

Business Strategy and Computer Simulation Model

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The business Strategy and Computer Simulation (SPAS) model consists of instructor and student software developed to simulate a competitive industry. It accommodates up to 10 firms that manufacture two products which can be sold in three markets. A competitive industrial environment and customized business environment make this software unique in that it aims to improve the skill and ability of decision makers in a dynamic business setting.

Introduction

An instructor's software has over 100 parameters/ indicators to define business conditions. These parameters could be adjusted according to the instructor's desire. Business parameters are categorized as Production, Marketing, Economic, Finance, Warehouse, Manpower, Merge, Transfer, and Performance. Two categories of Merge and Transfer increase the capability of the instructor to adjust the business setting according to the participants' desire. Merge permits two firms to merge by using appropriate windows, and Transfer allows two firms to exchange raw materials in order to smoothen their operations. Finally, Performance category helps the instructor to evaluate firms' performance according to pre-set selected criteria.

The student software requires each firm to make 74 quantitative decisions concerning manpower, operations, marketing, and financial matters. These decisions are inputted by diskettes into the main program. Output from the program includes reports on: Operations, Financial Ratios, Cash Flow, Earnings, Balance Sheet, Costs, and General Information. Outputs reports could be viewed or printed by activating menu-driven modules.

Systems requirement: Microsoft Windows 95.

MAJOR CHARACTERISTICS OF THE MODEL

- Each firm can produce and sell one or two types of manufactured goods called Product 1 and Product 2. A decision could be made to produce any or both types. Therefore the level of participants' capability determines the complexity of the model.
- The model is generic and the aggregate market demand has a tendency toward using more of Product 1. (It is assumed that Product 1 has a better quality than Product 2 for a given quality-oriented society.)
- The environmental conditions in which firms are competing against each other are easily modified at any time in order to comply with a specific setting. The generic structure of the parameters allows the instructor to adjust the environmental parameters according to the specifically desired conditions.
- Firms can merge or be acquired by another firm and participants are allowed to restart with a new firm.
- Firms can sell/buy extra quantity of raw material to/from their competitors in order to smooth their operations.
- Instructors select a set of criteria from a menu to rank firms' performance during the last four runs.

Target Audience

The simulation model is especially designed to expose MBA students and managers to a rapidly growing manufacturing firm. A heavy emphasis on inter-relations of the firms' performance, including finance, marketing, operations, and human resources, are designed to improve participants' skill and enable them to work in a highly competitive business environment. The simulation is also suitable for graduating business students by limiting the program to only one product.

Procedure and Sequence of Operations

Participants enter their decisions on their diskettes by using the Business Strategy and Computer Simulation Model (SPAS) Student Version. Typical data for a student version is related to manpower, production, marketing, and financial decisions. The instructor will call the main program, SPAS Instructor Version, and adjust the business setting/environment according to a preferred model and run the computer software by pressing the "RUN" Icon.

The result of the run is recorded on each firm's diskette. Participants can either print or review the current and previous outputs.

This procedure is schematically presented in Fig. 1, showing two sets of inputs, the student version input and the instructor's input via changing parameters.

In summary: participants input their data on firm's diskette and the instructor adjusts the business environment, activates the Icon to run the model, and subsequently inserts the firm's diskette as requested by the main program to record firm's data on firm's diskette.

