SIMULATION OF INTERACTIVE BUSINESS STRATEGIES AND OPERATIONS

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There is growing application of simulation to practical training in management of business on strategic and operational level. In use are simple models where a business is immersed in a much bigger market which sets the context, and others where the context is set dynamically by the actions of the competitors (3), (4).

The simulation exercises reported are centered on the question of how to appreciate the impact of a reactive context in managing a business (1). The Implementation of Simulation with continuous simulation (Dynamo, etc.) gives easy appreciation of the impact of operational dynamics in a reactive strategic context.

INTRODUCTION

With earlier work (1), presented at the 1989 S.D.S. conference, it was shown, how based on strict definitions of markets, business segments and company portfolio strategies, a reactive strategy context could be simulated. The work reported covered a first simulation experiment with a one company - one segment model extended to a two competitor situation.

In this paper we report further work towards a general approach which is starting to be used for verifications of robust business strategies in specific and real competitive contexts.

An interesting key question for which we report some simulation results is centered on the paradigm that not the bigger but the faster competitors will succeed. This story of the hare's and the turtle's race is translated into a model comprising two competitors, each with two businesses immersed in two separate markets.

The simulation results do not confirm that the best way to win is maximum operational flexibility. Much better success goes with a longer strategy-setting time span and reasonable operational flexibility adapted to the market. A strategy setting time horizon serves to alleviate the need for operational flexibility in confronting competitors.

BASIC MODELLING STRUCTURES

In this chapter we will step by step put the concepts together that are the building blocks of our modelling approach to the real world of competitive, interactive business.

The very basis is the definition of the business segment as the specific arena, where competition meets and market shares are measured. A business segment is defined by a client or clients problem served by a product (7). This is understood to be a market context outside the company. All a company can do is to take part in business segments on the market or to leave them.

Business strategy will be based on the relative position a company achieves in a certain business segment. There exists a natural strategy which starts a business in a specific business segment according to its so-called life-cycle. From the two prominent strategy-classifications, namely (5)

- market-/company attractiveness (Boston Consulting Group)
- product life-cycle (Arthur D. Little Inc.)

we compiled a simplified combination, that uses relative market share and product life cycle as parameters to define the four typical strategic cases such as dog, question-mark, star, cow.

The necessary backbone of a strategy simulation in an interactive context however is a reasonable realistic simulation of the every day operational business transactions within each of the competitors (2). For the reported simulation exercise we have restricted ourselves to simplified models, where for each business segment, even within the same company, we have separate business operations. This could of course be changed and adapted to any relevant case.

The causal-loop structure of adjusting demand and supply in a business is summarized in Fig. 1, adapted from (3). There are four major parameters:

- BL, backlog of incoming orders, which defines delivery delay, capacity increases and delivery rate
- FI, stock of finished goods, which together with production capacity defines production rate, delivery rate and selling price preference
- PC, production capacity, which defines production rate and fixed manufacturing cost
- PRICE, price preferences to customer, which is used to control the stock of finished goods

Of course this simple structure is complemented by an accounting sector and a strategy sector, treated below.

The accounting sector in its illustrative and minimum implementation just represents the calculation of the net product contribution after marketing and after deduction of the fixed manufacturing cost (financing and managing cost, not initial investments etc.).

Included are the effects of the learning curve in production capacity and in the unit-variable-cost over time. Total marketing

expense also includes financing of stocks of finished goods. A model for this simplified accounting is demonstrated in (3).

Based on accumulated accounting parameters and market-shares a strategy-setting sector within operations sets the strategy limits for the strategic business parameters. In the minimum implementation reported these were chosen to be, see also (3):
- price
- capacity for production
- sales expense

Policy setting, e.g. defining the actual strategy case is implemented using the parameters from the interplay of operations and accounting. Strategy setting and policy setting as input to strategy results in the overall structure shown in Fig. 2. The model can of course be adapted so that policy setting does not follow the interactive market development but instead follows a given program over time. Such a feature allows to test preprogrammed business plans.

Modules for coupling the company to competition

The market allocation module calculates for each moment in time what will be the incremental gain or loss of market share depending on how the relative product attractiveness compares to market average.

By integration over time we get the time dependent market-share of the company in the business-segment considered. Multiplication of market-share and the also time dependent market-size calculated in the competition-data module gives the flow of orders booked as input to the business operations. The implementation presented is summarized in Fig. 3.

In order to couple a number of competitors to a business segment we use, as shown in Fig. 3, a module competition data called "gendat" that calculates the mean values of product attractiveness parameters needed within the market allocation. For each separate company the budget module finally serves to calculate the allowable sales effort expenses based on fixed manufacturing cost and net product contribution sum.

Implemented is a priority-setting algorithm that concentrates allowable expense on question-mark/star strategies. If a business is terminated the remaining assets (here simply the stock of finished goods) are liquidated and the result transferred to the net contribution sum of the company.

