

Strategic Modelling for Competitive Advantage

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Abstract

This paper provides an interim report of the work of the authors in developing a framework for analysing strategic and policy decisions within organisations. To explore frameworks a system dynamics model is developed which draws upon Michael Porter's approach to assessing industry profitability, Alfred Rappaport's method for measuring value creation and Oliver Williamson's approach for aligning management structures with the nature of the service being provided that promote economic efficiency. The framework is empirically tested based on the development of a dynamic simulation model of a subsidiary of a large private sector company in New Zealand. A number of scenarios are provided illustrating the use of the model.

Introduction

Recent work of the authors has been to identify the actions available to managers to increase the value of organisations. This paper describes the initial framework and model developed to evaluate value creating actions.

Porter (1991, 98) identified two approaches to theory building, that of developing models and frameworks:

"These two approaches to theory building are not mutually exclusive. Indeed, they should create a constructive tension with each other. Models are particularly valuable in ensuring logical consistency and exploring the subtle interactions involving a limited number of variables. Models should challenge the variables included in frameworks and assertions about their link to outcomes. Frameworks, in turn, should challenge models by highlighting omitted variables, the diversity of competitive situations, the range of actual strategy choices, and the extent to which important parameters are not fixed but continually in flux."

These approaches to theory building have been employed by the authors to develop frameworks for understanding the sources and methods of exploiting competitive advantage available to managers. This paper is an interim report of the authors' work in the area.

This paper is organised into five further sections. The next section covers the overview of the framework. This is followed by a discussion of the model; then the key components of the model. Next some scenarios illustrating the use of the model are provided. Finally, some concluding comments are presented.

Overview of the framework

The framework is based on a view of the organisation as a coalition of management units and/or independent parties, that co-operate to manage the flow of products and services along the entire chain of activity to meet client needs. This chain of activity covers all the stages in the service delivery process. (Further details of this approach are provided in Hughes (1993)). The entire

workflow is managed - from service development to delivery to end users. Management units are seen to operate in competitive markets in which customers and investors can choose who they want to buy from, or where to invest. Viewing an organisation in this way, emphasises the following decisions faced by managers: the need to demonstrate value for money; the problem of how to stay close to the customer; how relationships with suppliers can best be managed; how competitive advantage can be maintained; and what return on investment will be achieved for shareholders, and how.

The key assumptions, based on Williamson (1991), on which this approach rests are:

- Competition is the best mechanism for ensuring that an organisation remains efficient.
- The strongest incentive to achieve ongoing efficiency gains is the requirement to prove to owners that the cost of producing a service internally, is no greater than the cost of purchasing the service on the open market.
- Managers who do not evaluate the effectiveness of their operations by making comparisons against external standards, run the risk of developing high cost structures and over time creating unviable organisations.
- All outputs are supplied to meet customer needs.
- The boundary of any organisation is defined by the market.

Overview of the model

The Strategy Simulation Model has been developed within a system dynamics framework (Forrester, 1961; Coyle, 1977) using the dynamic simulation software *ithink* (Richmond et al., 1992). The suitability of system dynamics as a method for policy and strategy analysis has also been discussed by Cavana (1981) and Morecroft (1984).

The Strategy Simulation Model provides a tool for the assessment of an organisation in a dynamic setting. The framework of the dynamic simulation model is presented in Figure 1. Assumptions which are implicit in this model include:

It is possible to simplify the description of a business to a form which allows the application of a system dynamics modelling tool. This assumes that the boundary of any management unit is defined by what products and services can be purchased on the open market. Organisations can be viewed as a network of business units with customer and supplier relationships. Value drivers are developed at business unit level. Value drivers are associated with factors such as asset utilisation, reduced transaction costs from integration, and retaining control of the economic rent from information.

The Strategy Simulation Model has been designed for use by managers and executive staff with only a rudimentary knowledge of *ithink*. The interface to the model guides the user through the model by pre-defined control panels for specifying key variables and generating standard reports.

