

## A GENERAL FEEDBACK MODEL OF BUSINESS PERFORMANCE

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### ABSTRACT

Models of business performance exist within the general management literature under different disciplines, notably those of Industrial Economics, Organizational Theory and Business Policy. There has been little attempt to date at combining these models and those attempts that have been made have used only a static framework. Business Performance is a dynamic variable and therefore requires a dynamic method of analysis.

The characteristics of such variables as may be included in a general model of business performance should be well suited to analysis using System Dynamics. Not only are they dynamic but also highly aggregated at top management level. The paper describes those variables that the authors feel need to be considered in such a general model.

The paper begins by attempting to determine in what manner a company measures its position in its environment and assesses how such measures as are currently expressed in the literature, (e.g. The Boston Consulting Group's Product Portfolio Approach) can be modelled within a dynamic framework?

The perception which the organization has of its position is, of course, a major determinate of the targets which need to be set and the strategies needed in order that these targets can be realised. The paper therefore considers the process of strategic choice and how a particular strategic action is determined from amongst a range of alternatives.

It is postulated that strategic choice is not only a function of the business's position within its environment but also a function of structural characteristics of the organization. These structural characteristics are not those of the model but reflect the degree of power held by any particular part of the organization. Different methods of measuring

and identifying this power base have been considered. The model assumes that the range of strategic alternatives are constrained by the relative power of different departments and the process of strategic choice is similarly limited.

The research undertaken has further attempted to identify how strategic choice affects the performance of the organization. However, performance and how it should be measured is not directly addressed by this paper. It is simply accepted that a measure of performance does exist and the outcome of a strategic action can be identified in the performance of the organization. Performance is considered to be both a direct input into the selection of strategy and an indirect input as a determinant of the position the organization has within the environment. Hence the model has the dynamic characteristics of feedback and inevitably delay.

The paper concludes that the general models of business performance should greatly benefit from analysis within a dynamic framework. The work has already indicated possible relationships between existing theories and formed the basis of a simulation model which may identify the possible consequences of certain strategic actions combined with alternative organization structures.

### 1. INTRODUCTION

Management could be dichotomized into several academic disciplines and a short review of the literature will indicate the impact that any of these differing disciplines has had on the notion of Business Performance. The body of people practising this management art appear to have received little benefit from academic efforts to-date due to the lack of a unified structure and the static nature of the studies, where the art is truly dynamic. It is the premise of this paper that the approach of the Industrial Economists, as typified by the PIMS study of Schoeffler, et.al. (1974) which related business performance to the position the business maintains in its industry could benefit from integration with the

Organizational Theories of Contingency and Congruency, Child, (1974). Contingency theory seeks to identify an appropriate fit between the organization's structure and its environment, whilst Congruency argues that organizational structure has a direct impact on business performance. The business policy theorists add a third dimension, namely that of strategy. Considerable research by Chandler (1962), Channon (1973) and Rumelt (1974) has indicated that the strategic actions of management influence both the organization's structure and its performance.

These three dimensions, environment, structure and strategy require placing within a framework that indicates how they uniformly impact on performance. The only work that the authors have come across that seeks to do this, is the work of White and Hamermesh (1981), see Diag. 1. The undoubted strength of this work is that it provides a framework for integrating efforts in several disciplines. However it is a static analysis which is restricted in that it fails to include the dynamic characteristics of a system, namely, the impact of feedback and likely delays between strategic action, performance and its impact on the environment.

It is the intention of this paper to construct a model of business performance, using system dynamics. This model will highlight the most important aspects of where feedback occurs and the impact of delays on the system.

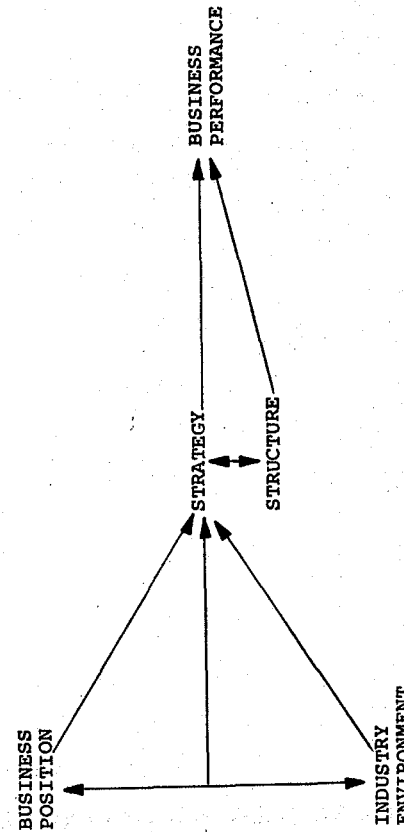


FIGURE 1: AN INTEGRATIVE MODEL OF PERFORMANCE  
(Taken from White and Hamermesh (1981, p. 218))

