666E+01.50000E+02
.40000E+02.20000E-01-.4000E+02.10000E+01.10000E-03.20000E+01.60000E+02
.55000E+02.12800E-00.55000E+02.10000E+01.25600E-02.20000E+01.30000E+02
.12000E+01.12000E+01.15000E+01.00000E+00.75000E+00.50000E+01.50000E-01
.31599E+01.20639E+01.21887E+02.00000E+00.65000E+00.50000E+01.50000E+05
.53144E+12.45043E+08.40707E+01.00000E+00.10000E+00.50000E+01.35000E+03
.30000E+00.12000E+01.10000E+01.00000E+00.10000E+00.10000E+04.15000E+01
.50000E+01.12000E+01.40000E+01.50000E+01.00000E+00.40000E-01.20000E+04
.30000E+02.39197E+00-.3000E+02.53846E+00.3719/E-02.15384E+01.70000E+02
.35000E+02.48000E-02-.5000E+03.10000E+01.48000E-05.20000E+01.45000E+02
.45000E+02.31300E-02.45000E+02.18571E+01.31300E-04.28571E+01.75000E+02
.18000E+03.35000E+01.10000E+01.20000E+01.10000E+01.20000E+01.16000E+01
.40000E+00.20000E+00.20000E+00.20000E+00.00000E+00.00000E+00.00000E+00
```

1	2500.	3000.	2500.	50.	5200.	2000.	800.
2	2500.	4000.	2500.	52.	4700.	2500.	800.
3	6000.	3000.	5000.	48.	9000.	2500.	1400.
4	3000.	3000.	3000.	49.	7400	2500.	1100.
5	1700.	2200.	1600.	46.	4800.	1500.	900.
6	1200.	3000.	700.	49.	3200.	1500.	800.
7	3800.	3000.	1600.	50.	6700.	2000.	1200.
8	2400.	3000.	1600.	48.	5400.	1500.	900
9	1700.	3000.	1300.	53.	4300.	1500.	1200.
10	3400.	4000.	2000.	51.	6600.	1700.	1700.
11	4800.	4000.	3000.	54.	7900.	2500.	1900.
12	2000.	3000.	2000.	49.	5000.	2500.	1700.
13	2000.	3000.	2000.	46.	3000.	2500.	1500.
14	4000.	4000.	3000.	53.	4800.	3000.	2200.
15	5000.	4000.	3000.	50.	6000.	3000.	3700.
16	2500.	3000.	1500.	49.	3200.	3000.	2400.
17	2000.	2000.	1000.	48.	1800.	3000.	1500.
18	2000.	2000.	1000.	47.	1200.	3000.	1600.
19	1500.	4000.	500.	49.	1700.	3500.	2300.
20	2000.	2000.	1500.	47.	1500.	2000.	1500.
21							
22							
23							
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34							

APPENDIX 10 Improved MARKSIM Initial HISTORY Deck (FILE 7)

```
  100          01              1              01
  200    FIRM ONE,     INDUSTRY ONE
  300        2500.        65.   50000.          0.
  400        2000.        65.       0.          0.
  500        1500.        65.     530.          0.
  600        1200.        65.    3000.          0.
  700        2500.        55.       4.          0.
  800        2000.        55.       0.          0.
  900        1500.        55.       0.          0.
 1000        1200.        55.    3000.          0.
 1100          01              2              01
 1200    FIRM TWO,     INDUSTRY ONE
 1300        2500.        65.   50000.          0.
 1400        2000.        65.       0.          0.
 1500        1500.        65.     530.          0.
 1600        1200.        65.    3000.          0.
 1700        2500.        55.       4.          0.
 1800        2000.        55.       0.          0.
 1900        1500.        55.       0.          0.
 2000        1200.        55.    3000.          0.
 2100          01              3              01
 2200    FIRM THREE,   INDUSTRY ONE
 2300        2500.        65.   50000.          0.
 2400        2000.        65.       0.          0.
 2500        1500.        65.     530.          0.
 2600        1200.        65.    3000.          0.
 2700        2500.        55.       4.          0.
 2800        2000.        55.       0.          0.
 2900        1500.        55.       0.          0.
 3000        1200.        55.    3000.          0.
 3100          01              1              02
 3200    FIRM ONE,     INDUSTRY TWO
 3300        2500.        65.   50000.          0.
 3400        2000.        65.       0.          0.
 3500        1500.        65.     530.          0.
 3600        1200.        65.    3000.          0.
 3700        2500.        55.       4.          0.
 3800        2000.        55.       0.          0.
 3900        1500.        55.       0.          0.
 4000        1200.        55.    3000.          0.
 4100          01              2              02
 4200    FIRM TWO,     INDUSTRY TWO
 4300        2500.        65.   50000.          0.
 4400        2000.        65.       0.          0.
 4500        1500.        65.     530.          0.
 4600        1200.        65.    3000.          0.
 4700        2500.        55.       4.          0.
 4800        2000.        55.       0.          0.
 4900        1500.        55.       0.          0.
 5000        1200.        55.    3000.          0.
 5100          01              3              02
 5200    FIRM THREE,   INDUSTRY TWO
 5300        2500.        65.   50000.          0.
 5400        2000.        65.       0.          0.
 5500        1500.        65.     530.          0.
 5600        1200.        65.    3000.          0.
 5700        2500.        55.       4.          0.
 5800        2000.        55.       0.          0.
 5900        1500.        55.       0.          0.
 6000        1200.        55.    3000.          0.
```