The flow diagram should contain all the variables that will be used to construct the model. The relationships shown in the diagram will reflect current management strategies. In the case of the private sector organisation in New Zealand where this framework was tested, for example, a key variable in their current management strategy was the delay time to complete a job. Managers were able to model how changes in strategy would impact on the economic value and competitive advantage of their business unit by changing delay times. They found that reducing these delays had a significant impact on the economic value of the unit and its competitiveness. Potentially, the ability to better manage this variable could provide a strategic advantage to the organisation.

As outlined in Figure 1, the Strategy Simulation Model comprises the control panels plus four main sectors including: the industry and market sector, the product & service delivery sector, financial measures and strategic performance indicators.

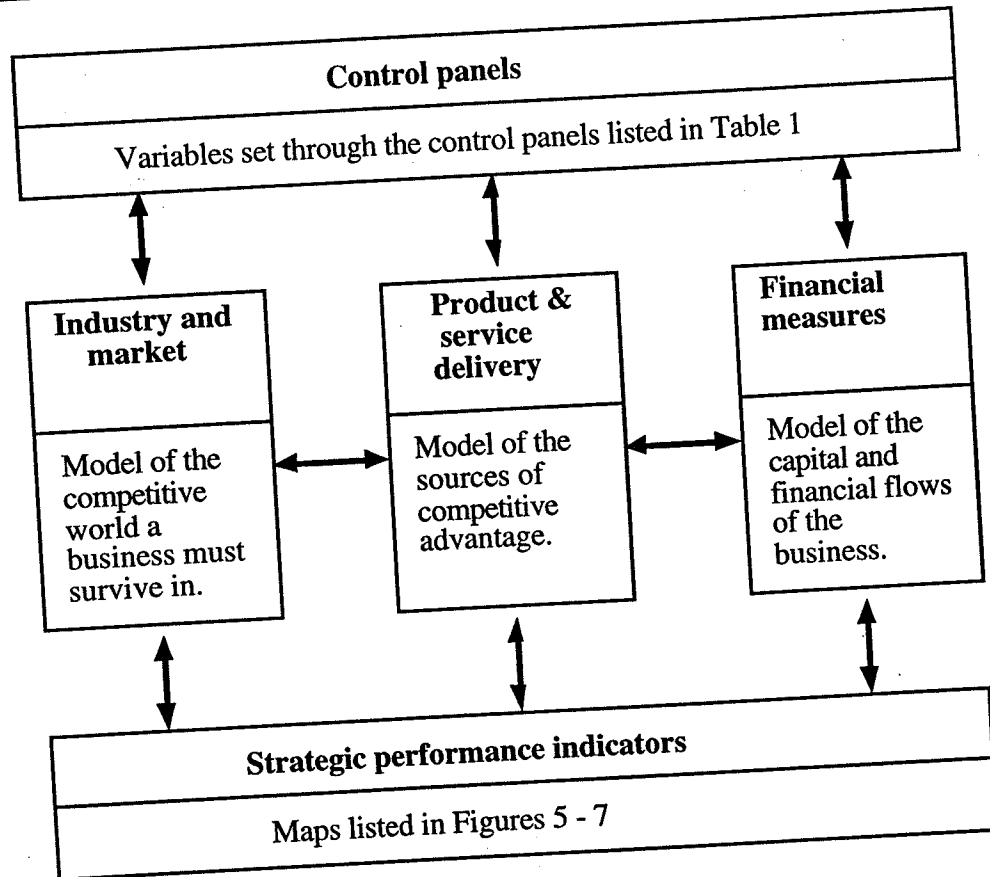
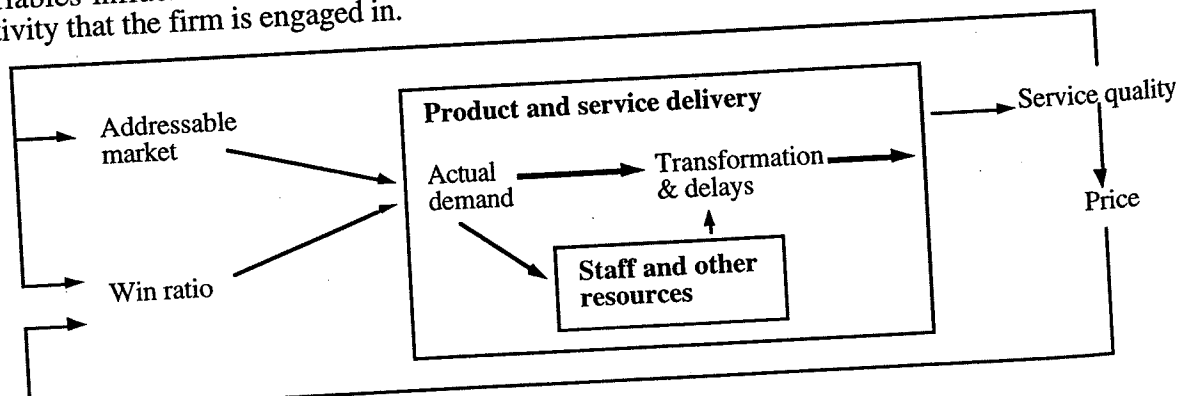