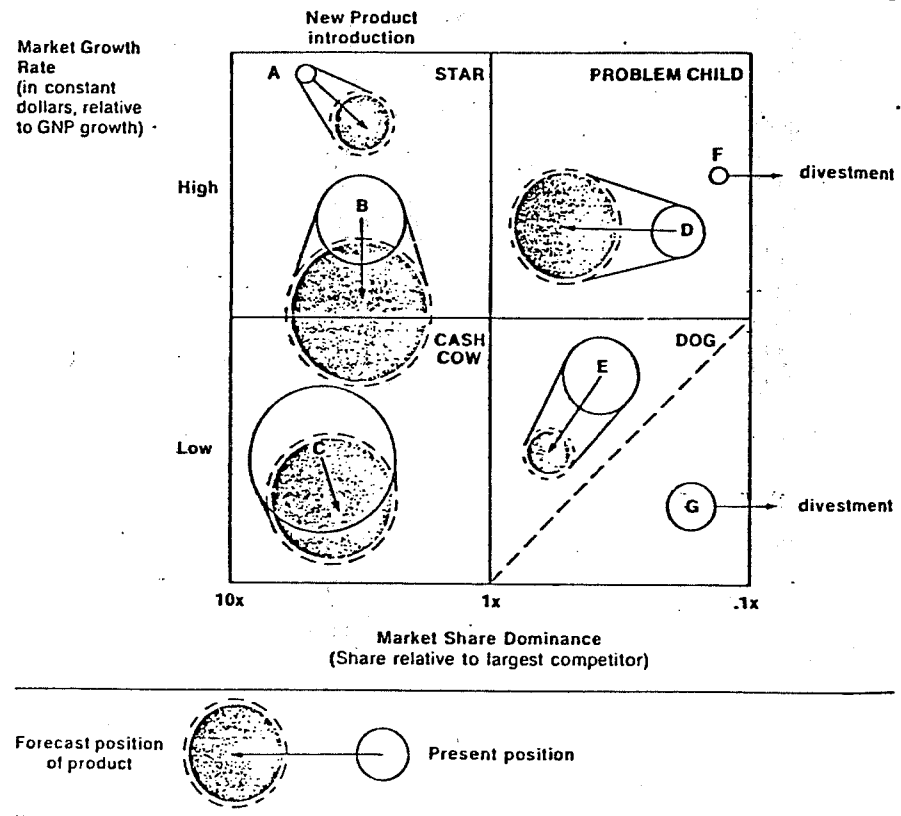
2. ENVIRONMENTAL MEASURES

One of the most commonly used environmental measures used by an organization to analyse its environment is the basic market growth / market share matrix, see Diag. 2. Wind and Mahajon (1981) indicate a minimum of 5 variations on this basic model. Such a matrix provides a consistent picture, at a point in time, of a particular product and may also be used to indicate the intended position for the same product, at some other point in time. Its major drawback is that it can only consider these two points in time.