Strategy setting and operational day to day adjustment

In order to simulate business strategies as compared to operational business behaviour a strategy setting time period is used. The relevant strategy paramenters (price, capacity, sales-effort) are fixed for a strategy planning period, which like most

other parameters of the model can be changed for each simulation run.

This allows to verify the size of optimum strategy-revision periods. If the period is set equal the time step for integration of the model equations we would have a purely operational oriented business adjustment from day to day.

SIMULATION OF SOME SIMPLE COMPETITIVE SITUATIONS

In order to illustrate what kind of investigation is possible with simulation of competitve situations we will go through two increasingly complex cases. They are:

A a single company, single business segment immersed in a stable market context, Fig. 4
B two companies, each with two businesses immersed in the two separate markets, Fig. 5

With this increasing complexity we will illustrate the procedure to simulate any given competitive context starting from the building blocks

- operational module
- gendat. or competitive data module
- budget module per company involved

RUN A - The single company, single business, immersed in a stable market context, Fig. 4
is the minimum configuration of our simulation. From the figure we identify the basic modules described above:

- the competitive data/gendat. module, that gets as input data the stable parameters of the immersion part of the market and those of our company business present
- the operations module (one per business and market) is shown as aggregation of the submodules:
  . market allocation
  . business adjustment loops supply/demand
  . accounting
  . strategy setting/policy setting

- the budget module where the means for sales effort are allocated

The simulation runs demonstrate the behaviour found for this minimum configuration with an aging product starting from a question-mark position.

Run A used starting parameters that let the business complete a full cycle from question-mark to star to cow and end with dog.

This was assured by

- low starting price
- low starting market share
- size of immersed market small

RUN B - Two companies, each with two businesses immersed in two separate markets

We do have two markets:

a. with X-business and U-business
b. with Y-business and V-business

The two companies are the XY-company and the UV-company. Just to get a first impression of the behaviour of this competitive structure we did introduce some differences into the parameter settings as summarized below:

- strategy setting periods for UV-company much longer
- B-market immersed size smaller
- B-market price-sensitivity higher

As a consequence the company UV does appreciably better mainly because of a better suited strategy setting time against more or less opportunistic operations management of its opponent, the XY-company. This can be inferred from the printouts of

- UBDUGET / XBUDGET
- net product contributions. NETPC for XY/UV

RUN C

In the next setup the only difference is a faster operational response of XY-company. This results in XY-company doing better (fewer lost sales and lower inventory).

Further experiments not shown in the paper confirm, that if a long enough strategy period is used, fast operational flexibility does only improve the results, as long as required by the market.

GENERAL COMPETITIVE STRUCTURES/APPLICATIONS AND FURTHER INVESTIGATIONS

With the very much simplified simulation exercises we just wanted to illustrate the feasibility of strategic business simulation with a tool, the Dynamo Simulation Language, and in a format that is comparatively easy to adapt to real world circumstances.

In a general competitive situation with several competitors serving different markets we would arrive at a structure like e.g. Fig. 6. Using the model building blocks introduced, the general relationship on which to build a simulation model for strategic planning analysis would be:

- number of different markets served	=	number of competitive data modules "gendat."
- number of competing companies	=	number of budgeting modules
- number of business per market	=	fan-out of competitive data module concerned
- number of business per company	=	fan-out of budgeting module concerned

In case of modelling a real company with known competitors one would of course not simply take identical modules for the respective business operations but rather modules adapted to represent the operations in question. As shown in his early book Industrial Dynamics (9) J. Forrester has shown how to do this and has demonstrated the relative ease to accomplish a realistic model for a specific case.

In our view using the identical simulation approach for strategy and operations planning helps very much to shorten the path for optimising in parallel the dynamics of the business operations themselves, which somehow appears to have been the original idea also of Industrial Dynamics, but which today in the context of computer-integrated-manufacturing is a much clearer necessity (8).

CONCLUSIONS

The straigth-forward approach to image the two competitive processes of market clearing of products and company clearing of businesses is validated further.

A very much simplified exercize on the question of the impact of different strategy planning periods on the one hand and operational flexibility on the other hand yields some clarifications on the effect of fast reaction flexibility in competition. Fast operational flexibility only helps win if your competitor does not use a strategy planning for a longer interval than you.

The work reported represents in the authors view a useful demonstration how to implement a strategy validation based on simulation of the behaviour of a reactive competitors context. The separation of the competition into a market clearing process and a company portfolio clearing process helps to generalize and adapt the approach to any real competitive context, e.g. Fig. 6.

