THE DEVELOPMENT OF A COMPUTER AIDED SYSTEM FOR ADAPTIVE BUDGETING IN A CONFECTIONERY MANUFACTURING FIRM

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DEDICATED TO:

THE ALMIGHTY FIVE BENEFACTORS

BUDDA, DHAMMA, SANGHA, MY PARENTS AUNG, YIN, YEE AND TEACHERS

who strengthen and inspire me.

SYNOPSIS

This thesis sets out to investigate the practicality of developing a computer-aided system for adaptive budgeting and state the requirements, problems and implications of such development.

The research is undertaken in two parts: literature search and field work. The relevant literature in management accounting, behavioural sciences, management sciences, systems and computers and related technology are examined in the literature survey. An 'in-depth' method is adopted to carry out the field work, involving the design, development and building of computer budget models at operational and corporate levels for a leading U.K. confectionery firm using time-sharing systems.

The thesis begins with an overview of planning systems - concepts, requirements and implications to give a broad perspective to budgeting systems. It then examines the external and internal environments of a firm and places the financial system in context. Systems models of finance, financial planning and budgeting functions are developed in this phase of the study. It also looks in depth at developments in budgeting systems encompassing philosophical, behavioural and technical aspects. The state of computer technology and its applications to budgeting are examined to provide background and assess the prospects. The thesis then gives an account of the computer models developed at operational and corporate levels. A modular approach is adopted and models are built first with 'STRATPLAN'; later, after uncovering serious shortcomings of 'STRATPLAN', 'BASIC' is used to code sales, production, direct wages, direct fixed salaries and associated employee costs budgets at 'budget centre' level. The next phase of the field work involves the development of 56 computer models in 'APL' to produce profit and loss, cash flow and financial position statements, with facilities for 'what if' options, at 'corporate' level.

The work at 'budget centre' level suggests that no dramatic benefits could be expected for reasons stated in the thesis. However, computerisation of budget preparation may still be worth while because of the massive processing of data required and of the prospects of benefiting from 'corporate' level applications. The thesis concludes with the statement of the problems, requirements and implications of this approach in terms of organisational environment, operation of the computer systems, the development and running costs and the use of models in applying computers to budgeting. The study is an in-depth one in a single firm and the results should contribute towards increasing the use of computers in financial planning and budgeting applications.

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CHAPTER 1

INTRODUCTION

This study sets out to investigate the practicality of developing a computer-aided system for adaptive budgeting and state the requirements, problems and implications in development. The investigations were carried out by building computer budget models for a leading U.K. confectionery manufacturer on a time-sharing computer system. The thesis begins with a survey of planning systems, concepts, requirements and implications to give a broad perspective to budgeting systems. It then examines the external and internal environments of a firm and places the financial planning and budgeting sub-systems in context. It also looks in depth at developments in budgeting systems. The state of computer technology and its applications to budgeting and financial planning are also examined in the thesis. This should provide background and enable us to collect some evidence concerning the problems involved in bringing budgeting, financial planning and computers together successfully.

1.1. PLANNING - WHY IN MONETARY UNITS?

All organisations and individuals have objectives, purposes and goals. Planning helps to achieve the goals and purposes by consciously preparing in advance a set or sets of actions based on forecasts of likely course of events and situations in the future. Such plans provide bench marks to evaluate the current activities for monitoring and control. Planning is a pervasive activity. We find planning carried out by individuals and organisations alike. The practice as well as the need for planning increases with growth in size and complexity of operations of planning units. Planning is being widely used on running present-day large organisations. For them the process is formalised, procedures defined and plans explicit and documented.

There are many criteria for classifying the planning activity. Planning is classified by function, length of time covered (planning horizon) or relative to level of management practising them. We have production, procurement, personnel, marketing and financial planning when classified by function. Planning is known as long-term, medium-term and short-term depending on the length of future time periods covered by the plans. Planning is again classified as strategic, tactical and operational relative to the rank in the organisational hierarchy which exercises it. Each type of planning indeed places different emphasis and/or deals with different aspects of an organisation's activities.

The activities in all plans are measured and expressed in two basic categories of accounting units: physical units and monetary values. The physical units of measure vary with the nature of activity and purpose of measurement. Monetary values, if not assignable to all functions, operations and activities for all purposes, are nevertheless the most common denominator of measurement available. The use of transfer prices for in-company services like transport, power, communications, engineering and maintenance, stores are examples. All plans are first drawn up in natural physical units. The planned activities and operations somehow or other and sooner or later give rise to revenues, incomes, costs and expenditures. These are worked out and the plans expressed in monetary values. It might therefore be reckoned that there are two aspects to all categories of planning: physical/operations and monetary/financial, referred to in this thesis respectively, as physical plans and monetary plans.

Physical plans specify the activities required to carry out an objective/goal/purpose/mission and place the necessary activities in the settings of responsible personnel, places, future time periods or other relevant aspects. These plans specify the whats, whens, wheres, hows and whos to carry out the activities. Physical plans are crucial for effectiveness of an organisation's activities. These plans, however, stand by themselves with their peculiar units of measurements. The character of plans also vary from one another. Some deal with revenues and others like support activity plans are concerned exclusively with the spending of money in the narrow sense. It is difficult to assess the efficiency of the activities even in each individual physical plans whenthe inputs and outputs in the same plan are measured by different yardsticks. It is also impossible either to justify 'stand-alone' plans or to evaluate the overall performance of the organisation when plans are expressed in different units of measurements.

Monetary plans use money as a unit of measurement, common to all plans. This enables economic evaluations to be made for each plan and also to bring together all plans and relate costs and expenses against revenues and incomes. Financial plans remove some limitations of physical plans and make possible: (1) individual evaluation and justification of every plan or programme, (2) consolidation and integration of all plans into a master or grand plan, and (3) assessment of the performance of the organisation as a whole.

Both aspects, planning in physical units and in monetary values, are useful in that the one makes the objective/goals/purpose/mission effective and the other discloses the financial implications to help achieve efficiency, profitability and liquidity. Budgeting, in fact, is interpretation in monetary units of physical plans (especially short-term annual ones) which are prepared to attain given objectives.

1.2. PLANNING IN MONETARY UNITS - REQUIREMENTS AND IMPLICATIONS

Every organisation operates with some kind of objectives and goals which may vary from business, social, ethical or political. For business firms they could be growth, reputation for quality, share of market, etc. Business organisations usually have profit targets related to capital employed, assets and turnover. Plans are drawn up with a view to achieving the objectives. When these plans are prepared, decisions are made about the future on the basis of certain assumptions. Assumptions are derived from informed opinions, anticipations and forecasts of the future. The future is not known for certain. Assumptions can therefore be different and many. A planner first gives thoughts to and works out a number of alternative courses of actions and programmes. The conception and formulation of various courses of actions demand a great deal of imagination, hard thinking, knowledge of business and firm grasp of the situation. These alternative plans of actions are tested out in various situations. A planner needs not only a knowledge of the results of alternative courses of actions but also the effects on them by changes in assumptions and variables. He makes adjustments to programmes and courses of actions before adopting a definite plan.

Planning for huge, complex and diversified organisations amid changing internal and external environments requires continuous conception, formulation, preparation and testing of different courses of actions against defined objectives and goals. The internal changes are taking place in the form of growing corporate complexity, increase in size, diversification, divisionalisation, decentralisation and changes in organisation structures. Rapid, abrupt and profound changes are also occurring in the external environment of business firms. We have seen in the last two years price inflation, shortages of materials, wage inflation, energy crises, changes in rates of V.A.T. and multiple public budgets (in single financial years), etc. All these changes alter the prospects, assumptions, premises and bases on which plans are prepared. The old plans are incompatible with new situations and are thrown out because they were prepared within the contexts of different environments and situations. They might not represent the best course of actions to achieve the specified objectives. The plans need to be changed to adapt to the changing internal and external environments to effectively steer and control the organisations. The term 'adaptive planning' means such a process of planning wherein changes are continually given effect to in the plans to suit the changes in internal and external environments.

Planning is highly challenging to management. We observe that planning embraces two distinct types of tasks: one subjective and judgemental, the other reducible to a set of algorithms. Tasks like the making of planning assumptions, initiation and conception of alternative course of actions are judgemental. They require intellect and intuition. Management cannot delegate such tasks to machines. The second type includes, among others, such tasks as following through the financial impacts of alternative courses of actions i.e. preparing financial plans, determining the effects of alternative courses of actions by changes in assumptions, decision variables and situations. It may also be said that the first category of tasks/problems are ill-structured whereas the second well-structured.

A model simulating the financial aspects of the activities of an organisation is required to test alternative courses of actions and to carry out sensitivity analysis. The use of 'what if' computer models could provide management fast feedback of probable outcomes to alternatives and also relieve personnel from routine clerical work to devote more time to creative work.

1.3. CONCEPTS, TECHNOLOGY AND PRACTICE

Developments pertinent to planning have been made in various disciplines: management accounting, finance, management sciences, behavioural sciences, data processing, systems engineering and computer technology. The spectrum of advances covers concepts, philosophy, methodology, techniques, practices and tools. The progress made in the following areas are particularly significant and important to the development of adaptive budgeting systems: concepts of flexible budgets, multiple outcomes budgets, continuous/running/rolling budgets and associated techniques, methods in budget updates and revisions, corporate modelling and simulation, computer hardware (mainframe and peripherals) especially mass storage devices, computer software notably tele-processing and time-sharing systems, high level general purpose conversational languages, and applications packages in financial planning.

We have the concepts and techniques to develop models simulating the financial aspects of the activities of an organisation. An accountant's profit and loss statement and balance sheet represent the financial model of a firm. The inter-relationships and movements of items in these statements are simulations of the financial aspects of the activities of a firm. The concepts of financial modelling were already in business and the evidence of applications could be seen from the preparation of forecast profit and loss statements and balance sheets. However, these statements are seldom found to be prepared for various alternative courses of actions under different assumptions and situations. The potentials of financial modelling have not been exploited to the full perhaps because of the amount of processing needed to be done on large masses of data.

