

BUDGET PLANNING AND CONTROL SYSTEMS

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Preface

The eight chapters making up this book are all concerned with some aspect of business budgeting or budgetary control: the first two with the former, the remaining six with the latter. (The final chapter is a summing up). The impetus to write them came from several sources. First, I became increasingly frustrated in trying to teach planning and control to graduate students of business administration by the unscientific nature of many of the procedures, leaving me with more questions than answers, and with the general reluctance of accountants to go outside their own discipline in search of answers—in short, with what G. H. Hofstede was later to call ‘The poverty of management control philosophy’.

Second, while it is probably true that budgets are the principal instruments of planning and control in large business organizations, the available empirical evidence—provided by accountants and accounting organizations and by some of Forrester’s industrial dynamics studies—suggested that budgets do not appear to perform very effectively either as planning or control devices in practice. This feeling was reinforced by reading Modigliani and Cohen’s ‘The role of anticipations and plans in economic behavior and their use in economic analysis and forecasting’, *Studies in Business Expectations and Planning*, No. 4 (Bureau of Economic and Business Research, University of Illinois, 1961), Cyert and March’s *A Behavioral Theory of the Firm* (Prentice-Hall, Englewood Cliffs, N.J., 1963), the proceedings of the Stanford seminar on basic research in management controls in 1963 (published as *Management Controls: New Directions in Basic Research*, Bonini, Jaedicke and Wagner, eds., McGraw-Hill, New York, 1964), Arrow’s very interesting presidential address to The Institute of Management Sciences in 1963 (‘Control in large organizations’, *Management Science* **10**, 397–408, 1964), and Williamson’s *Corporate Control and Cost Behavior* (Prentice-Hall, Englewood Cliffs, N.J., 1970).

Finally, I had the feeling that systems theory and modern control theory, so successfully applied in other areas, might also provide the keys to some of the unresolved problems in organizational planning and control. That was my rationale for writing this book, which seeks in a modest way to continue the work referred to above by beginning a fundamental re-examination of the foundations of budgeting and budgetary control. The subjects here presented concern some of the

elements thought to be in need of early re-examination. A number of the proposals made concerning both planning and control stem from recognition of the business enterprise as an open system, with the consequent need to give more attention to its environment, and to the system-environment interface.

Chapters 1 and 2 on budget planning start from the premise that budgets should no longer do double duty as plans and as controls; that if they are to be effective in either capacity they need to be *formally* separated, not just by means of budget variances. Chapter 1 discusses the problem, not usually considered in accounting theory or practice, of defining the planning system. Chapter 2 starts from the position that it would be desirable to make budget plans dynamic, since they represent a dynamic process, and considers whether it would be feasible to do so.

Chapters 3 and 4 contain material in preparation for the re-examination of budgetary control. In Chapter 3 this consists of presenting some ideas on control from other disciplines—organization theory, cybernetics, communication theory, game theory, and biology—and some preparatory notes on systems theory and learning. Chapter 4 examines some of the principal concepts of systems theory (steady state, equifinality, degrees of freedom, and the ‘system’ concept itself), asks whether they are not in need of some modification, some different motivation than in the case of the dynamics of rigid bodies with relatively few degrees of freedom, for example, before being applied to socio-technical systems, and tries to identify the main open-system controls in a business, and their relations to the cybernetic control.

Chapters 5 and 6 seek to classify the budget control system in systems theory and control theory terms, and to specify it, first in terms of an input-output model, and then in terms of a state-space model. In the process an attempt is made to present the main ideas from control theory to accountants and business students in a more palatable form. With its extensive use of mechanical, electrical, chemical, and biological systems as illustrations, much of the systems and control theory literature would otherwise remain inaccessible to many of these. (Aoki’s *Optimal Control and System Theory in Dynamic Economic Analysis*, North-Holland, Amsterdam, 1976, is a notable exception.) It is felt that many of the ideas discussed in this literature are common ground to those interested in the task of controlling large corporations more effectively.

Chapter 7 presents a summary of the main work done to date on the theory of fuzzy subsets as it relates to planning and control. It is included in the belief, shared with Bellman and Zadeh, that in many of the situations we encounter, imprecision, as distinct from randomness, is an important factor—that most of our commerce in the real world

takes place in an environment in which the goals, the constraints and the consequences of possible actions are not known precisely. This is thought to be particularly true of business planning and control. A non-statistical tool for handling the inexact exactly is outlined, and related to the budget planning and budget control models presented earlier.