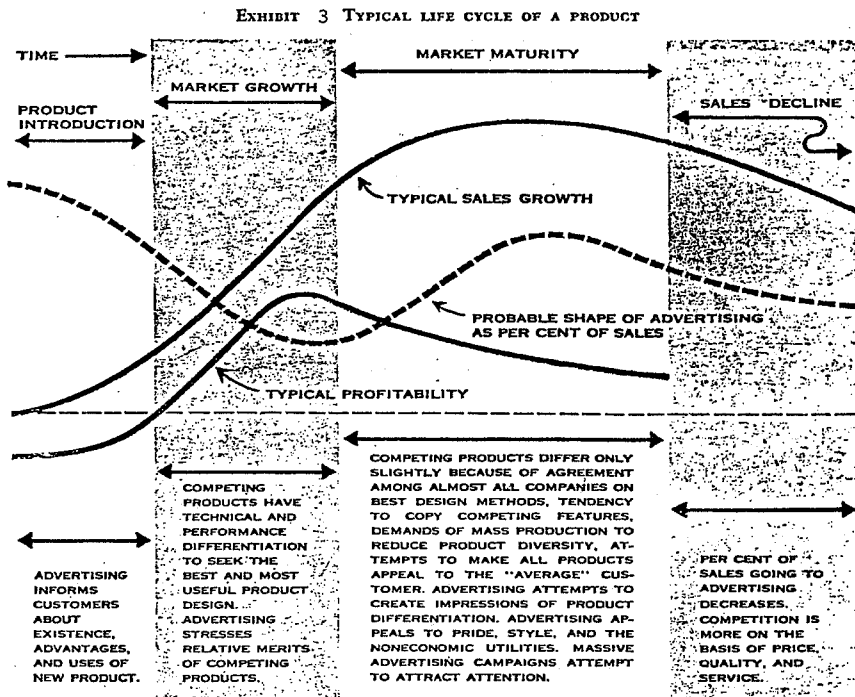
However, both variables, Market Share and Market Growth are dynamic and it is the authors' view that they can more usefully be used within a dynamic framework. Lyneis has demonstrated their use in a model appearing in Managerial application of System Dynamics by Roberts (1978), pp. 485-501, where the two variables are the determinants of Sales, for a particular organization. The object of the dynamic model is to determine the best financial policies for that particular organization in order not to restrict the growth of the firm. The other concept frequently used as an environmental measure of a product's position is The Product Life Cycle. This is a time dependant concept indicating the likely return on a product over the period of its life. This concept has been used by Forrester (1959), among others, in a dynamic model relating advertising expenditures to the life cycle of a product, measured in terms of both sales and profitability,

EXHIBIT 2  
Balancing the Product Portfolio

(Diameter of circle is proportional to products contribution to total company sales volume)



Taken from Day, Journal of Marketing (1977, p.34)



Taken from Forrester (1959, p.108)

see Diag. 3.

The model developed in this paper essentially represents a hypothetical company, but uses information obtained from interviews with the Managing Directors of several companies. It is driven by a set of exogenously input market growth rate (see Diag. 4) in the shape of a typical product life cycle, representing the development, growth and maturity phases for a number of products over a 20 year time period. Naturally the exact shape and length of each stage will depend upon the nature of the product and its market. This growth rate influences the total market size. The market share for a particular company and its product is measured by comparing an average of the actual sales for the company with market size.

An important concept in this model is that Management's strategic actions are not based as an exact measure of market share or the exact shape of the product life cycle, but what they perceive the position to be. The perceived market growth rate used is an averaging of the actual growth rate dependant upon the time it takes the management to perceive that a change has taken place. The measurement of the environment has within the model determined not only the perceived position of a product on the matrix but also the target or intended position as indicated in Diag. 2, measured in terms of the sales required.

3. STRATEGIC CHOICE

The model then breaks down the target total sales, i.e. the intended position as indicated by the matrix, into individual targets resulting from opposing strategies, sponsored by departmental policies (see Diag. 4). For simplification purposes the model considers only two departments where each department has its own strategy for achieving the target sales.

Choice between these two strategies, within the model, results from either of the following:

1. Pure Economic Criteria - here the model simulates the likely outcome of each strategy and the one with the highest return on investment is chosen. This particular strategy is then implemented and the resulting performance measured in both sales and financial terms. The level of sales achieved is fed-back as an input into the measurement of the environment, through market share, and thereby influencing future strategy. The financial performance measure also acts as a dynamic constraint in determining whether

- a) funds are available for investment;
- b) expectations of achievements are altered according to what has actually occurred previously.