Computers are very efficient in processing large masses of data with fast accurate response. They have proved to be successful in routine clerical applications such as payroll, invoicing, order and stock control. This suggests the application of computers and related technology to well-structured operations/problems in planning. One would expect a wide-spread use of computers in planning in view of the amount of processing and iterations required for adaptations to environmental changes on one hand and the developments in computer hardware and software on the other. The actual state of affairs is far from these expectations. Few companies were modelling in the U.K. in 1968. A random survey suggests that in 1973 only 9 per cent of the largest U.K. companies - 'The Times 1000' - were using corporate models. It was also observed that not all of these few have applications for financial planning. The financial planning applications were 38% for short-term (up to 1 year), 78% for medium-term (1 to 5 years) and 45% for long term (over 5 years). This, in fact, means that only 7% of the largest U.K. companies at most were using computers for financial planning in 1973 and that was for medium-term planning. The number of companies using computers for short and long-term financial planning were only 3% and 4% of the largest U.K. companies.[1] This is rather interesting in view of the requirements for adaptive planning, capabilities rendered by available computer technology and potential benefits likely to result from computer applications.

1.4. OBJECTIVES OF RESEARCH

The objective of this research project in broadest terms is to investigate and state the requirements, problems and implications of using computers in budgeting.

The research specifies the following elements in the application of computers to budgeting and financial planning.

1. The physical data processing hardware.
2. Management policy, the attitudes and responses by employees to budgets.
3. Our knowledge/understanding of budgeting and financial planning systems.
4. The computer technology.
5. The skills in computing.
6. Our ability to relate 3 and 4.

The research deals with the following propositions:

1. There exists a sufficient body of knowledge in related inter-

1. Peter H. Grinyer and Jeff Wooller, Corporate Models Today, The Institute of Chartered Accountants in England and Wales, 1975, pp. 4-5.

disciplinary fields to provide us with a conceptual framework for the design, development, installation and implementation of an adaptive planning and budgeting system.

2. The state of computer technology, in view of the advances and progress made, is adequate to make beneficial use of adaptive budgeting practice, and

3. It is therefore practical, worthwhile and whithin the means of a large number of companies to use computers for financial planning and budgeting purposes.

This research is aimed to make significant contributions towards increased awareness of budgeting concepts and available computing technology such that further exploitation of opportunities may be encouraged. The research indicates the following ways of bridging the gap between theory (expectations) and practice:

1. Simple accounting relationships are all that is necessary to begin building mathematical models to aid financial planning and budgeting.

2. These simple models are useful to explain the financial impacts of a company's activities and also to predict financial outcomes of alternative policies, courses of actions and assumptions.

3. The recently introduced and currently available high level general purpose computer languages place tailor-made budget models within the reach of many companies.

4. The necessity of in-house computers is dispensed with by tele-processing and time-sharing systems. The development of these systems also enable us to do away with additional I/O (input/output) units with complications in data entry and outputting results. A tele-type terminal is all that is required.

5. Direct talk/communication with the computer makes possible manipulations of simple models with fast, accurate response.

6. The opportunities opened up by tele-processing and time-sharing systems enable us to put into practice advanced concepts in planning and budgeting systems.

7. The research also examines some of the behavioural considerations in budgeting systems which demand management attention and careful administration and which require further intensive study.

1.5. RESEARCH METHODOLOGY

The research is undertaken in two parts: literature search and field work.

The relevant literature in associated disciplines of management accounting, finance, data processing, management sciences and systems are examined to provide a background to the study. We looked at a firm in the external environment and noted the exchanges which take place between them. The main systems in a firm are then identified, followed by conception of systems models for finance and budgeting functions. The developments in planning and budgeting systems are followed through by an examination of relevant literature in associated disciplines. The state of computer technology is looked at, and the hardware and software developments particularly lending to computer applications in budgeting and financial planning functions are assessed. Literature search is also made to examine the state of computer budgeting and planning applications.

An 'experimental' ('participative' or 'in-depth') method in carrying out the field work is used, involving the design, development and building of a computer aided system for adaptive budgeting in a real life industrial situation.

The firm concerned is in the confectionery industry. The confectionery market is highly sensitive to price changes and competitive. The supplies of raw materials are uncertain and prices often subject to fluctuations. The industry faces similar experiences to others in labour and other services markets. A company in this industry, therefore, needs an adaptive planning and budgeting system for survival. The company chosen is a leading U.K. confectionery manufacturer, having a share capital of £30.8 m. The company has a turnover of £170 m. with pre-tax profits of £12.5 m. It produces about 250 products, with new products being introduced every year. It has overseas branches and its factories are spread throughout Great Britain.

The development of computer-aids to budgeting has stretched into two distinct phases. It was originally set out with bottom up applications to build computer models for operational level budgets. The start point was an examination and analysis of the existing system. In this phase, a detailed examination was made of two of the software packages which appear to suit financial planning applications, viz. I.C.L.'s 'PROSPER' (PROfit Simulation Planning and Evaluation of Risks) and I.B.M.'s 'STRATPLAN' (Corporate Modelling and Financial Planning System). Models were built with 'STRATPLAN' to produce sales, production, direct wages, direct fixed salaries and associated employee costs budgets for one of the 240 budget centres. Some serious limitations of 'STRATPLAN', dealt with in the thesis, were brought out and models were again developed and run using a conversational general purpose computer language, 'BASIC' (Beginners All purpose Symbolic Instruction Code) to produce the same budgets. The next phase involves the building of computer budget models at the corporate level. Some 11 models for the production of profit and loss and cash flow statements and a further 10 models to produce a financial position statement were developed and run using A.P.L. (A Programming Language) in the first part of this phase. In the second part, we prepared a number of models (37 computer programs in all) to produce the same set of reports following 'what if' exercises or selective changes to any or all of the 20 budget assumptions and 40 variables. There are altogether 56 computer programs developed and run in the second phase. Computer budget models, we observe, could be of great help to management. The system was demonstrated to and interviews held with a group of senior finance personnel who responded with some enthusiasm.

The models in the field work were developed, tested and run on I.B.M. computers in London and Birmingham through an I.B.M. 2741 terminal linked to the mainframes on tele-processing and time-sharing systems. A modular approach was adopted in the design and programming of the budget models. We used system/360 in running the operational level budget models programmed in 'STRATPLAN' and 'BASIC'. The design, development, testing, validation and running of the corporate level budget models, programmed in 'A.P.L.'

were carried out within the environments of C.M.S. (Control Monitor System)/VM.370 (Virtual Machines of System 370).

1.6. SUMMARY OF RESULTS

This research has examined the relevant literature and succeeded in building computer budget models at the operational and corporate levels. The work at the operational level was directed to a selected section of the Company. Programs were designed, developed, tested and run for the preparation of production, material costs, direct and indirect wages and associated employee costs budgets relating to this section. The results were satisfactory and it has, in our opinion, paved the way for computerising the preparation of the said budgets at comparable levels within all divisions in the confectionery group. The work at strategic or corporate level went further in that the company could readily take the models and produce profit and loss statement, cash flow statement and balance sheet. We have set up all the relevant data files for 1976 budgets of the company.

The work at 'budget centre' level showed that no dramatic benefits could be expected from computer budgeting applications at operational levels. This is largely because (i) the participation and involvement of employees in setting standards, quotas and others are so important and indispensible that computers could not simply take over, (ii) the budget time cycle would not be reduced drastically by reason of (i), (iii) many operations require a lot of input data with once-off simple calculations, (iv) the use of computers would not help much to produce equitable budgets, and (v) the budget holders, being at shop floor levels, would not require and use much of 'what if' facilities to work out budgets with alternative values of variables and parameters.

Information collected from discussions with the financial controller and other senior finance staff at interviews, in relation to the work at 'corporate' level, suggested that the system would render a number of uses to the company. The system is expected to: (i) produce broad guidelines for establishment of group/corporate budgets, (ii) facilitate revision of budgets, (iii) assist in setting targets of profits, sales and production and (iv) enable to check compatibility of sales, production, stocks and personnel plans with group financial resources, thereby assisting management in planning the activities and operations of the company.

The research has identified the problem areas and stated the requirements in developing computer models for adaptive budgeting. It showed that the project should be pursued in the systematic way: feasibility study, determination of the basic structure and formulation of necessary equations, computer coding, testing and debugging, accuracy testing, management review, and continual process of extensions and revisions. It also specified a desirable organisational environment wherein management enthusiastically supports and actively involved in the process. Data availability and accessibility often caused delays but could be overcome and eased of by embedding the computer models in well-defined and quantified budgeting systems. The research considered employee participation and human considerations very important and noted that computerised budgeting systems have to take cognizance of them and be prepared to function in such environments. It showed that applications still have a wide vista of benefits and potentials to be harnessed from theoretical advances. On the other hand, models, if they are to be used should have the attributes of simplicity, robustness, adaptability, communicability, completeness and manipulability (ease of user control). The experiences obtained from this research showed that the advances in computers and related technology have lowered a great deal of the DP hardware and personnel requirements.

It is considered appropriate and necessary to state a few caveats to be noted in using computers for budgeting.

Firstly, the matter of accommodating programs and data in the current size of the work spaces could become serious necessitating models in the suite to be dispersed and kept separately, if not amending them altogether to save store usage. We have faced similar problems and the models in the strategic level budgeting system are placed in three separate work spaces. This requires the transfer of variables from one work space to another to be processed on successively.

Secondly, it is observed that the disparity between the speeds of computers and character printers on terminals are very large and a great deal of time is required to print out complete statements. It might, therefor, be necessary and preferable to use VDUs (Visual Display Units) to flash instantly complete financial statements not requiring hard copies.

Thirdly, computer budget models are fairly complicated. They are still quite rigid in the sense that it takes some time and efforts to make amendments compared to manual systems. Besides, they are very sensitive to errors in inputs and programs.

Fourthly, computer budget models or computer systems in general are still complex and difficult to hand over easily to managements. The question of who should run and control them is not easily settled. The system cannot in practical terms be administered by the highest level. The questions of which organisation unit, which section, and then which member of staff should run them, therefore, arise involving data accessability, operating efficiency, communications, rapport and other organisational aspects to be considered in settling them.

Lastly,users should be aware that the tele-processing and time-sharing systems are at times faulty and far from perfect. There can sometimes be disturbances on telephone lines and systems break-downs at main computer installations, the worse of which is that they occur at the most undesirable times.