Chapter 8, by my McGill colleague H. R. Howson, looks at various effects feedback may have on performance, prompted by the uncomfortable suggestion from some psychologists that in certain types of learning situations outcome feedback, the typical kind generated by conventional systems of budgetary control, may have a negative influence on future performance. Since Dr Howson had already researched this area it seemed only fitting that he should write this chapter.

Chapter 9 presents a brief summary of the main proposals made in Chapters 1-8 and indicates some directions for further research.

As with any selection, some readers are bound to be surprised by the inclusion of some topics and the omission of others. Justification for the former must be sought in the essays themselves; a word of explanation might be offered about the latter. It may be considered by some a surprising omission that in my discussion of control budgets (Chapters 3-7) there is no mention of (i) the measurement of performance against *ex post* rather than the traditional *ex ante* standards, and (ii) to whether, and how, budgets should be used as motivating devices, which budgets should be so used (*ex ante* or *ex post*), and the related question of what is the optimal structure of incentives under uncertainty in a given organization. These have been among the most heavily researched questions on business budgets in recent years. (On (i) see Anthony, *Planning and Control Systems: A Framework for Analysis*, 1965; Dearden, *Harvard Business Review*, May-June, 1968; Demski, *Accounting Review*, October 1967, January 1970, April, 1971; Swieringa and Demski, in *Behavioral Experiments in Accounting*, T. J. Burns, ed., The Ohio State University, 1972; Itami, *Adaptive Control: Management Control and Information Analysis*, AAA monograph, 1977; Lin, *Accounting Review*, January 1978 and on (ii) see Alchian and Demsetz, *American Economic Review*, December 1972; Stiglitz, *Review of Economic Studies*, April 1974; Mirrlees, *Bell Journal of Economics*, Spring 1976; Lawler and Rhode, *Information and Control in Organizations*, Goodyear, 1976; Hopwood, *Accounting and Human Behaviour*, 1976; Demski and Feltham, *Accounting Review*, April 1978.)

These are all unquestionably highly significant research questions, on which more remains to be said. At the same time budgets in practice are notoriously multipurpose instruments, so it should not be surprising to anyone that (i) and (ii) are not the *only* significant questions to

be addressed. The line had to be drawn somewhere; to examine all such questions in a single work was impossible. I elected to concentrate in the main on the use of budgets in planning and control, and to make a formal separation between the budgets serving these functions (with the exception of Hopwood, all of the writers just mentioned still favour the use of a single budget for both purposes).

Questions as to the best standard against which to measure performance from a motivational point of view, and the role and optimal design of an extrinsic reward system, while obviously not unrelated questions, were, for the purposes of this study, regarded as separable, and abstracted from. Except in Chapter 8, where the contributor was left completely free to express his own views, a traditional approach has been taken to these questions. Specifically, Chapters 3-7 assume that the measurement of performance (and any determination of extrinsic rewards) is in relation to *ex ante* standards, and that the traditional accounting variance analysis is followed.

While I do not wish to take a position here on these issues (and I stress that what follows is not offered as a defence of the traditional position), I might be misunderstood if I avoid them completely. I therefore point out that, since the *ex ante* planning budgets against which I have chosen to measure performance are to be systematically revised whenever a key variable goes out of control in some defined sense, the difference in practice between '*ex post*' and '*ex ante*' performance measurement would be a difference in degree, not a difference in kind. Such *ex ante* standards would not be seriously inimical to *adaptive behaviour*, as Itami claims (*op. cit.*), or be noticeably inferior as *motivation devices*, or as the *base for incentive payments*, although in my scheme the need to motivate is seen as a principal reason for having formally separate control budgets. The tying of extrinsic rewards to performance measures, and reliance upon outcome feedback to provide positive motivation, run equal risks of causing dysfunctional effects under both '*ex ante*' and '*ex post*' schemes (Lawler and Rhode, *op. cit.*, and Chapter 8). *Controls* based upon the most recently revised plans, modified to allow for motivational considerations as I propose, would likewise not be significantly inferior, and might indeed prove to be superior, to those based on *ex post* standards which are simultaneously plans and controls, one would suspect. As *coordinating devices*, systematically revised planning budgets would have the advantage over *ex post* budgets of being more timely; in fact *ex post* budgets as such fail to fulfil this role.