Figure 1. Structure of the Strategy Simulation Model

Feedback loops

A significant feature of the modelling approach is the representation of the major relationships as feedback loops, which are closed chains of cause and effect relationships that generate dynamic behaviour over time. For example, Figure 2 illustrates major feedback loops operating through changes in price and quality of service on the firms market share through changes in win ratio and addressable market. Based on the actual demand products and services are delivered following the transformation of inputs of staff, resources, assets and managerial skills, etc. After a delay the service is provided, which depending on the quality, determines the price of the service and subsequently effects the addressable market and win ratio (which determines market share). These variables influence the future demand for products and services, which determines the level of activity that the firm is engaged in.



Control panels

The control panels cluster the variables into the main areas of strategic decision making: industry, operational efficiency, scope of business, finance, indifference curves, and indices. The variables shown in the control panels in Table 1 have been selected for illustrative purposes. These variables and parameters can be altered by managers or analysts without much previous experience in *think* modelling to examine the behaviour of the system under different scenarios.

Table 1. Variables available in the control panels

<u>Industry</u>	<u>Operational efficiency</u>
Rivalry amongst competitors	Average contractor cost per job
Supplier bargaining power	Material costs per job
Buyer bargaining power	Management emphasis index
Threat of new entrants & exit barriers	Hours available per person
Threat of substitutes	Average hours per job
Government actions	Fraction hours recovery
Market growth rate	Hire delay
Price discount premiums	Firing delay
Normal industry price per job	Average salaries
Normal industry lead time	Support staff costs
Industry labour productivity	Regulatory delays
Industry capital productivity	Other delays
% labour productivity in productivity index	
<u>Scope of business</u>	<u>Finance</u>
New investment	Tax rate
Other operating expenses	Debt equity ratio
Normal fraction of market addressable	Interest rate
Normal win ratio	Discount rate
	Average receivable delays
	Average payable delays
<u>Indifference curves</u>	<u>Indices</u>
Price discount or premium	Quality index
Quality effect on win ratio	Labour productivity index
Quality effect on price	Capital productivity index
Quality effect on addressable market	Financial strength index
	Addressable market index

Industry and market sector

The industry and market sector links the variables in the wider market to the actual market share gained by the organisation. This sector links the main variables of industry profitability with the price per job, market size and growth rate, the addressable market and win ratio. For example, the effects of Porter's (1980) five competitive forces of: rivalry among competitors, supplier and buyer bargaining power, and threat of new entrants and substitutes on industry profitability are shown in the *think* flow diagram in Figure 3. An additional variable, government action, is also shown as an effect on industry profitability. These variables (effects) are modelled as graph functions which can take on a different value each year for the five year simulation run. The values depend on managerial judgement or are the result of further analytical studies on behalf of management.