CHAPTER 2

SYSTEMS OVERVIEW OF A FIRM

2.1 INTRODUCTION

The term systems covers a wide range of phenomena, conceptual constructs as well as physical entities. The financial planning and budgeting process is a system with objectives, resources, interrelated elements and functions operating within the contexts of a wider system. It is a subsystem of the financial system, which is one of the systems operating in a firm. The firm, itself, is one of the many systems functioning in an environment. We are adopting a systems approach in conducting our study. This means that we are pursuing an orderly way of appraising a phenomena by identifying the distinguishable elements, determining their relationships, defining their functions and ascertaining the trade-offs required among resources. The systems approach also does not merely confine its efforts to the element under the study but also to the system, super system and the environment in which the former is embedded. The basic concept behind 'systems' approach is that the whole is more than the sum of the parts. This approach therefore accepts a solution only when it just not optimises the function of an element but also improves the performance of the system as a whole.

We begin our study by looking at the firm in relation to its environment. We then proceed successively to identify the systems in the firm, and examine in detail the financial system and its sub-systems until we come to the elements of the financial planning and budgeting sub-system. Thus we agree in principle with Thome and Willard who suggest, as a basic guide, to start at the highest and most general echelon of cognizance and authority to determine the boundaries of the overall system and to proceed in stages of increasing detail in defining the system.[1]

2.2 A FIRM IN THE ENVIRONMENT

The systems conception of a firm in its relation to the environment could be of varying degrees of generality and content. The general conception gives us the structure, characteristics and basic functions applicable to all organisations or for that matter to all firms. Those, richer in content but less general, present us with views which are highly pertinent to a particular study. We present two system conceptions of a firm, one general and the other specific. Others might argue that the two conceptions that we have presented are 'vertical' and 'horizontal' dimensions of the same phenomena.

Perhaps Katz and Kahn's theoretical model, though admittedly biased towards the study of social behaviour in organisations best represents a general conception of an organisation in relation to its environment. They write:

> "Social organizations are flagrantly open systems in that the input of energies and the conversion of output into further energetic input consist of transactions between the organization and its environment".[2]

1. P. G. Thome and R. G. Willard, The Systems Approach, A Unified Concept of Planning. in S. L. Optner (Ed.) Systems Analysis, Penguin Books, Middlesex, England, 1973 p. 212-213.

2. Daniel Katz, Robert L. Kahn, The Social Psychology of Organizations, John Wiley & Sons, Inc., New York, 1966. p.16-17.

They go on further to specify the characteristics which seem to define all open systems.

> "These include the importation of energy from the environment, the through-put or transformation of the imported energy into some product form which is characteristic of the system, the exporting of that product into the environment, and the re-energizing of the system from sources in the environment.
>
> Open systems also share the characteristics of negative entropy, feedback, homeostasis, differentiation and equifinality. The law of negative entropy states that systems contrive and maintain their characteristic internal order only so long as they import from the environment more energy than they expend in the process of transformation and exportation. The feedback principle has to do with information input , which is a special kind of energic importation, a kind of signal to the system about environmental conditions and about the functioning of the system in relation to its environment. The feedback of such information enables the system to correct for its own malfunctioning or for changes in the environment, and thus to maintain a steady state or homeostasis. This is a dynamic rather than a static balance however. Open systems are not at rest but tend toward differentiation and elaboration, bothbecause of subsystem dynamics and because of the relationship between growth and survival. Finally, open systems are characterized by the principle of equifinality, which asserts that systems can reach the same final state from different initial conditions and by different paths of development."[3]

This as we said earlier is a general systems model of a firm. We now turn our attention to a less generalised systems model. A firm is interrelated and interdependent with the government, investors/lending institutions, suppliers (of materials, labour and services), competitors and consumers/patrons/clients in the wider systems of an economy and a society. There always is an interaction i.e. action and reaction in the relations of a firm with any other system. The actions by an external system create responses by a firm and the moves by a firm is always matched by countermoves of external parties. The characteristic exchange of material, energy and information between a firm andany system coming into contact with it is also noticeable there. We would examine these exchanges first by confining

3. Ibid, p.28-29.

ourselves to financial transactions. This is done to highlight the financial implications because we are dealing with financial planning in our study. We observe that capital grants and loaned capitals from the government, investors and lenders flow into a firm. These inflows, together with retained profits of a firm, form the circulating and fixed capital. Taxes to the government, dividends and interests to investors and lenders represent the outflows from a firm to complete the traffic with those parties. We note the inflows of raw materials, sub-assemblies, labour and services and the outflows of moneys in payment of invoices, wages and fees in a firm's relations with various suppliers. Products in the form of finished goods and services leave a firm and money is received into the firm for sales and services in its relations with consumers/patrons/clients. The interaction of a firm with its competitors takes place indirectly through its relations with the market in the shape of movements in demand, supply and prices. The exchanges between a firm and the various agents in the environment with emphasis on financial aspects is shown in Figure 2.1. This neither means that there are no other exchanges nor that other exchanges are insignificant and unimportant. Actions by the government like the enforcement of certain fiscal, monetary and other economic measures are reacted by a firm by the pursuit of specific objectives, purposes and policies. The government's legislation relating to labour, conduct of trade and business, preservation of nature and environment, prevention of pollution, observation of safety, health, and prevention and protection against accidents at work, etc. etc., are met by a firm by the formulation of particular policies, safeguards, procedures and rules of behaviour. On the other hand, any action by a firm not in contravention of any existing law or regulation but detrimental to public interests is retaliated by the government by the promulgation of appropriate laws. Aspects of the interactions between a firm and investors and lenders could be seen

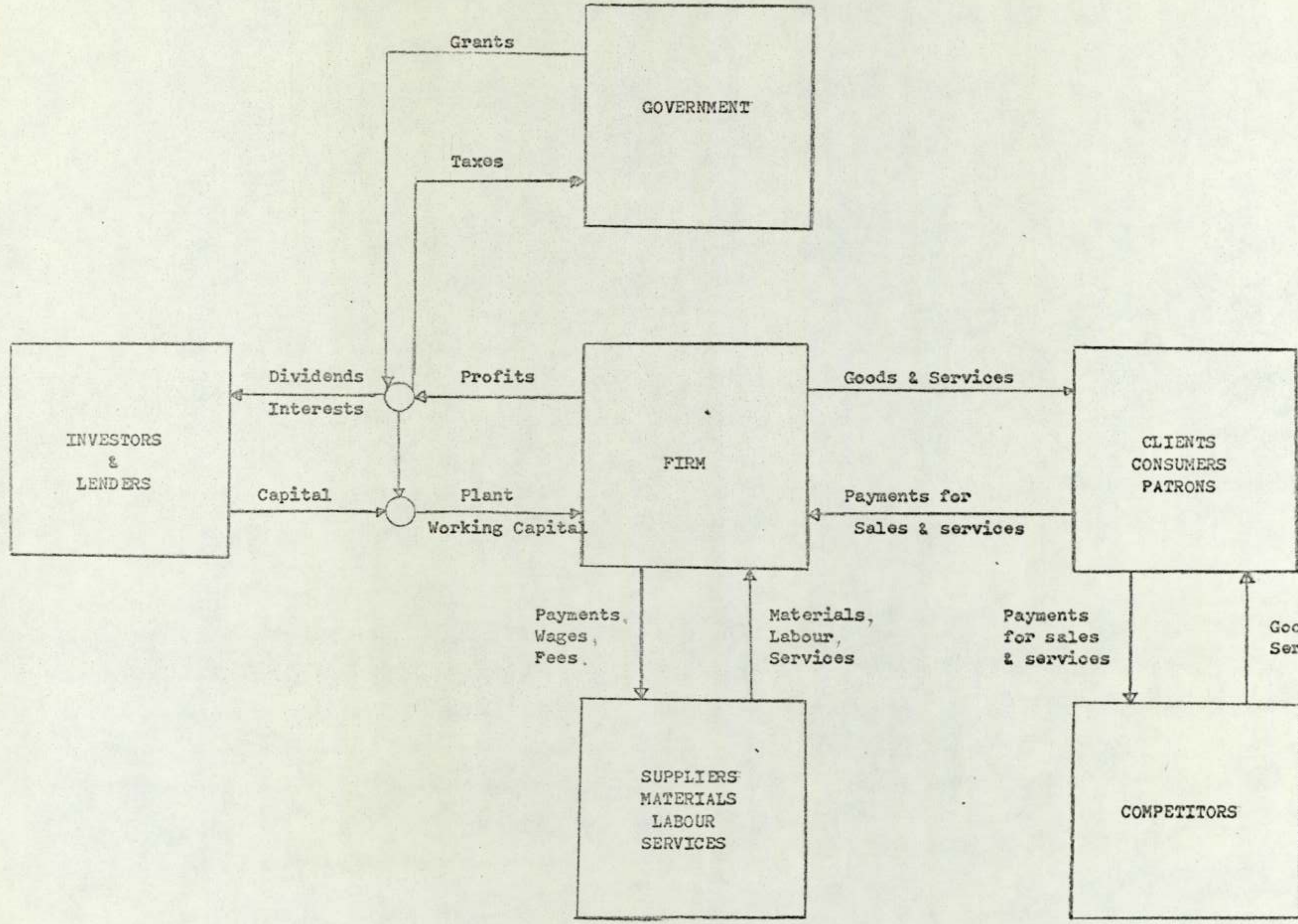

FIGURE 2.1 A FIRM IN THE ENVIRONMENT

daily. The amounts willing and ready to be invested by institutions and individuals vary with the success as reflected in the dividend payouts of a firm. The rates of interests charged by lenders determine the level of demand for loans by a firm. The changes in key posts in a firm are accepted by the financial community with certain changes in attitudes towards the firm. The disclosure requirements by the financial community, labour and the government are met by certain policies and practices of a firm. The implications of all the actions and reactions are ultimately reflected in the economic indicaters like interests, dividends, demand and supply of loans and share quotations. We could find aspects other than financial, of the exchanges between a firm and its suppliers. A firm's insistence on better quality and faster delivery of raw materials on suppliers are met by the latter by modifications and improvements in production technology and transport facilities which in turn demand increased prices. We find in the history of business that break-through in technology of manufacture in either firms or suppliers causing repercussions in counter parties. Poor working conditions, unsuitable remuneration schemes, poor labour management relations on the part of a firm hold less attractions to workers in the labour market and lower the morale of workers in employment. These reduce labour productivity which affects both a firm and its workers. The interaction of a firm with its market (consumers/patrons/clients) have attracted most of the attention of the economists in the past. We find a lot being written about demand, supply, forces behind them, and the workings of price mechanism in the economics literature. The impacts made by competitors are felt through the market and are so great that competition becomes an integral element in the studies of the market. Sales promotions, advertising campaigns, market research, changes in distribution channels, modifications and product market diversifications done by a firm and its competitors and the changes in tastes, beliefs, customs, values and cultures of consumers play important roles in a firm's interaction with its markets and competitors. This description of a firm in the environment is not exhaustive but we hope, it presents a more specific systems model.