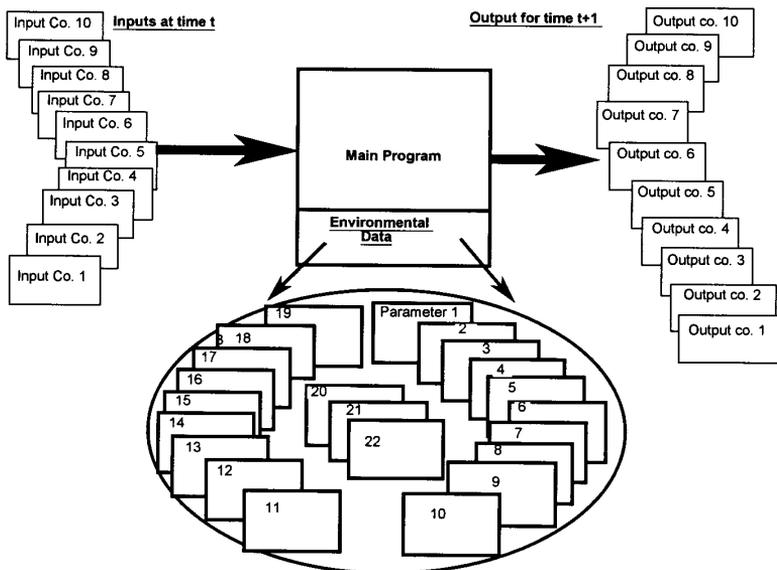


Fig. 1 - Procedures and Sequence of the Operations

Instructor's Software

The instructor’s software consists of two parts: “Business Setting”, which uses a set of window driven menus, and “Formulas”, which consist of the engine for the simulation. Adjustment of the simulation to the specific business environment is done by activating a set of user friendly menus. The engine is comprised of three sub-models which are referred to as: Production, Marketing, and Finance Sub-models.

There are 8 main folders that the instructor could use in order to adjust the business environment. These folders contain over 100 parameters and are referred to as: Production, Marketing, Economic, Costs, Warehouse, Transfer, Merge, and Performance. The Merge, Transfer, and Performance folders allow the instructor to exchange raw materials between two forms in exchange for cash. The Merge folder is used for merging two firms by following a series of menu driven windows. The Performance folder is designed to help the instructor evaluate firms according to set of pre-selected criteria.

Due to the particular setting of some of the parameters such as: effect of wage, effect of training, corresponding tables are in the range format as shown on Figure 2, while some other parameters i.e. carrying costs, a simple table format is used as shown on Fig. 3.

As mentioned earlier, the instructor could review any past period’s data and accept or change future values of any indicator.

In addition to the eight folders, the menu bar offers additional options to modify the simulation model using icons such as File, Game, Teams, Quarter, and Help. The current period and year are also shown below the menu bar. Any changes to these parameters could be done by activating the Icon “+” or “-”.



Fig. 2 - Typical Menu using Tables to Define Parameters

PRODUCTION SUB-MODEL

The production function is composed of a set of inter-related functions. At the aggregate form, the total number of units produced is determined by three major factors all computed for time t. These factors are labor force, system's efficiency, and quantity of available raw material.

The equation of the production function is:

$$P_t = P(L_t, R_t, E_t) \tag{1}$$

Where:

- P_t is number of units produced during time t,
- L_t is the available labor force at time t,
- R_t is the quantity of raw material available at the beginning of the time t, and
- E_t is the system's efficiency during time t.

The system's efficiency itself is a function of effective/tangible profit sharing plan applied during the last time period, average paid salary as compared to the industry's average during previous period, and the amount of R&D budget invested during the last two time periods.

$$E_t = E(Ps_{t-1}, As_{t-1}, P_{rd,t-1}) \tag{2}$$

Where:

- Ps_{t-1} is the effective profit sharing plan during the last time period,
- As_{t-1} is the average paid salary and compared with the industry's average during the last time period, and
- $P_{rd,t-1}$ is the amount of R&D budget invested for production purposes during the last two time periods.

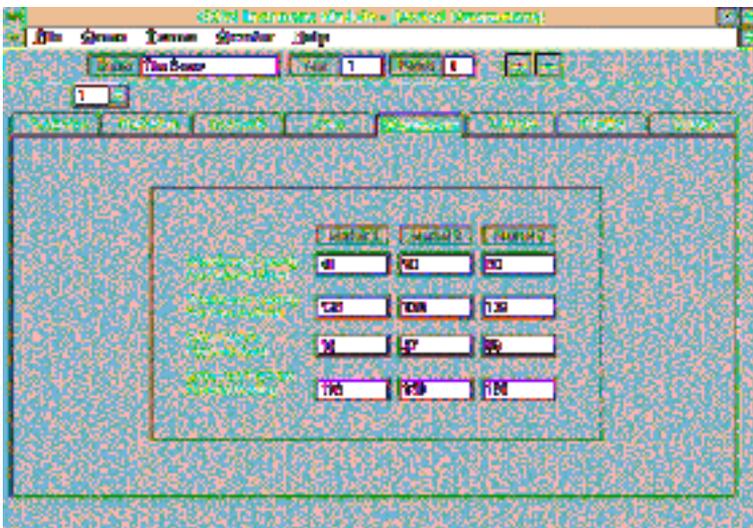


Fig. 3 - Typical Menu using Simple Data Presentation

MARKETING SUB-MODEL

Demands evaluation for a Product (1 or 2) are subject to the general aggregate demand at the macro level. This demand is later adjusted by other factors at the micro and the firm's levels. While Gross Domestic Product, Price Defoliator, and Number of Household Formation determine the macro level, other factors such as price, advertising budget, R&D in marketing, sale's salary, and sale's capacity are determinant factors for the micro and firm's levels.