Parallel Program

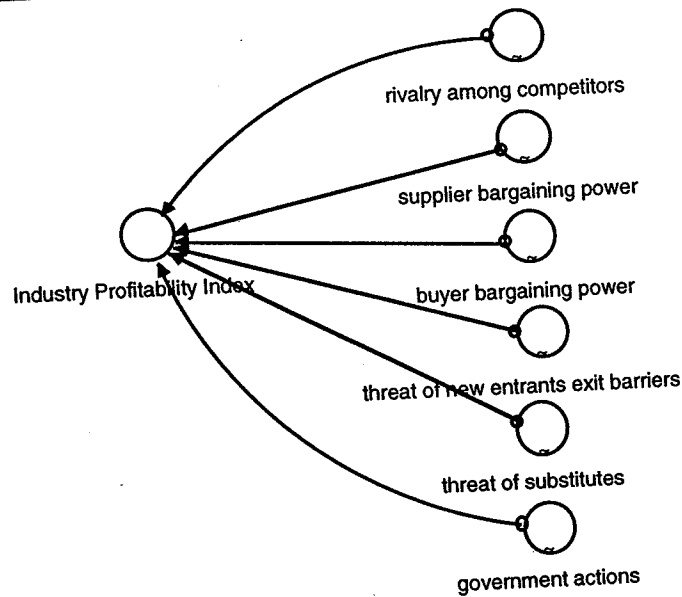


Figure 3. Sources of industry profitability

Strategic performance indicators

The performance indicators sector contains the calculations for the performance indices including: the quality index, labour and capital productivity indices, financial strength index and addressable market index. These indices are used in the calculations of the key model outputs, viz. the market positioning map, economic value map and competitive advantage map, which are discussed below.

The *ithink* diagram for the calculation of shareholder value is provided in Figure 4. This incorporates Rappaport's (1986) concepts of value creation, whereby shareholder value is defined as the difference between the corporate value less the market value of the debt. The corporate value is based on the present value of the operating net cash flows plus the present value of the residual value of the entity.

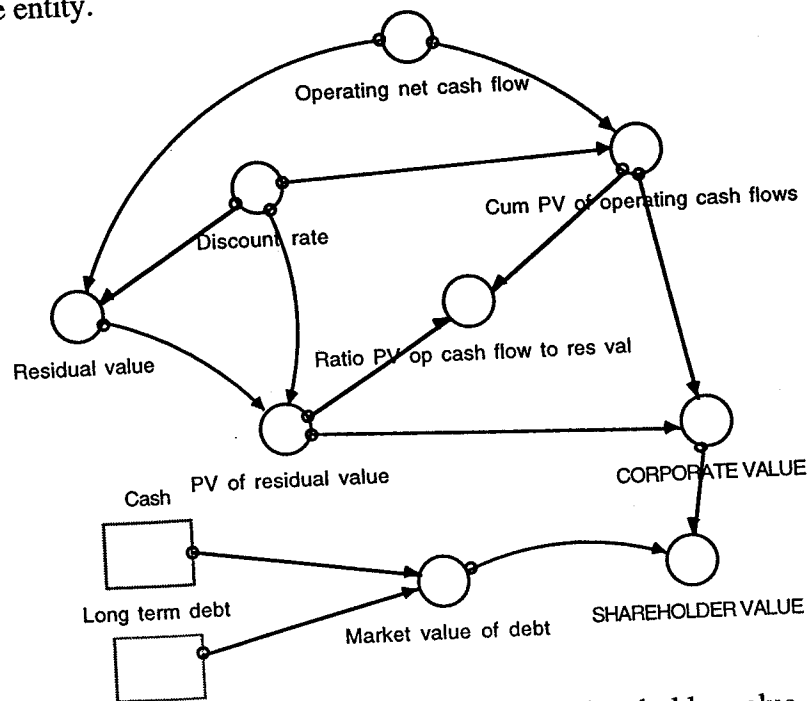


Figure 4. Calculation of shareholder value

Key model outputs

Experience has confirmed that it is possible for managers unfamiliar with simulation modelling to work with these tools and quickly gain important insights into their businesses from them. With this analytical framework and the strategy simulation model, the user will be able to set their own input parameters, and evaluate the impact of different decisions in order to identify and understand the unique value drivers of their business unit. The three key diagnostic outputs of the Strategy Simulation Model are: the market positioning map, the economic value map, and the competitive advantage map.

Market positioning map

Figure 5 shows the market positioning map. Where the result is close to the origin a weak market position exists. Managers would be expected to respond to this by taking steps to clearly position the business in the market. This mapping tool enables managers to evaluate how the business unit is currently positioned in a competitive environment, and whether the current competitive strategy is the most appropriate option for the future.