2.3. SYSTEMS IN A FIRM

There are different ways of classifying systems in a firm. Each depends on how they are looked at: general, specific, descriptive, functional, horizontal, vertical, etc. It is difficult to agree to a standard classification because it all depends on the purpose in each categorisation. We are presenting four such classifications, including our own which is done in the particular way in the present contexts of our study.

Mills, in what he labels the functional approach, enumerates four systems, with the functions under each, existing in a firm as follows:

"1. The political function - determining objectives, and planning, controlling and co-ordinating activities.

2. The economic function - acquiring and husbanding resources to enable the system to achieve the goals.

3. The integrative function - influencing norms of behaviour in the various units and groups to achieve cohesion in their activities.

4. The value function - protecting, modifying and creating values to support the kind of integrated activity required to achieve system objectives."[4]

Johnson, et al observe six systems and/or functions in their general systems model of a business firm.

4. Arthur E. Mills, The Dynamics of Management Control Systems, London, Business Publications, Ltd., 1967, p.43

"1. A sensor subsystem design to measure changes within the system and with the environment.

2. An information processing subsystem such as accounting, or data processing system.

3. A decision making subsystem which receives information inputs and output planning messages.

4. A processing subsystem which utilizes information, energy and materials to accomplish certain tasks.

5. A control component which ensures that processing is in accordance with planning. Typically, this provides feedback control.

6. A memory or information storage subsystem which may take the form of records, manuals, procedures, computer programs, etc."[5]

Katz and Kahn classify five subsystems in an organisation.[6]

1. Production or Technical Subsystems are concerned with the throughput, the energic or informational transformation whose cycles of activity comprise the major functions of the system.

2. Supportive Subsystems carry on the environmental transactions in procuring the input or disposing of the output or aiding in these processes. Supportive subsystems also carry out the more general high level activities of securing favourable relations with larger structures.

3. Maintenance Subsystems direct their activities not at the material

5. Richard A. Johnson, Fremont E. Kast, and James E. Rosenzweig, Systems Theory & Management, Management Science, Vol. X No. 2 (Jan.1964) p.373.

6. Katz and Kahn, op cit, p.39-43

being worked on but at the equipment for getting the work done. This equipment consists of patterned human behaviour. Maintenance subsystems tie people to the system as functioning parts and perform recruitment, indoctrination or socialisation, rewarding and sanctioning functions to maintain the fabric of interdependent human behaviour.

4. Adaptive Subsystems are specifically concerned with sensing relevant changes in the outside world such as external changes in taste, in cultural norms and values, in competitive organisations, in economic and political power, and translating the meaning of those changes for the organisation. These subsystems bear names as product research, market research, long range planning, research and development.

5. Managerial Subsystems comprise the organisational activities of controlling, co-ordinating and directing the many subsystems. They also deal with adjustment of the total system to its environment. The functions of this subsystem require actions affecting large sectors of organisational space, the formulation of rules or a change in policy to achieve better utilization of the system's resources.

We observe that the above subsystem identifications in a firm are functional. All of them are 'general' and 'theoretical' in their own ways to be applicable in many cases. On the whole, it appears that the shades of differences lie in semantics. The political function (Mills), the decision making subsystem and control component (Johnson et al), and the managerial subsystems (Katz and Kahn) are fundamentally similar in having functions for planning, control, co-ordination and directing. We also observe that the economic and value functions (Mills), the processing subsystem (Johnson et al) and the production or technical subsystems (Katz and Kahn) share the productive activities in common. The integrative function (Mills) and the maintenance subsystems (Katz and Kahn) are essentially the same in what is commonly called 'personnel' functions. Johnson, et al do not explicitly or separately identify personnel function. We feel that Katz and Kahn's terminology maintenance subsystem, at least on the surface, may mean different from the sense they use. It is also true of Mill's integrative function for that matter. The marketing activities in the supportive subsystems of Katz and Kahn are assumed in the value function (Mills) and implicit in the processing subsystems (Johnson et al). Johnson, et al's classification appears to us to be a vertical dimension of any system. We are not going to argue further on semantics.

We concur with the functionalconception of the systems in a firm, and are inclined towards the traditional functional approach in classifying the systems in a firm. We believe this mode of classification is practical, easily understandable and suggestive of the nature of a firm's tasks and operations by mere descriptions. Thus we identify the following subsystems and elements in a firm.

Subsystems	Elements
Administrative	Planning and research, Administration, Secretarial
Personnel	Selection and appointment Training and placement Health, recreation and welfare Transfers, promotion and demotion Retirement, dismissal and layoff
Production	Research and development Procurement and stores Factory Service Engineering and maintenance
Finance	Capital issue Capital budgeting Financial Planning and budgeting Treasury Financial Accounting Cost Accounting
Marketing	Market research Advertising and promotion Sales Packing and despatch Warehousing

2.4 THE FINANCIAL SYSTEM

The financial system has interactions with all systems in and outside a firm in the environment. It also has exchanges among its subsystems. These numerous exchanges assume different character depending on the nature, aspect and context of each individual transaction. We observe, thus, objectives, policies, guides, rules, orders, instructions, premises, decisions, sanctions, approvals and authorisations passed to the financial system from administrative system. The financial system sends forth to the latter submissions for approval of allotments, calls, transfers, redemptions, plans, programs, budgets as well as evaluations, appraisals, reports and cost analyses. In its relations with other systems in a firm, we find that the financial system passes information requests, purchase orders, financial orders, programs, budgets, intimations of receipts and payments, reports, evaluations, appraisals and cost analyses. It receives technical standards, quotas, performance data, operating data, costs, prices, deliveries, needs, information about events and transactions, bills, invoices, payment orders, purchase requisitions from them. The government imposes legal requirements, restrictions and obligations on the financial system which complies with them. We also observe that grants, allowances and queries, on one side and annual returns, reports, statements, analyses, duties and taxes from the other pass between the financial system and the government agencies. In a firm's relations with investors and lenders, prospectuses, allotments, transfers, redemptions, annual accounts, reports, dividends and interests flow out from the financial system and applications, subscriptions are received into the financial system. The investers and lenders also make demands on the financial system for interests and their rights under the statutes. The financial system comes into contact with consumers and suppliers in its conduct of receiving and paying for goods and services rendered by or to the firm. A firm's competitors set standards and present opportunities to which the financial system adapts the firm's plans and operations. These exchanges are multi-faceted and numerous. Moreover, as we said earlier, there are also exchanges taking place among the subsystems of finance. The content and character vary with the nature and type of transactions which could be issue of shares, debentures, loans, mortgages, acquisition and deployment of assets, financial planning and budgeting of the firm's operations, production activities, marketing operations, presentation of accounts and reports of meetings, cash transactions and costing and controlling a firm's activities. We identify six subsystems in the financial system and we feel it necessary to examine each to enable us to appreciate and place the exchanges of the financial system with others in proper perspective.

Our examination of the subsystems of the financial system is presented in diagrams with a commentary to each subsystem.

2.4.1. Capital Issue Subsystem

The capital issue subsystem in relation to other subsystems of finance, systems in a firm and the environment is shown in Figure 2.2. A study of Figure 2.2 shows that:

(i) The administrative system issues policies, directives, and guides to the capital issue subsystem which in turn submits plans of allotments, calls, transfers and redemptions for approval. The administrative system finally decides the issues and hands down approvals and sanctions.

(ii) The capital issue subsystem operates within the bounds of legal requirements and restrictions prescribed by the legislative bodies, law courts and Board of Trade.