Adaptation in its several forms is, to a large extent, seen here as part of the planning function, as under the *ex post* scheme, except that there the planning budget is, in effect, not revised until after the costing period has ended. There is no question that the encouragement of adaptive behaviour should be given top priority. The only question is

'At what level in the firm should it be initiated?' From a systems theory point of view the answer to this question seems clear: all forms of adaptation by a dynamic open system—by changing its environment to its own advantage, changing its internal structure, changing its boundary conditions at the system–environment interface, and growth—are, in the case of a firm, mainly *top management* prerogatives and hence logically prior to the problem of control, not usually or mainly the responsibility of the controller individually or the controlled. Nor is there reason to believe that the view taken of planning budgets (and formally separate control budgets) in this book would result in significantly poorer *planning* in future periods. The question of which scheme is to be preferred on cost–benefit grounds remains, a difficult question which it is impossible to answer in general terms.

The text and notes indicate my considerable indebtedness to other writers, most notably in systems theory, control theory, and the theory of fuzzy subsets. In addition, my colleague G. A. Whitmore was, as always, very generous with his comments and advice, and my debt to him at key points in Chapters 1, 2, and 4 as the work developed is considerable. I managed to persuade him to put his name to Appendix B in Chapter 2. I also wish to express my thanks to A. P. Bonaert in Brussels, as a result of whose reading suggestions and comments Chapters 5 and 6 took on a different appearance than originally planned, and for his comments on Appendix A in Chapter 2. We also shared an instinctive feeling for the potential significance of fuzzy subsets theory. As a result, he prepared a first draft of Chapter 7 as an M.B.A. term paper for Boston University, Brussels, in 1976 under my supervision. Both of us benefited from stimulating discussions on this subject with A. Kaufmann at Université de Louvain. I wish to thank Professor Kaufmann and his two associates, Michel Cools and Thierry Dubois, of Centre IMAGO, Université de Louvain, for giving me access to Volumes 2–5 of Kaufmann's work *Introduction à la théorie des sous-ensembles flous* (in French). Professor Kaufmann later kindly read and gave me his comments on Chapter 7. None of the abovementioned are, of course, responsible for any errors that remain.

I wish to thank McGill University and the Canada Council for making it possible for me to spend the academic year 1975–76 on sabbatical leave at the European Institute for Advanced Studies in Management, Brussels. The assistance of Miss Amina Rajabalee, Miss Katherine Ko, Mrs Joan Abdallah, and Mrs Joyce Lewis of McGill, and of Mrs Jessie Goveas of EIASM, Brussels, in typing portions of the manuscript is gratefully acknowledged.

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Part 1 Planning Budgets

1 Specification of the budget planning system

The prediction can be hazarded that organizations in our society will increasingly move toward the improvement of the facilities for research in assessing environmental forces (Katz and Kahn²⁷)

Elsewhere the writer has made a number of criticisms of conventional business budgets, regarded in turn as plans and as controls.¹ This chapter seeks to substantiate one of the principal of these criticisms, that little attention has been paid to the overriding problem of defining the *systems* involved. Our purpose will be to specify as closely as possible the substantive systems underlying budget plans and budget controls, as distinct from the system implied by the business budgets found in practice. We shall not, however, attempt to model a business budget system *per se*, but rather demonstrate what is involved by reference to a less disaggregated model. Extension to an actual budget system only involves adding to the number of variables considered.

An accounting system, whether historical or prospective, can be regarded as a self-contained system: one never has to go outside the system for an 'explanation' of the relationships recorded. But of course this 'explanation' does not take us very far, consisting as it does merely of the duality aspect of double-entry. If we are concerned with understanding the truly causal relationships that make up the *substantive* systems which accounts or budgets purport to represent, we are dealing with dynamic systems which interact with their environments.²

In examining the substantive systems underlying forecast accounts it will be argued that planning and control, to be effective, should be represented by separate and distinct models, though the two are obviously related. We shall be concerned with the mathematical representation of the substantive models which forecast the future behaviour of the system (the planning budget), and which seek to regulate its actual behaviour in relation to this forecast behaviour (the control budget). The principal question to be addressed in each case will be: what is the underlying system, and what does its specification entail? This question is discussed in relation to planning in the present chapter and to the budgetary control system in Chapters 5 and 6. But first it is necessary to justify separation of planning and control budgets (*see also* Note 26).