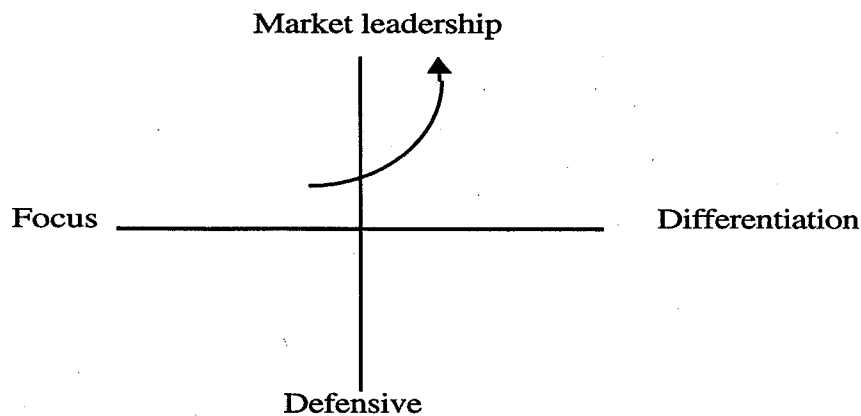


Figure 5. Market positioning map

Economic value map

The economic value map, shown in Figure 6, traces out the present value of expected future earnings. The final value is the present value of all expected future earnings (following Rappaport (1986)). Also incorporated into this map is the weighted average cost of capital faced by the organisation. Where the economic value is greater than the cost of capital, the business is generating a positive return to shareholders. Where it is below, a negative return is being generated and it can be expected that shareholders will seek to redress this position.

The slope of the economic value curve indicates the rate at which value is being added by the business. From this map, managers can determine whether the bulk of the value of their business is being generated within the planning horizon, or in the far future.

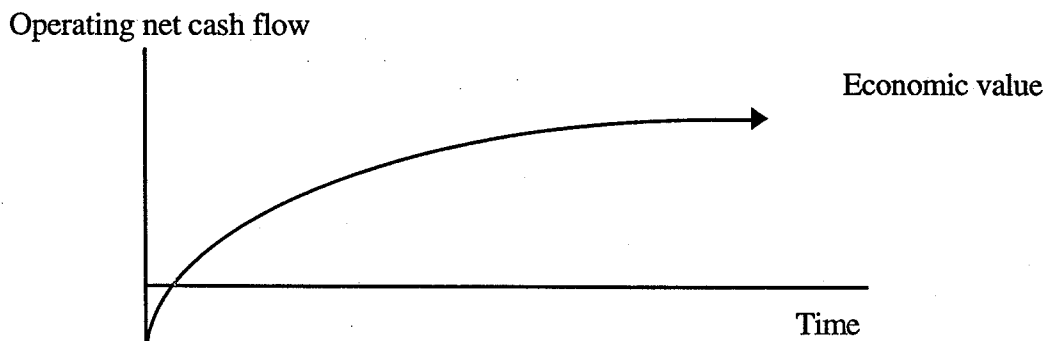


Figure 6. Economic value map

Competitive advantage map

The competitive advantage index is a measure of how effective current policies, strategies, systems and procedures are at positioning the business to compete. This measure does not tell us anything about the quality of management. Management commitment is a subjective assessment of the quality of management. It assesses management's commitment to long term issues requiring investment, where the benefits may not be immediate, but which reflect management's vision of the future.

Competitive advantage index

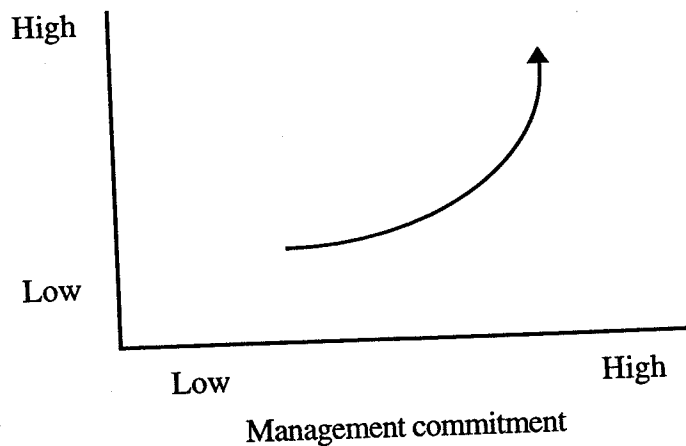


Figure 7. Competitive advantage map

Scenario analysis

The aim of managers is to target key areas of the business to improve economic value. There are many underlying factors that directly influence competitiveness and which therefore underpin the success of the business. The Strategy Simulation Model was used to improve the understanding of the relationships between key factors and how these factors influence the business's economic value. This knowledge would enable management policies to be improved.