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(5) A.C. Hax and N.S. Mailuf; Strategic management 1984 Prentice-
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(7) U. La Roche; Von der Kunst, mit der richtigen Produkt-/Markt-Strategie-Methode zu planen, IO Management Zeitschrift 56 (1987) Nr. 3, DK 658.624.012.2

(8) Alan K. Graham; Generic models as a basis for computer-based case studies. Proc. Int. Conference of the System Dynamic Society 1988 La Jolla, P. 133

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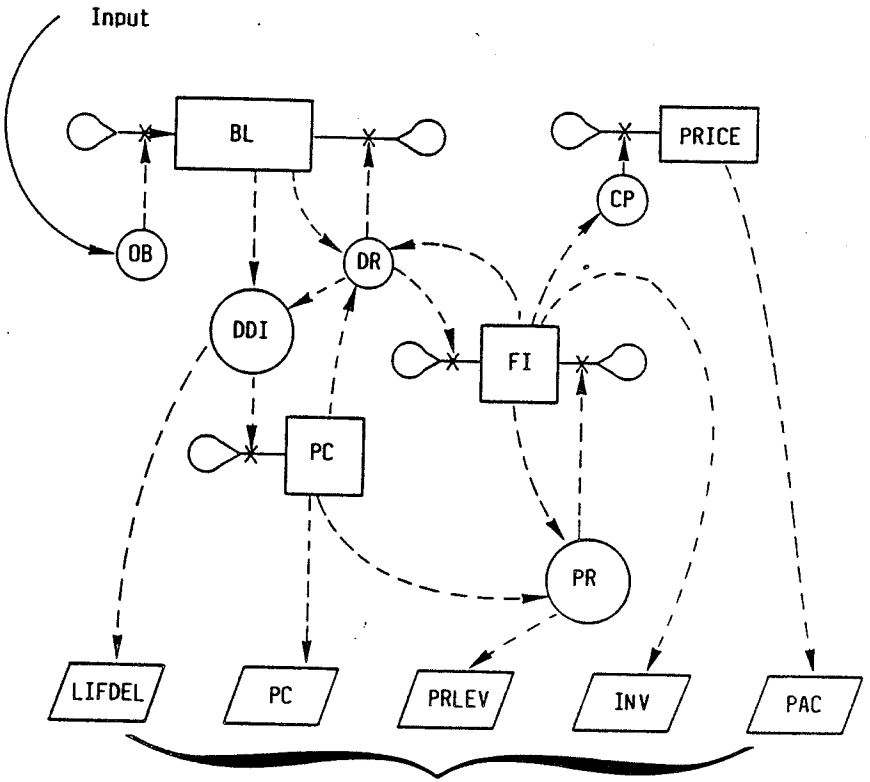
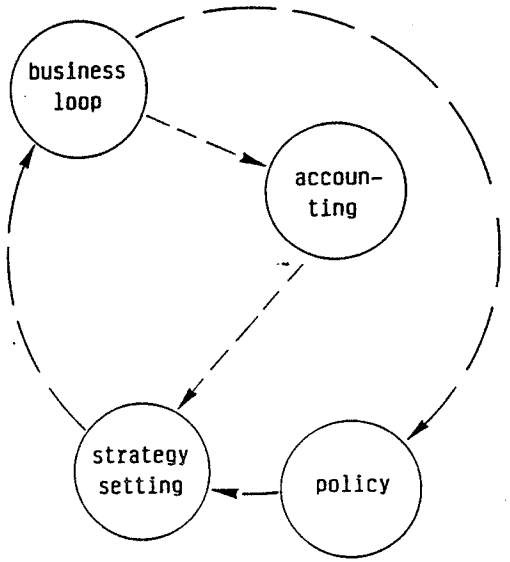


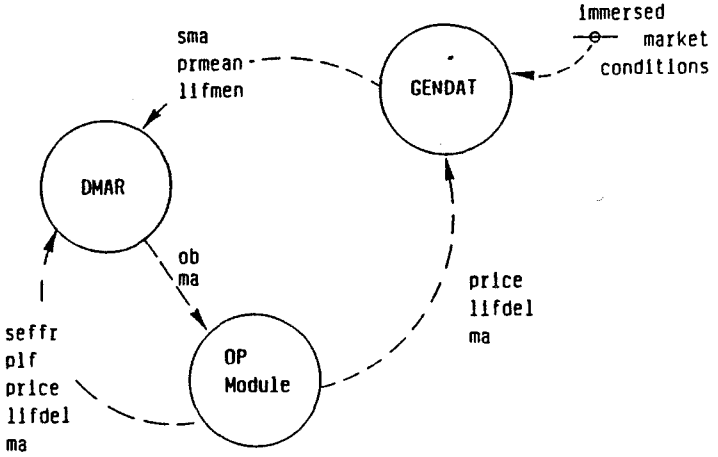
Business loop for demand/supply and related parameters