(iii) Prospectuses, application forms, letters of allotment/regret,

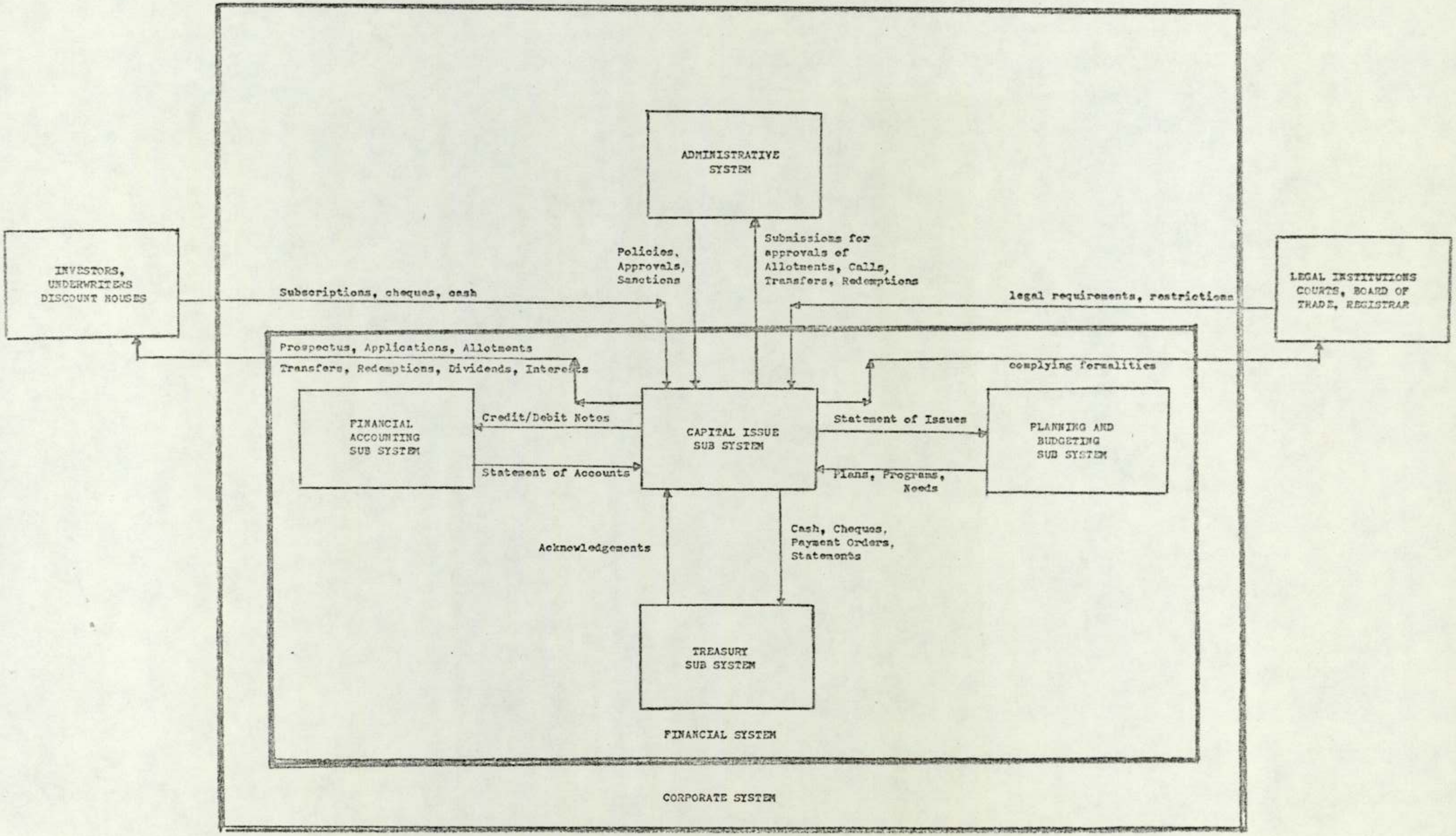

FIGURE 2.2 CAPITAL ISSUE SUB SYSTEM

calls, transfers, redemptions, forfeitures, subscriptions, dividends and interests pass between the capital issue subsystem and investors and lending institutions.

(iv) As among the subsystems of finance, the capital issue subsystem is interdependent with financial accounting, treasury, and financial planning and budgeting subsystems. Plans, programs, needs and requirements, statements of issues/accounts, debit/credit notes, cash, cheques, payment orders, and acknowledgements pass among them.

2.4.2. Capital Budgeting Subsystem

The capital budgeting subsystem, at the centre, in relation to other subsystems of finance and systems in a firm is shown in Figure 2.3. We observe in 2.3 that:

(i) The capital budgeting subsystem has no direct contacts with systems outside a firm. It is self-contained in a firm.

(ii) The administrative system hands down policies, objectives and premises to the capital budgeting system which, basing on them, prepares and submits appraisals and evaluations for decision and approval.

(iii) The capital budgeting subsystem interacts with all other systems requiring capital assets but chiefly with production system. This interaction involves the flow of information requests, purchase/construction requisitions and orders, needs, performance data, costs and delivery/completion specifications between them.

(iv) The capital budgeting subsystem passes information requests, orders, prices, costs and delivery/completion specifications to the procurement, a subsystem of production.

(v) Among the subsystems of finance, it has relations with financial planning and budgeting, treasury, cost accounting and financial accounting

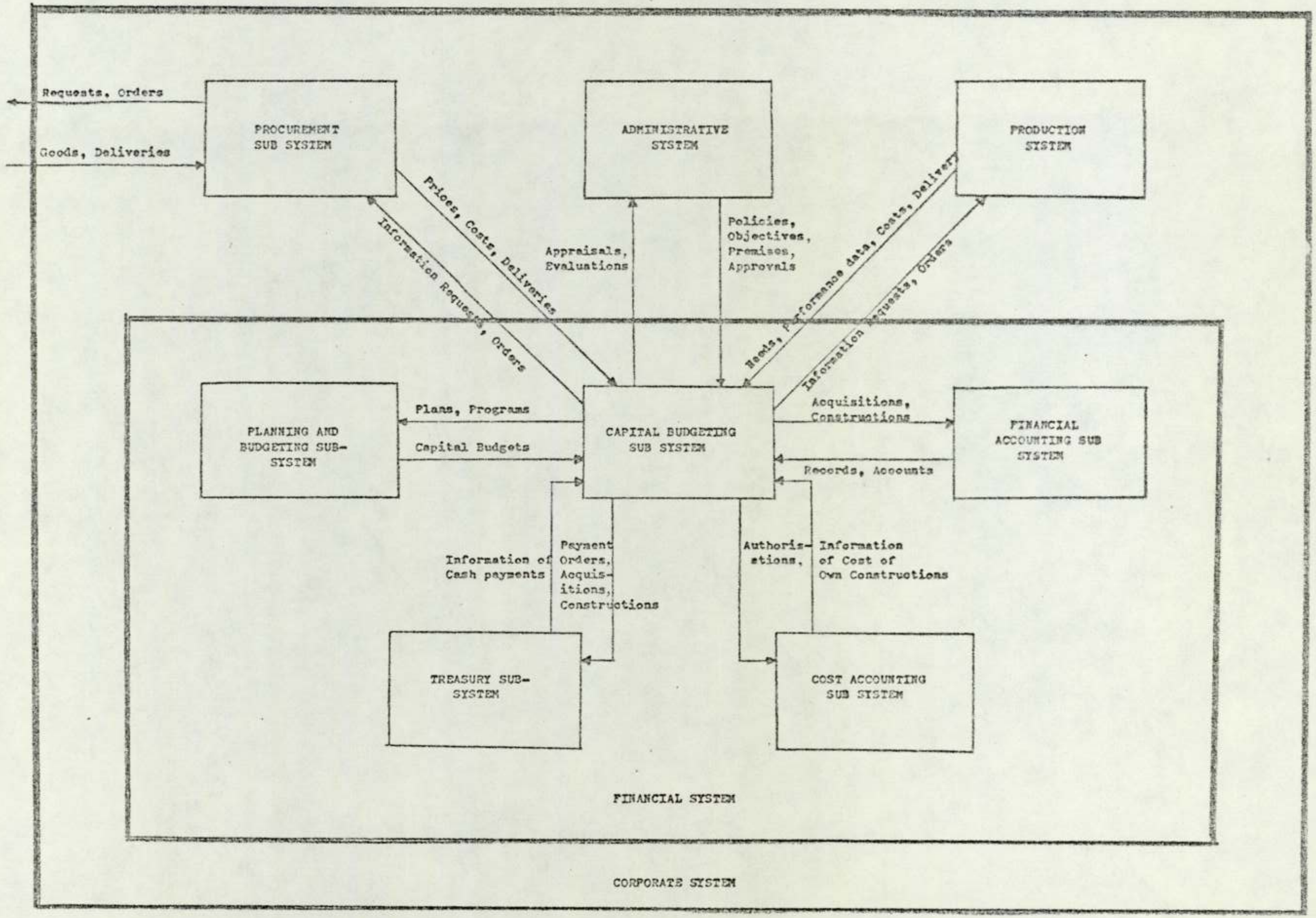

FIGURE 2.3 CAPITAL BUDGETING SUB-SYSTEM

subsystems. Information such as plans, programs, capital budgets, payment intimations , payment orders for acquisitions and constructions, authorisations, statement of costs of own constructions, and accounts flow among them.

2.4.3. Financial Planning and Budgeting Subsystem

Financial planning and budgeting subsystem, where in our interests focus, is shown in Figure 2.4, in its relation to other subsystems of finance, other systems in a firm and the environment. A study of 2.4 reveals that:

(i) The administrative system issues objectives, policies and premises to the financial planning and budgeting (hereafter abbreviated P & B) subsystem which submits plans, programs and budgets for approval.

(ii) The P & B subsystem interacts with other systems in a firm. Information as to needs technical standards and quotas flow to and plans, programs and budgets flow out from P & B subsystem.

(iii) The P & B subsystem detects, absorbs, monitors and adapts to the changes in the environment. Since the plans, programs and budgets represent a firm's operations, the P & B subsystem comes into contact with practically all the systems with which a firm interacts.

(iv) The P & B subsystem has relations with all other subsystems of finance. Information of needs, plans, programs, statement of issues, cash budgets and comparisons, cash requirement statements, capital budgets, cost standards, price standards, actual costs and prices, actual performances and comparisons with budgets pass among them.