To illustrate the output of the Strategy Simulation Model the graphs from the following indicative issues are attached:

- Impact of a sudden increase in work load, see Figure 9.
- Impact of change in delays, see Figure 10.
- Impact of the introduction of competition, see Figure 11.

The impact of these changes can be gauged by how the economic value added changes, this is shown in the four graphs attached. For comparison purposes Figure 8 shows the base case performance of the organisation under good management practices.

Figure 9 indicates that if the organisation is operating at full capacity, then taking on unplanned extra work can result in deteriorated performance if resources are stretched, extra delays in completion occur, and quality suffers thus affecting market position, prices and long term profitability. This behaviour was contrary to what was expected by the managers advocating taking on the extra work!

Figure 10 shows the effects of increased processing delays, raw material delivery times and/or regulatory delays. Service quality and economic performance clearly deteriorate with increased delays not experienced by competitors.

Figure 11 demonstrates the levelling off of the economic performance of the organisation following the introduction of a major competitor.

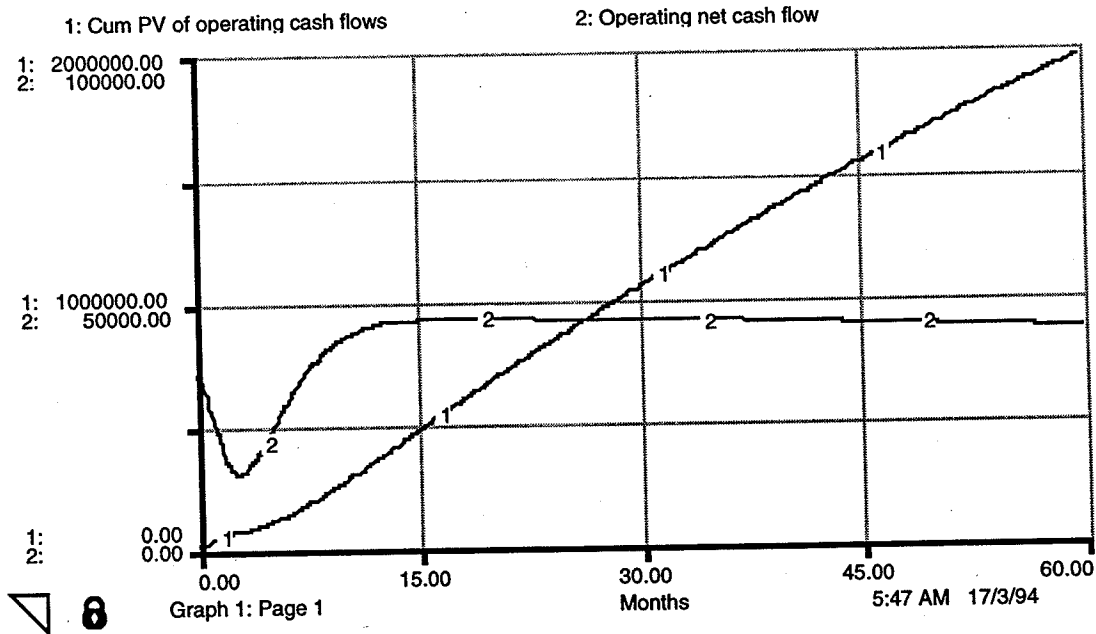


Figure 8. Base case which assumes a well managed business

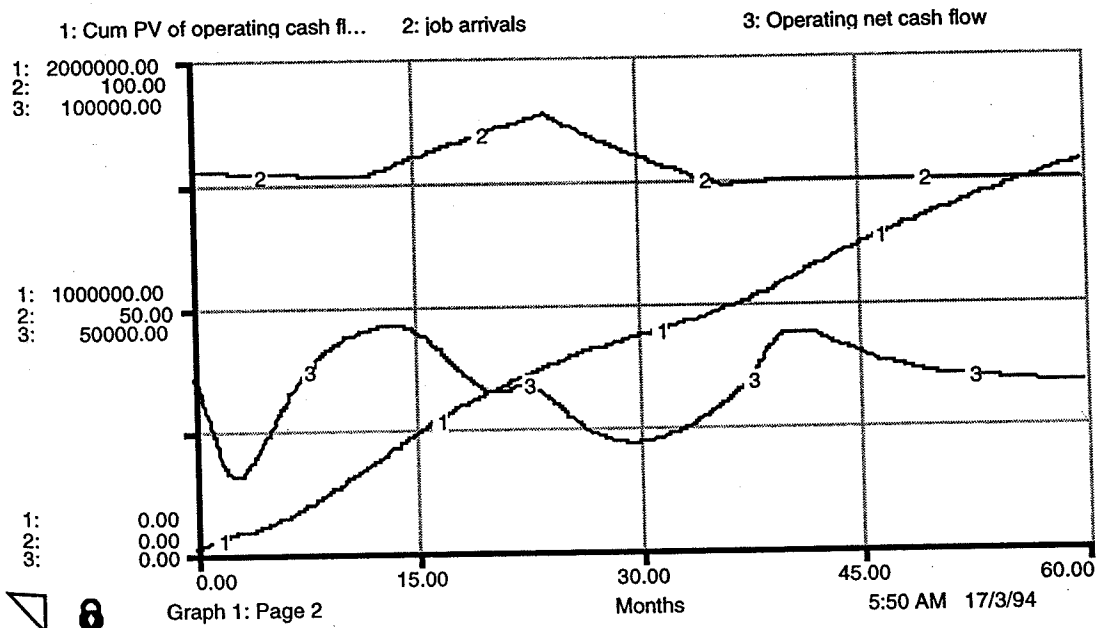


Figure 9. A temporary increase in workload of 10%

Parallel Program

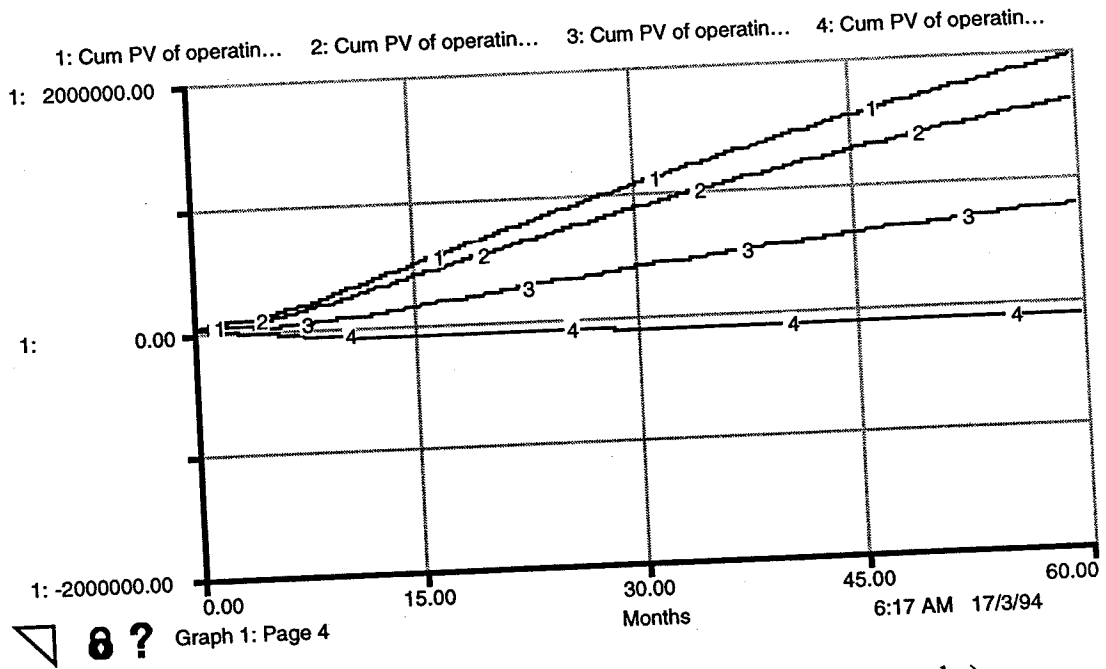


Figure 10. Change in delays (0.5, 0.75, 1.5 and 3 months)