FIG. 1



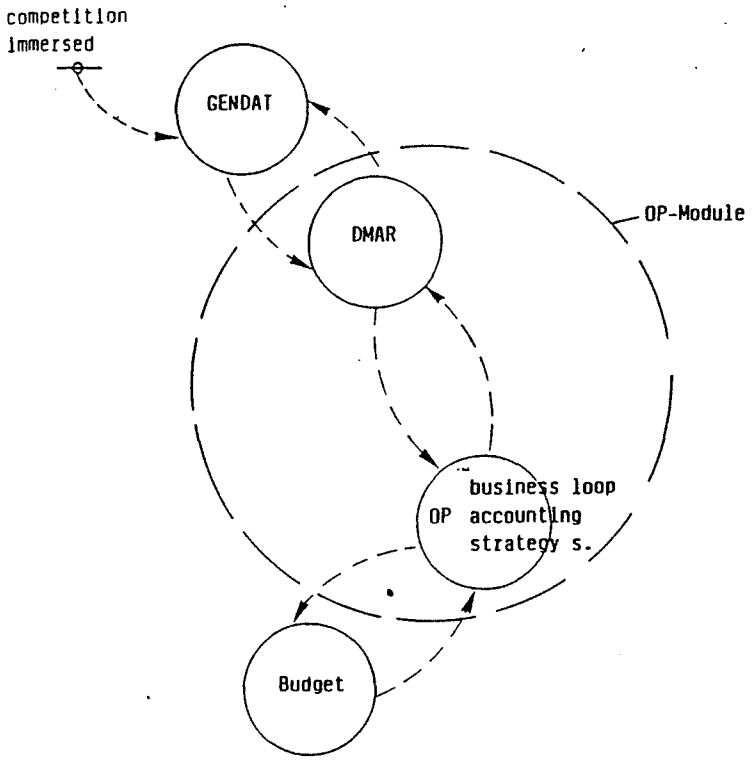
Policy setting within business module

FIG. 2



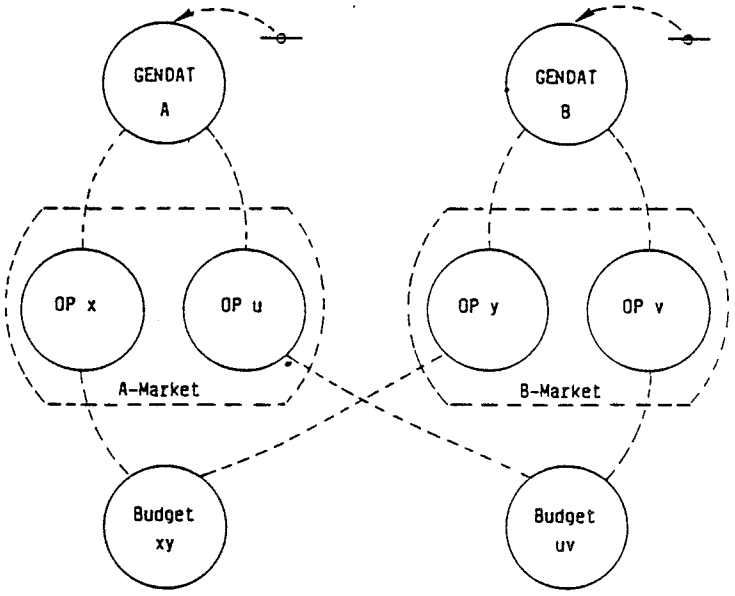
Market allocation with product attractiveness parameters

FIG. 3



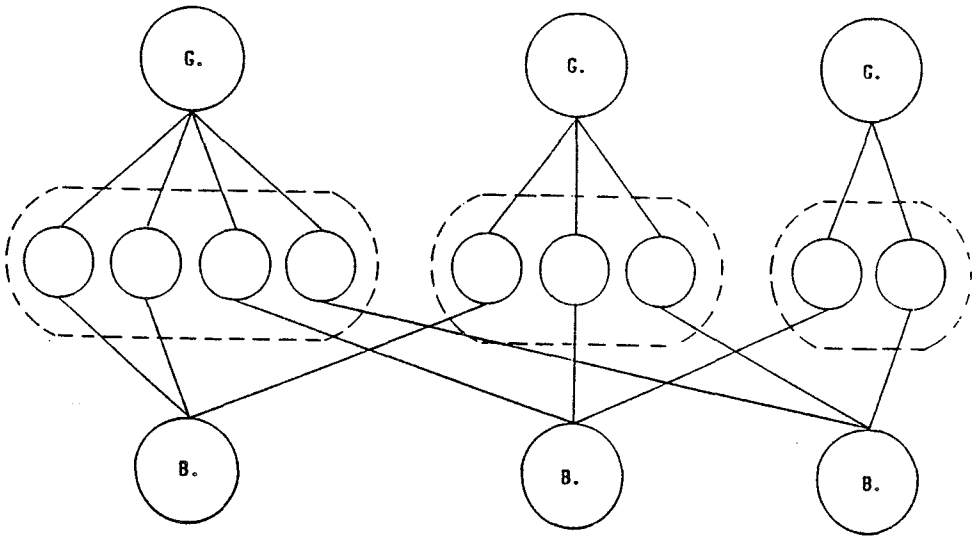
RUN A:
single company/single business segment minimum implementation