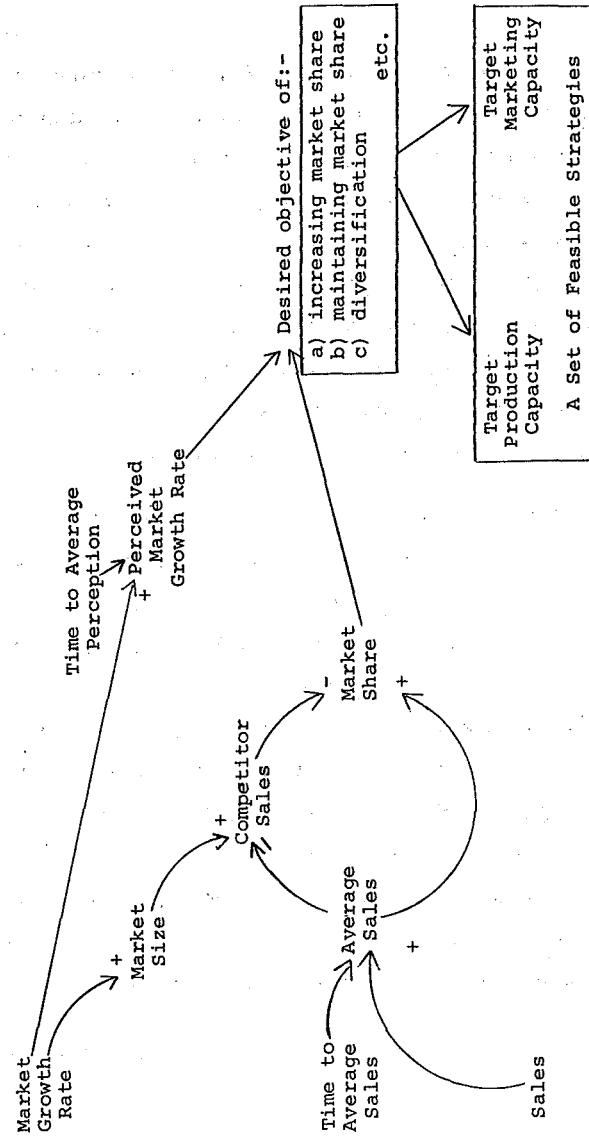


FIGURE 4: The relationship between Environmental measures and a set of Feasible Strategies.

2. Relative Departmental Power - in this instance the model chooses between strategies according to the relative power of the department concerned. Departmental power has been initialised by using Hickson, et.al.'s model of a Strategic Contingencies' Theory of Intra-Organizational Power (1971). The author's model of business performance has relative power dependant. on the relative asset size of each department.

The perpetuating nature of power, empire building, etc., assumes that the strategic choice will be re-inforcing (see Diag. 5), i.e. a department with greater power will choose its own strategy, which in turn will further increase its asset size and increase its own power. Such a positive loop will, as has been shown previously, under the right conditions lead to exponential growth and eventual collapse.

It is the authors' opinion that such dominant loops may well be the cause of Argenti's corporate collapse mode of behaviour (1976). It is only when collapse has occurred that power changes hands, e.g. Rolls Royce collapse of 1971 and the change of power from Engineering to Finance departments. Or, under alternative b) in 1. above, where a department has consistently under-achieved its expectations, relative departmental power may also change, if there is some over-riding neutral force allowing the change to take place, e.g. Head Office.

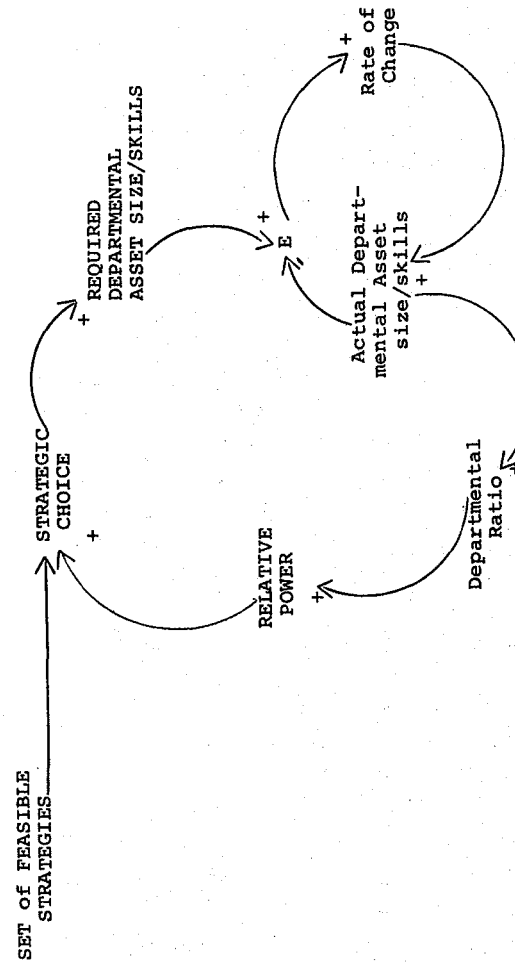


FIGURE 5: The positive loop of Departmental Power.