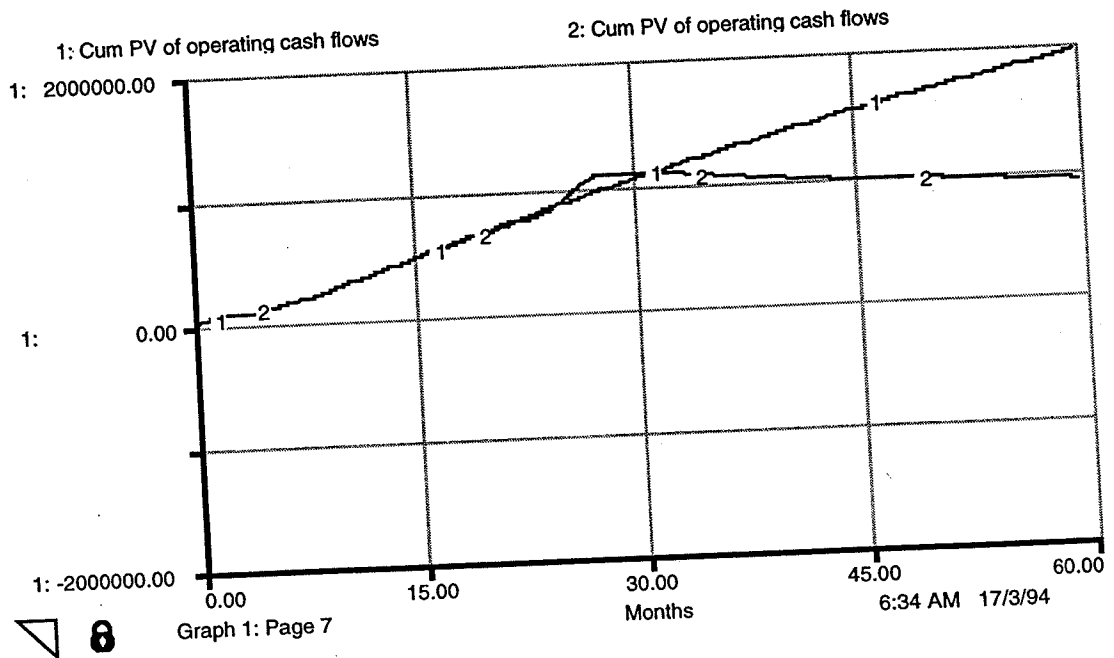


Figure 11. Introduction of competition

Conclusions

This paper has discussed the development of an integrative framework for analysing strategic and policy decisions within organisations. In particular, it has discussed the development and utilisation of a strategic simulation model which incorporates frameworks outlined by Porter (1980, 1985), Rappaport (1986) and Williamson (1991). In this sense the paper provides a contribution to the development of a dynamic theory of strategy outlined by Porter (1991) utilising both approaches to theory building. This has involved developing a model to improve understanding of how sources of competitive advantage can be managed, and developing a framework to improve understanding of how competitive advantage is created and maintained.

We plan to report our views on what we have learnt about frameworks for competitive advantage in a forthcoming paper.

In conclusion, we have found that models were an extremely useful enabling and facilitating device. In particular, our experience has been when managers had access to the Strategy Simulation Model that:

- it was an effective way of communicating the scope of strategy analysis to busy managers;
- the framework and the ability to quickly explore scenarios proved influential in gaining their involvement in exploring strategy and testing intuitive understanding, and examining the operational aspects of strategy alternatives; and
- managers' knowledge of the value and applicability of strategy is considerably enhanced by being able to illustrate that different strategies have different outcomes.

The use of this type of framework in a planning process which involves managers could help to stem the current fall in strategic planning that has been so widely observed in organisations and discussed particularly by Mintzberg (1994). In a previous paper (Cavana and Hughes 1995) we have also discussed ways in which these methods could be used to overcome the current crisis in strategic planning.

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