FIG. 4



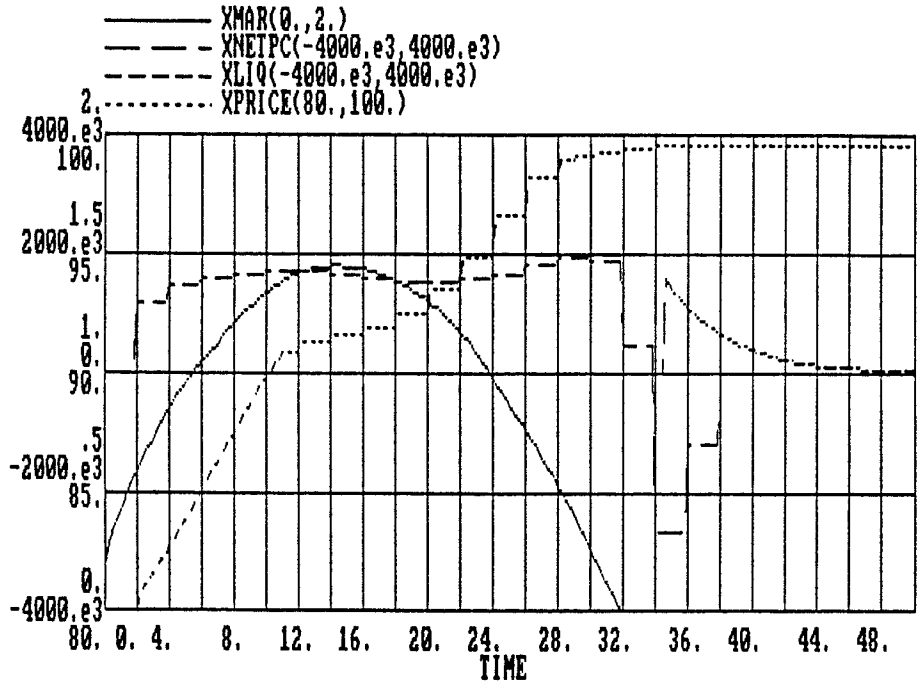
RUN B/C:
two companies/two two segment markets separately immersed

FIG. 5



Generalized multi-company/multi-market/multi-segment structure

FIG. 6



Comments RUN A

A1 The strategy transition from quest to star to cow and dog before divesting is visible by following market-share XMAR and price XPRICE. Around time = 32 the business is liquidated, the proceeds get the remaining budget above zero.
XNETPC the net contribution of the product and XPRICE reflect the strategy changing.
XLIQ is the eroding business liquidation proceeds available after divesting.

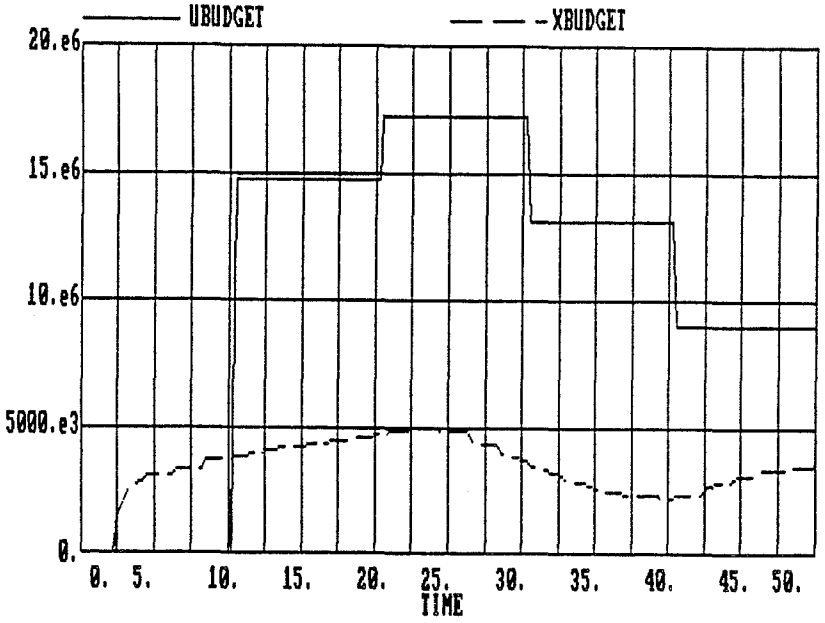
Portfolio-Parameter ENTRY signals, if conditions would be right to enter depending on competitor market-share.

cravad.rsl - Page 1 PORTFOLIO-PARAMETERS ONE SEGMENT

TIME	0.	5.	10.	15.	20.	25.	30.
XDOGS	0.	0.	0.	0.	0.	0.	1.
XQUEST	1.	1.	0.	0.	0.	0.	0.
XSTAR	0.	0.	1.	1.	1.	0.	0.
XCOW	0.	0.	0.	0.	0.	1.	0.
XDIVEST	0.	0.	0.	0.	0.	0.	0.
XENTRY	1.	0.	0.	0.	0.	0.	1.