2.4.4 Financial Accounting Subsystems

The financial accounting subsystem in relation to other subsystems of

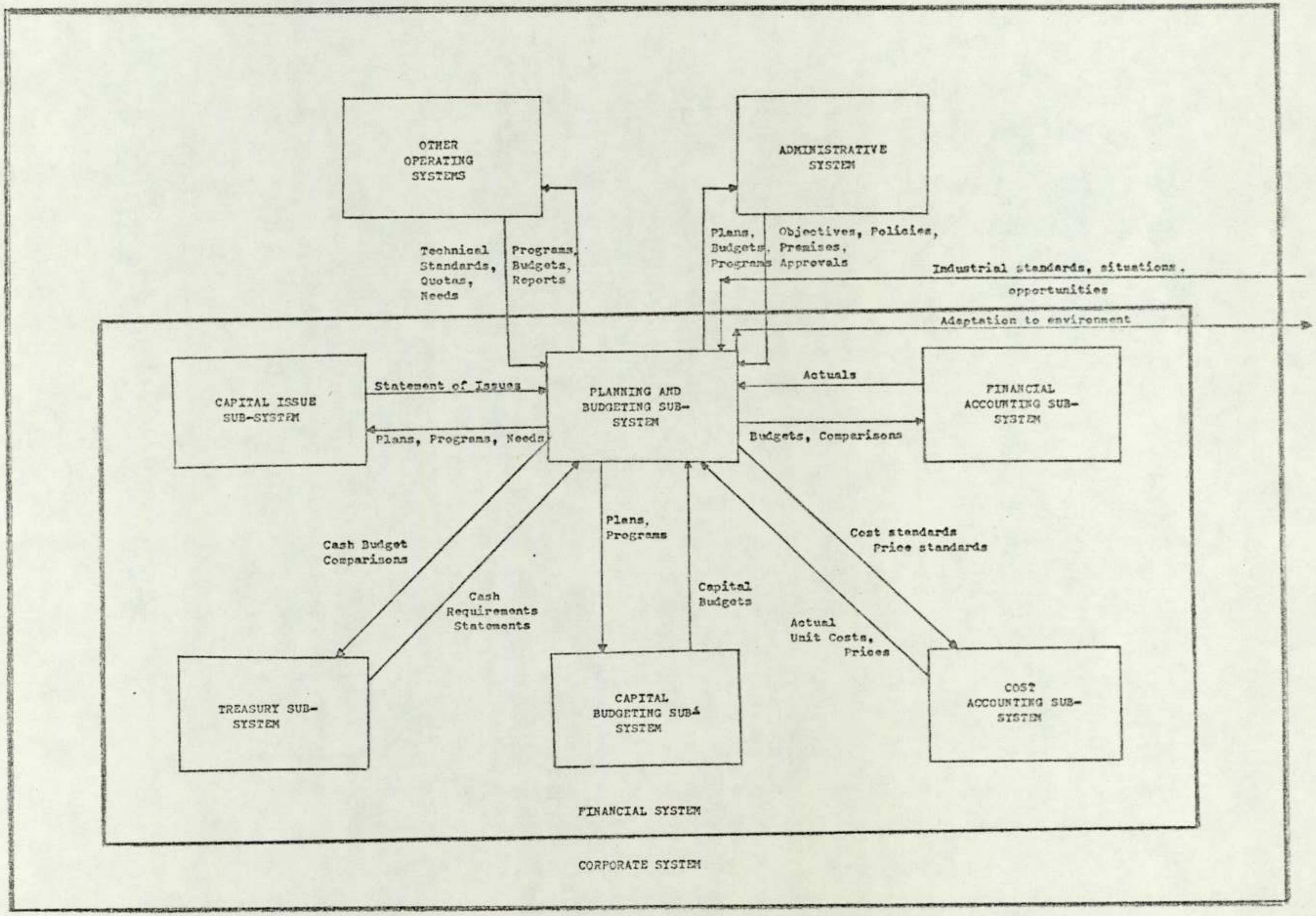

FIGURE 2.4 FINANCIAL PLANNING & BUDGETING SUBSYSTEM

finance, systems in a firm and the environment is shown in Figure 2.5. We observe in 2.5 that:

(i) The administrative system issues accounts guides and policies, and authorisations in respect of the reports and submissions for approval from the financial accounting subsystem.

(ii) Information relating to all events and transactions of the other systems in a firm are passed to the financial accounting subsystem which records them and reports and appraisals of them are prepared and sent to other systems from time to time.

(iii) The financial accounting subsystem prepares and circulates the annual accounts and report to the investors and members who are entitled to them under the statutes.

(iv) The financial accounting subsystem operates within the confines of statutes and legislatures. It has to file the reports and returns to government agencies and trade associations.

(v) It is interdependent with all other subsystems of finance. The financial aspects of transactions which fall under the perview of the latter are notified to it. The financial accounting subsystem renders statements of accounts.

2.4.5. Treasury Subsystem

The treasury subsystem's interrelations with other subsystems of finance, the systems in and outside a firm in the environment is shown in Figure 2.6. We observe that:

(i) The administrative system lays down rules, regulations and policies in relation to the receiving and disbursement of finances for the treasury subsystem which reports to the former for orders and authorisations.

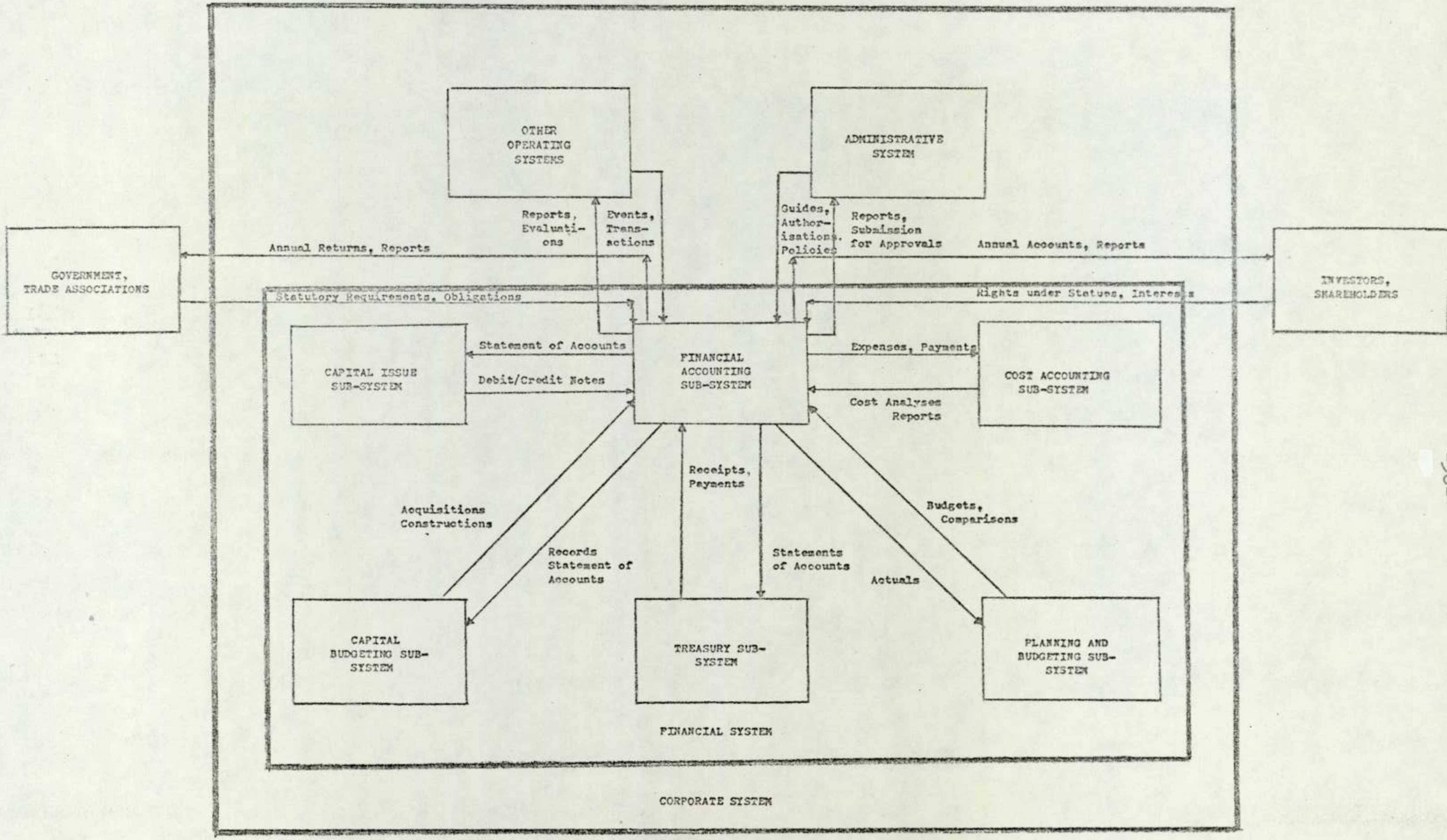

FIGURE 2.5 FINANCIAL ACCOUNTING SUB-SYSTEM

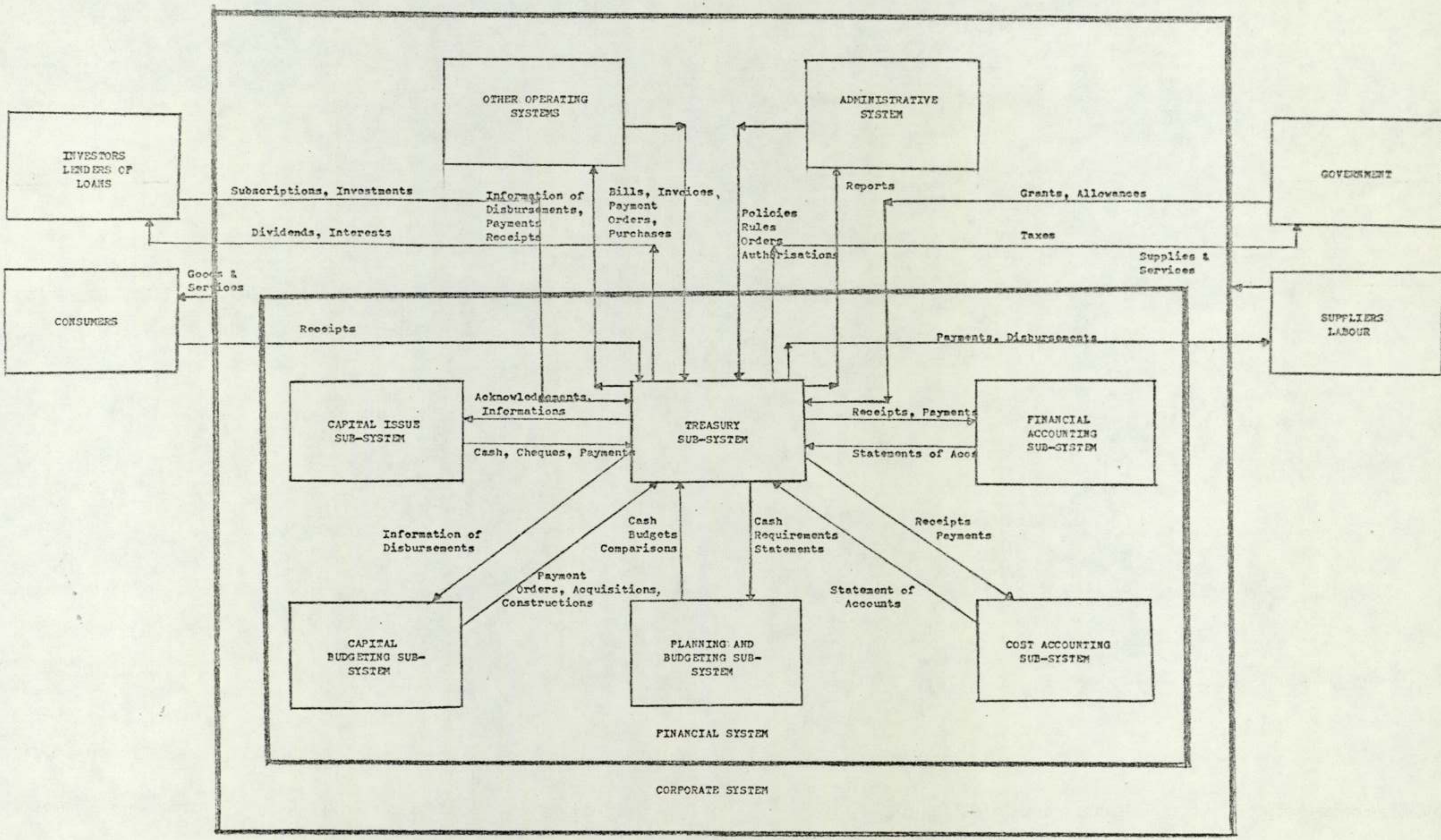

FIGURE 2.6 TREASURY SUB-SYSTEM

(ii) All systems in a firm forwards the bills, invoices and payment orders to the treasury which acts on them and renders intimation of receipts, payments and disbursements to other systems.