Demand function has the following format:

$$M_t = M (Mk_t, GDP_t, PDE_t, Hf_t, P_t, Adv_{t-1}, Avsal_{t-1}, Avcom_{t-1}) \quad (3)$$

Where:

- Mk_t is the demand for a product at time t,
- GDP_t is the Gross Domestic Product at time t,
- PDE_t is the price defoliator at time t,
- HF_t is the household formation at time t,
- P_t is the selling price of the product at time t,
- Adv_{t-1} is the advertising budget during previous time period,
- $Avsal_{t-1}$ is the average sales salary paid during previous time period as compared to the industry's average,
- $Avcom_{t-1}$ is the average sales salary paid during the previous time period and compared to the industry's average.

FINANCIAL SUB-MODEL

Cost and Revenue compose the financial sub-model. This sub-model follows general accounting principles and presents the result of financial operations in the form of a balance sheet, income statement, and flow of funds. The Cost function computes all related costs such as labor, raw material, transportation, carrying costs of raw material, and finished goods, bond interest, administrative/overhead cost, etc.

Cost function is given by:

$$C_t = C (Tr_t, Wh_t, Hr_t, P_{rd,t}, Mkt_{rd,t}, \dots) \quad (4)$$

Where:

- C_t is the cost in \$,
- Tr_t is the transportation cost during time t,
- Wh_t is the carrying costs at the warehouse level for raw material and finished goods during time t,
- Hr_t is cost of manpower during time t,
- $P_{rd,t}$ is the R & D budget used in the production sector during time t,
- $Mkt_{rd,t}$ is the R & D budget allocated in the marketing sector during time t.

The Revenue function reflects all revenues to the firm including sales, selling land and equipment, issuing stocks and bonds, getting a bank loan. Issuing stocks, bonds, and financing through bank loans will increase liabilities of the firm and they are reflected on the flow of funds and balance sheet of the firm.

A typical formula for the revenue function is:

$$R_t = R (S_t, La_t, St_t, Bo_t, Bkl_t, \dots)$$

(5)

Where:

- S_t** is the sales in \$ during time period t,
- La_t** is the land and equipment sales during time period t,
- St_t** is the stock is sued in \$ during time period t,
- Bo_t** is the bond issued in \$ during time t,
- Bkl_t** is the bank loan in \$ during time t.

STUDENT MODULE

This module consists of two parts, inputs and outputs. In the input section, participants select up to two types of products. Total decision variables are 74 decisions presented in a menu driven style categorized in the four areas of Production, Marketing, Manpower, and Finance. (See Fig. 4.)



Fig. 4- Typical Student Window for Data Inputs

In the output section "Operation's Results" participants can browse through their past performance and print any or all sections of the Operation's Results. Operations and marketing areas give information separated by the type of product while Financial information is divided into three categories: Product 1, Product 2, and Consolidated.

In addition to the general information about the overall performance of all firms involved, the student software gives information about the average industries' ratios, which provide a basis of comparing firms. It also gives values of the most commonly used financial data. Fig. 5 shows typical window for student software.

Market	Production	Financial Administration
R & D	R & D	Foreign Inv. Costs
Sales Salaries	Salaries	Capital Inv. M.A.
Procurement	Procurement	Administrative
Advertising	Marketing	Bond Interest
Transportation	Leasing	Loan Interest
Order Processing	Factor Expenses	
Research & Dev.	Total R&D Investment	
	Administration	
	Transportation	
Subtotal Total	Production Total	Administrative Total

Fig. 5 - Typical Student Window for Data Inputs

References

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- Smith, Gary D., Arnold, Danny R., & Bizzell, Bobby G. (1991). *Strategy and Business Policy*, Third Edition. Houghton Mifflin Company.