TIME	35.	40.	45.	50.
XDOGS	1.	1.	1.	1.
XQUEST	0.	0.	0.	0.
XSTAR	0.	0.	0.	0.
XCOW	0.	0.	0.	0.
XDIVEST	1.	1.	1.	1.
XENTRY	1.	1.	1.	1.

A2 Strategy parameters from quest to dog.



Comments RUN B

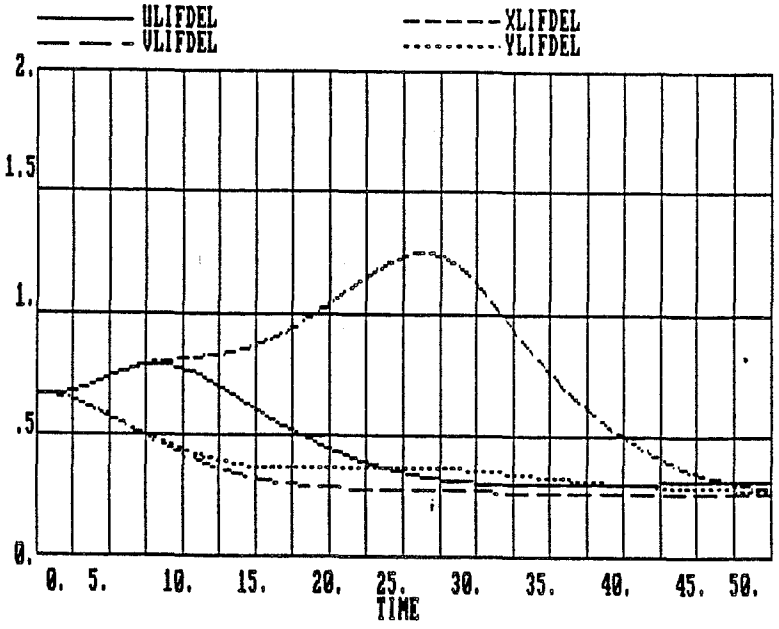
Please remember the market and company settings:

companies are: xy-company with x-budget
uv-company with u-budget

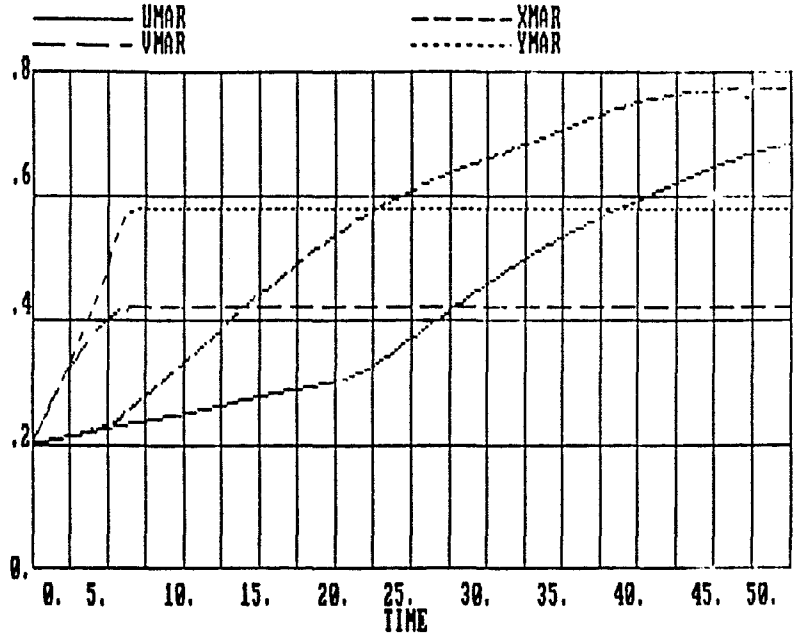
markets are: xu-business in A-market
yv-business in B-market

B-market is reduced immersed size, highly price sensitive and short market-share reaction. The uv-businesses use a strategy setting period which is very much longer than xy-businesses.