(iii) The treasury subsystem receives subscriptions for shares and loans and pays out dividends and interests to investers and lenders.

(iv) The treasury subsystem makes payments and disbursements to suppliers and workers for services rendered to a firm.

(v) The treasury subsystem receives from consumers payments for goods and services rendered to them.

(vi) The treasury receives grants and allowances and pays out duties and taxes to government agencies.

(vii) There are also interrelations with other subsystems of finance. Material, energy and information in the form of cash, cheques, acknowledgements, intimations, payment orders, acquisitions, constructions, budgets, budget comparison statements and statements of accounts flow between the treasury subsystem and others within finance.

2.4.6. Cost Accounting Subsystem

The cost accounting subsystem in relation to other subsystems of finance and the systems in and outside a firm is shown in Figure 2.7. A study of 2.7 reveals that:

(i) The administrative system issues policies, premises and instructions according to which the cost accounting subsystem monitors the operations of a firm and reports to the former by submitting cost analyses.

(ii) Other systems of the firm give information relating to their transactions to cost accounting subsystem which feeds back cost analyses, reports and appraisals for guidance and corrective actions.

(iii) The cost accounting subsystem conforms to and complies with the

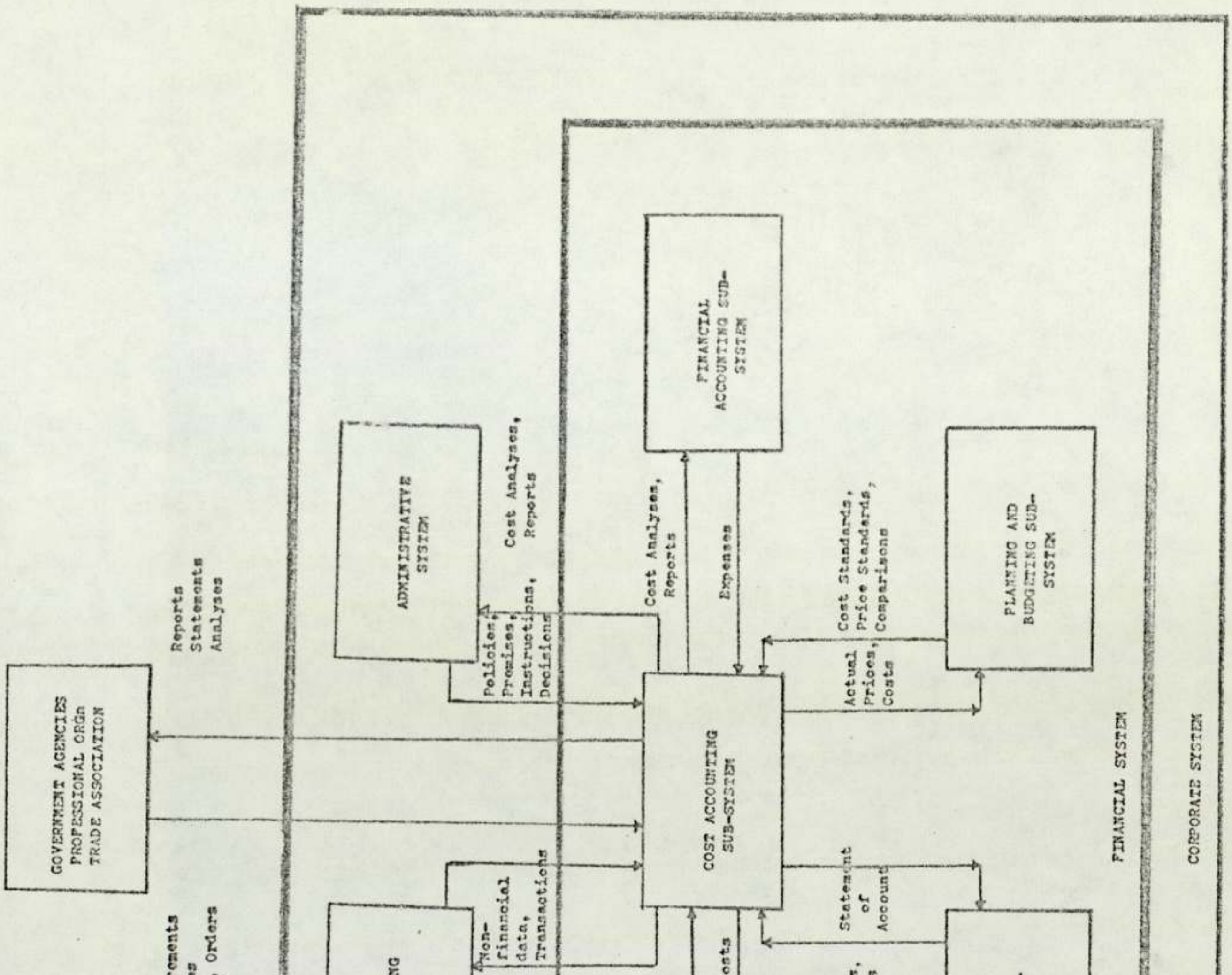

FIGURE 2.7 COST ACCOUNTING SUB-SYSTEM

rules, orders, guides and queries made by the government agencies, trade associations and professional institutions by feedback of reports, statements and cost analyses.

(iv) It interacts with capital budgeting, treasury, financial planning and budgeting, and financial accounting subsystems within finance. Authorisations, intimation of costs, prices, receipts and payments, statements of accounts, cost and price standards, comparison statements and cost analyses interchange between cost accounting and other subsystems within finance.

2.5. SUMMARY

A wide range of phenomena is reckoned as systems. A system is a set of interrelated elements or an entity, conceptual or physical, consisting of interdependent parts. The systems approach to a problem involves the complete and exhaustive examination of all elements and their relations with a view to optimising the overall performance of the entire system. This approach crosses all boundaries and widens the outlook of the problem solver.

The financial planning and budgeting process is a subsystem of the financial system of a firm. The financial system is one of the systems in a firm. When we climb up the hierarchy of systems, the firm is one of the systems in the environment. We map out the interrelations of a firm in the wider system of an economy, the systems in a firm and the subsystems of finance since the study of a system in isolation is not in the traditions of systems approach.

CHAPTER 3

FINANCIAL PLANNING AND BUDGETING SUBSYSTEM

3.1 INTRODUCTION

In the previous chapter, we looked at a firm as a system within the wider contexts of an industry and economy comprising the government, investors, lending institutions, resource markets and product markets. We then come to look at the major systems in a firm viz. administrative, personnel, production, financial and marketing systems resulting in a break-down of the systems into their subsystems. Our main interest is in financial planning and budgeting subsystem. As such we do not go into the details of systems other than the financial systems. We examine the interfaces of the subsystems of finance among themselves and with systems in and outside a firm. A logical step from this juncture is to study the financial planning and budgeting subsystem and this is the subject of the present chapter.

The words 'planning' and 'budgeting' connote certain shades of difference in meaning. They are often used synonymously. Financial planning and budgeting subsystems have been acclaimed and extolled by many as purporting to achieve numerous uses and benefits. They may be summarised as achieving planning, co-ordination and control over the operations of a firm. We can identify six elements in a financial planning and budgeting sub-systems viz. forecasting, planning, budgeting, performance register, control and library. Budgeting, contrary to what it suggests at least superficially, is not confined to finance personnel. It is carried out by all departments in a firm. We therefore find various sectional budgets being prepared in a firm.

3.2 PLANNING AND BUDGETING

The words 'planning' and 'budgeting' suggest some fine differences in meaning. We use 'planning' to be oriented towards 'operations' or 'actions' and 'longer-term' horizons in making plans. Budgeting is used to align more to 'financial' aspects and 'annual' in time dimension of preparing plans. Oxford English Dictionery defines:-

> "Plan, a scheme of action, project, design; the way in which it is proposed to carry out some proceeding"
>
> Plan, v. to devise, design (something to be done or some action, etc. to be carried out); to arrange beforehand" 1
>
> "Budget, A statement of the probable revenue and expenditure for the ensuing year, with financial proposals founded thereon, annually submitted by the Chancellor of the Exchequer for the approval of the House of Commons. Sometimes put for the condition of the national finances as thus disclosed; also for the financial measures proposed. Hence any analogous statement, estimate or proposals. Budget, v, to b. for: to provide for in the b."[2]

But these two words 'planning' and 'budgeting' are often used synonymously.

Myron Gordon and Gordon Shillinglaw, for example, writes:

1. C. T. Onions (Ed.) The Shorter Oxford English Dictionary, Oxford University Press, London, 1962. pp.1514-1515

2. Ibid; p.230

"Planning, in the common parlance of business, is the preparation of comprehensive operating and financial plans for the coming months, year or years. These plans, sometimes referred to as budgets, show expected production volume, purchases, sales, expenses, income, cash receipts and expenditures, and so forth, in detail by departments, divisions, and product lines and in total for the company all for a specified period into the future."[3]

3.3 OBJECTIVES

Many firms have different purposes or objectives of their financial planning and budgeting systems. The emphasis all depend on the needs and the resources available and willing to be devoted to the operation of these systems. But needless to say, firms in general strive to aim for as much benefits as possible under the given circumstances. The objectives, purposes or aims of budgeting systems are not difficult to uncover. A good text on management accounting or budgetary control would include a list of objectives or purposes. Given below are such lists extracted from publications on both sides of the Atlantic.