move dynamically within the matrix is the realisation that management experience and knowledge is lost as diversification takes place. Diversification is a natural consequence of the product life cycle, its importance will depend on the rate of technological and consumer change, shortening the maturity period or increasing the growth rate and thereby enhancing the process of the cycle. As the growth of the product falls management must make strategic decisions concerning diversification and the extent they are prepared to adopt this strategy. This model adjusts the influence which a particular department has over performance depending on the extent of the diversification involved with the use of learning curves. These curves indicate the time required for a particular department to gain knowledge concerning a particular product or market.

This dynamic framework is a general one in that it has not been constructed for use in a particular organization, but to provide insight into how management's strategic actions impact on performance.

In order for the model to be used in a particular organization it requires that the parameters be attuned to that organization. Those parameters which are most important are listed below and the behaviour of those variables need validation against reference modes from the organization concerned. Critical parameters that require evaluation in a particular organization are:-

- 1) Market Growth Rates, the exact shape of each product life cycle.
- 2) Market Share, the exact proportions of product sales relative to market size.
- 3) Economic Criteria, the relationships between price and sales, the relative operating costs of each department.
- 4) Relative Power, the relationship between functional departments, the likelihood that a particular department's strategy would be adopted.
- 5) Delays in the process, the time taken to perceive what is happening, the time taken for strategy to impact on performance, the time delays in installing departmental capacity, particularly production and marketing, and the time taken in manufacturing the product.
- 6) Nature of the Learning Curve - this will obviously differ dependant on the extent of the diversification which is undertaken.

##### 5. CONCLUSION

The paper has shown that there is a need for a unifying theory of performance rather than management relying solely



on the efforts of a particular discipline. The paper has shown the outline steps of how a model of business performance has been put together within a dynamic framework. The authors contend that such a framework has advantages over the other known attempts of unification using a static analysis.

The model itself encompasses the three dimensions of environment, structure and strategy and indicates the nature of the impact these have on performance. Such a model is likely to lead to clearer understanding of the future performance of organizations.

#### References

- (1) Schoeffler, S., Buzzel, R.D. and Heaney, D.F. Impact of Strategic Planning on Profit Performance. Harvard Business Review, 1974, Vol.52, pp. 137-145.
- (2) Child, J. Managerial and Organizational Factors associated with company performance - Part I. Journal of Management Studies, 1974, Vol.11, pp. 115-189.
- (3) Chandler, A.D. Strategy and Structure: Chapters in the history of the American industrial enterprise. Cambridge: M.I.T. Press, 1962.
- (4) Channon, D.F. The Strategy and Structure of British Enterprise. London Macmillan Press Ltd., 1973.
- (5) Rumelt, R.P. Strategy, Structure and Economic Performance. Cambridge: Harvard University Press, 1974.
- (6) White, R.E., and Hamermesh, R.G. Towards a model of Business Unit Performance: An Integrative Approach. Academy of Management Review, 1981, Vol.6, No.2, pp. 213-223.
- (7) Wind, Y., and Mahajon, V. Designing product and business portfolios, Harvard Business Review, 1981, January - February, pp. 155-165.
- (8) Lyneis, J.M., Designing Financial Policies to Deal with Limited Financial Resources in Managerial Applications of System Dynamics by Roberts, E.B. London: MIT Press, 1978.
- (9) Forrester, J.W. Advertising: a problem in industrial dynamics; Harvard Business Review, 1959, Vol.37, No.2.
- (10) Hickson, D.J., Hinings, C.R., Lee, C.A., Schneck, R.E. and Pennings, I.M. A Strategic Contingencies theory of intraorganizational power; Administrative Science Quarterly, 1971, Vol. 16, Part 2, pp. 216-229.
- (11) Argenti, J. Corporate Collapse, the Causes and Symptoms. London: McGraw-Hill, 1976.