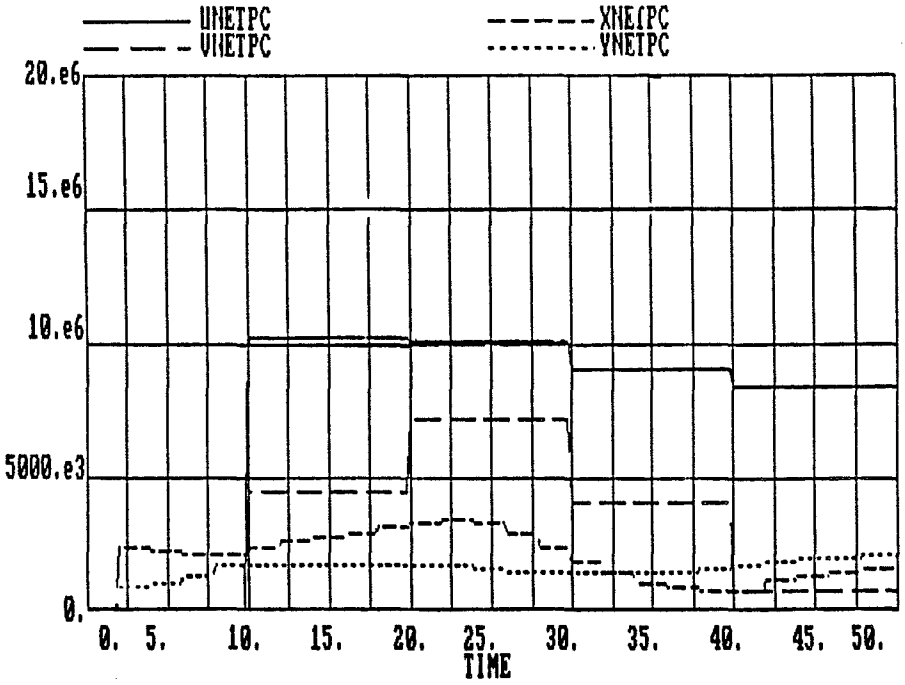
B1 On the same scale we see the dramatically bigger income generated in the longer term for uv-company with longer strategy-setting period, compare u-budget/x-budget.



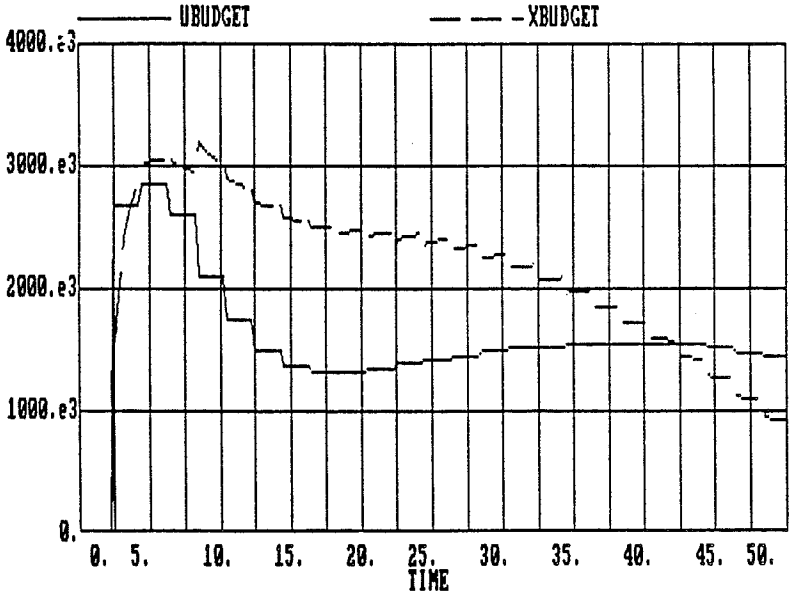
B2 Operational flexibility is only in the slow market A enough to gain market share after start-up also.



B3 due to small immersed size of B-market, market shares get saturated



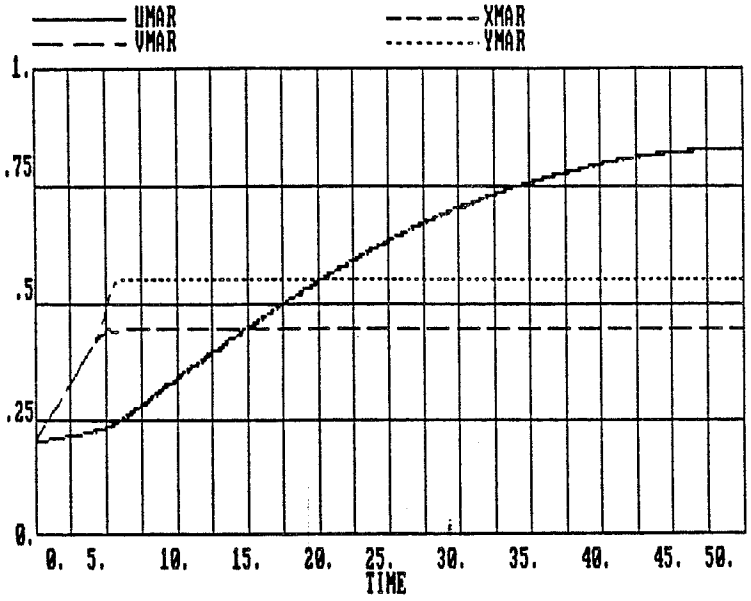
B4 Strategy actions of xy company are not able to overcome operational level behavior.