1.1 Why budget plans and controls should be separated

Why should controls be separate from plans? We can offer three different arguments. The first is that they serve entirely different functions. The latter are concerned with the allocation of resources and claims to resources. Planning is therefore essentially an economic problem, which should be stated in economic terms. Control is concerned with quite different considerations, namely stabilization or regulation, which are not essentially economic in character. The effectiveness of a control budget is measured solely by the results it produces, not by any relation the data it contains may have to economic reality.

Nor is it just that planning budgets should be *stated* in economic terms, whereas control budgets need not. The *format* of the two needs to be different. For purposes of detailed financial control the input-oriented (lines of expenditure) format of conventional business budgets is useful. When it comes to allocation and utilization of resources, efficiency and other questions about resource use, the conventional format is inimical. Something like a programme budgeting (PPBS) information framework is necessary for considering such questions—a functional analysis of *costs* (rather than expenditures), related to specific outputs.

In many businesses at present the planning process begins with the budget. But meetings of the budget committee are a singularly unsatisfactory place to begin serious planning. Apart from the time constraint, managers attending budgetary hearings are partisan, each anxious to protect his own special interests, and each knowing that he must commit himself to a performance target once the hearings are concluded. In planning discussions, by contrast, the participants need to subordinate their sectional interests and think only of furthering corporate objectives. Qualitative as well as quantitative variables need to be taken into account, also the dynamic aspects of the business as a 'going concern', the uncertainties attaching to alternative courses of action and ways of reducing these uncertainties.³

A second argument, really implicit in the first, is the view expressed by Charnes and Cooper that 'A good plan . . . does not necessarily yield a good control', and that 'good planning data and good control data are not necessarily the same'.⁴ This introduces the question of motivation and incentives: the best target for control purposes coincides with planned results if and only if each employee has an automatic incentive to work to this target. If planned performance is effectively unattainable no matter how great the reward for achieving it is made and penalties are fixed for non-attainment, the expected value of the reward is zero and the net expected value of rewards and penalties

negative. Such a control system would cause discontent and workers would not agree to it. It would not be very effective even in the absence of penalties for non-attainment of objectives, because employees would still regard the target as unreasonable. They would therefore feel under no compulsion to try to attain it, and their performance would be likely to drift further and further away from it. It seems quite clear, then, that behavioural considerations, in the form of the motivation and personal aspiration levels of employees, and how they are influenced by the level of the control target set and by the form the reward-penalty system takes, are an additional factor when we are considering control.

Third, are the *substantive* systems underlying planning and control identical? We can conceive of a dynamic system as a state vector, or vector of endogenous variables $x(t)$, and a rule for determining its value at any time. Thus in the planning system of the imperfectly competitive firm discussed later in this chapter, the state vector at any time t comprises the variables (p, A, s, c, x, q, D) , and the rule for determining the values of the components of this vector consists of the decision model plus the initial values of the decision variables, p and A . In accounting and business practice the control system, call it set B , is most usually, though not always, regarded as an identity mapping of the planning system, set A : each of the endogenous planning variables maps into itself in the control system:

$$x(t) \in A: \quad \lambda(x) = x(t) \in B.$$

In Chapter 5 we shall examine the assumption that these set memberships are the same, and the nature of the mapping λ . Anticipating that discussion, we can assert that the sets and systems are not even approximately the same. It seems highly unlikely, therefore, that a single budget will prove effective as both a plan and as a control.

1.2 The planning system

The points at issue concerning the specification of the planning system will now be illustrated by considering a dynamic model of a single-product, imperfectly competitive firm whose objective is wealth maximization, wealth being defined as the present value of the stream of future revenues net of production and selling costs.⁵ The reasons for choosing this particular model will become apparent as we proceed. It will be assumed for convenience that the firm has an infinite planning horizon and that production equals sales in each period. In displaying the firm's decision model we will abstract from uncertainty initially.