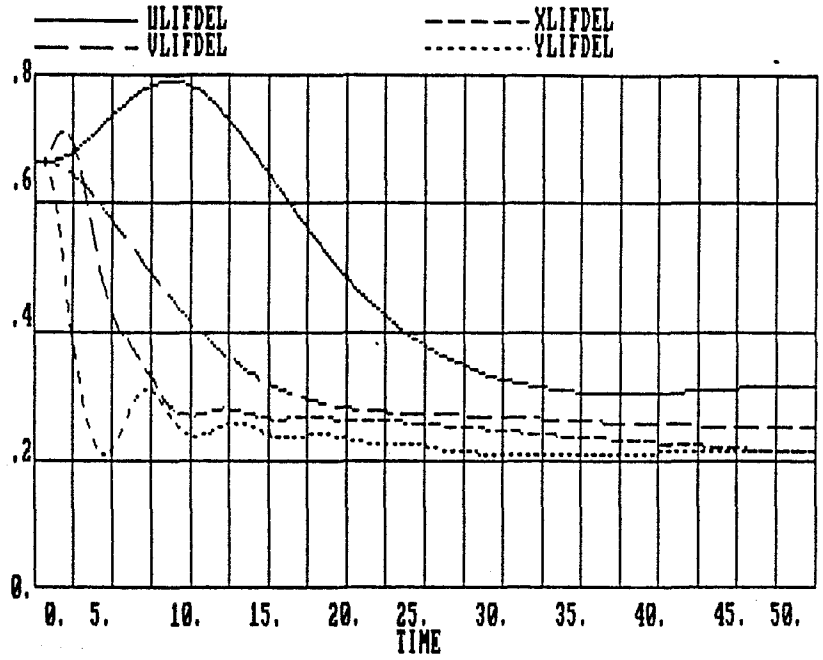
Comments RUN C

The strategy setting periods of the competitors are now equal but the xy-company has faster operational reactions. So xy-company does now better, compare

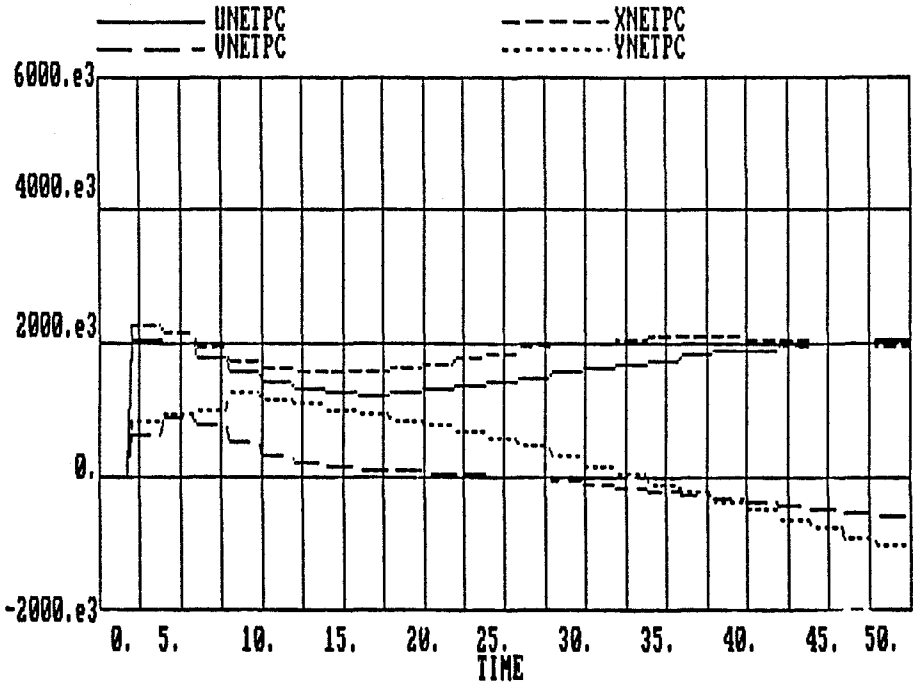
C1 UBUDGET vs. XBUDGET as the respective totals of product contributions.



C2 Market shares in the slow A-market come out equal.



C3 Delivery delay problems (with loss of business) build with uv-company only.



C4 The delivery problems of uv company compared to xy company translate in reduced product contributions...