The Institute of Cost and Works Accountants (now The Institute of Cost and Management Accountants) in its research publication states:

"Budgetary Control is used for the following main purposes:-

a) to define the objective of the organisation as a whole;

b) to define the results to be achieved by departments and personnel thereof for the purpose of realising the organisational objective;

c) to reveal the extent by which actual results have exceeded or failed to reach the defined objective;

d) to measure the magnitude and establish the causes of the variations as a basis of executive action to correct adverse trends or secure benefits from advantageous conditions;

3. Myron J. Gordon and Gordon Shillinglaw, Accounting: A Management Approach, Richard D. Irwin Inc., Homewood, Illinois, 1964 p.529.

e) to secure the most economical use of the factors of production;

f) to provide a measure of the efficiency with which the activities of the organisation have been co-ordinated;

g) to provide a basis for future policy, and if desired, revision of current policy;

h) to facilitate centralised control in circumstances of decentralised activity;

i) to facilitate stabalisation of industrial or other activities in conditions subject to seasonal or other cyclical influences."

"Within the framework of main uses, a number of secondary uses can be defined. The most important are indicated below:-

a) to establish the conditions precedent to the establishment of Standard Costs;

b) to supply a basis of internal audit by regular examination of departmental results;

c) to provide a basis for forms of incentive remuneration related to the results expected in a period of time."[4]

J. Lewis Brown and Leslie R. Howard, both lecturers from England, say:

"Briefly, the main objectives of budgetary control are:

1. to combine the ideas of all levels of management in the preparation of the budget.

2. to co-ordinate all the activities of the business.

3. to centralise control.

4. to decentralise responsibility onto each manager involved.

5. to act as a guide for management decisions when unforseeable conditions affect the budget.

6. to plan and control income and expenditure so that maximum profitability is achieved.

4. I.C.W.A., An Introduction to Budgetary Control, Standard Costing, Material Control, and Production Control, Gee & Co. (Publishers) Ltd. London, 1950, p.19.

7. to direct capital expenditure in the most profitable direction.

8. to ensure that sufficient working capital is available for the efficient operation of the business.

9. to provide a yardstick against which actual results can be compared.

10. to show management where action is needed to remedy a situation."[5]

These are the objectives stated on this side of the Atlantic. We now look to the other side. A group of authorities, professors and certified public accountants in America, agree with the following reasons, given by functional areas, for budgeting:

"Planning

1. to base action upon thorough investigation, study, and research.

2. to enlist the assistance of the entire organization in determining the most profitable course.

3. to serve as a declaration of policies.

4. to define objectives.

5. to stabilize employment.

6. to make more effective use of physical equipment.

Co-ordination

1. to coordinate human effort within the business structure.

2. to relate the activities of the business to the general trend of economic conditions.

3. to direct capital and effort into the most profitable channels by means of a balanced and unified program.

5. J. Lewis Brown, Leslie R. Howard, Principles of Management Accountancy, MacDonald and Evans Ltd., London, 1966, p.167.

4. to reveal weaknesses in organisation.

Control

1. to control specific operations or expenditures.

2. to prevent waste."[6]

I. Wayne Keller and William L. Ferrara, say in their book, Management Accounting for Profit Control:

"The purpose of a budget is to provide:

1. A realistic estimate of income and costs for a period and of the financial position at the close of the period, defined by areas of management responsibility.

2. A co-ordinated plan of action which is designed to achieve the estimates reflected in the budget.

3. A comparison of actual results with those budgeted and an analysis and interpretation of deviations by areas of responsibility to indicate courses of corrective action and to lead to improvement in procedures in building future budgets.

4. A guide for management decisions in adjusting plans and objectives as uncontrollable conditions change.

5. A ready basis for making forecasts during the budget period to guide management in day-to-day decisions."[7]

The mere statement as objectives or purposes does not necessarily mean that a firm achieves them. But the fact that they have been aimed at to achieve means either some firms have reaped such benefits or a particular firm has all prospects of achieving them. Under such inferences, financial planning and budgeting systems seem to possess many good attributes. Firms using budgetary control systems appear infallable and foolproof against all adversities. But the actual scence is contrary to that. Budgeting and

6. Robert I. Dickey (Ed) Accountants' Cost Handbook, The Ronald Press Co., New York, p.20.9.

7. I. Wayne Keller, William L. Ferrara, Management Accounting for Profit Control, McGraw-Hill Book Company, New York 1966 p.389

financial planning systems often fail to achieve their purposes. We hope our study would enhance the knowledge/understanding of the financial planning and budgeting systems to improve their effectiveness.

3.4 STRUCTURE AND FUNCTIONS

A financial planning and budgeting subsystem could be analysed into six elements:

1) Forecasting
2) Planning
3) Budgeting
4) Perception (Performance register)
5) Feedback or reporting (control)
6) Memory (library)

The interaction of these elements with other subsystems of finance, systems in and out of a firm are shown in Figure 3.1.

3.4.1. Forecasting Element

A firm exists in the external environment and seeks harmony with the latter by developing appropriate strategies for responding to changes in the wider system. The changes in the environment are abrupt, rapid and dramatic. Moreover there are many firms in an industry. If a firm is not responsive to these changes, active firms will usurp its share. The unstationary states and the keen competition of the modern industry make it imperative for firms to look into the future. The success of a business depends on how reliable it could forecast the future as also on its abilities

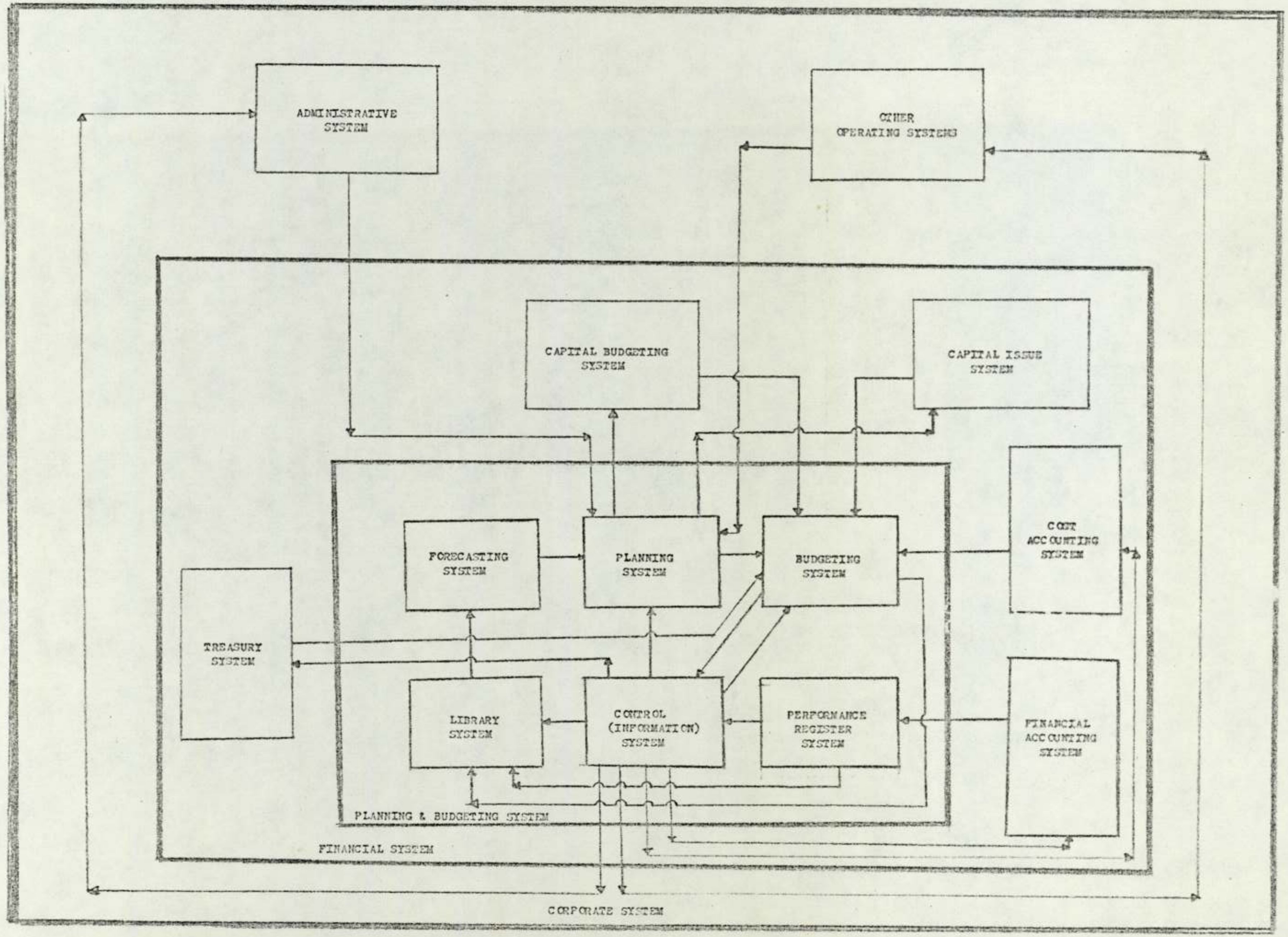

FIGURE 3.1 FINANCIAL AND BUDGETING SYSTEM ELEMENTS IN RELATION TO SYSTEMS AT HIGHER LEVELS

to cope with changes. Forecasting could be a forward looking or rear view type. It could encompass from rigorous assessments and appraisals of products, markets, resources, national and international economic states and political outlooks to simple extrapolations of past performances. The type, orientation and sophistication depends on the particular corporate characteristics in the growth spectrum. Corporations with single product market profiles organised on traditional functional lines may find adequate with simple extrapolations of historic sales data. Highly diversified corporations with autonomous product divisions or for that matter geographically decentralised ones, on the other hand, will have to adopt wider bases and take broader considerations in forecasting.

Forecasting as representing our best thinking about what will happen to us in thefuture precedes planning which is designing or scheming what we want to happen. Forecasting element collects external information from the environment. External information comprises population, age distribution, tastes, habits, customs, cultures, markets, a firm's shares, and national and international economic and political situations. The memory element feeds the forecasting element with internal information, which consists of past sales data by products, divisions, geographical locations, costs and prices, etc.

3.4.2. Planning Element

Business organisations are purposeful systems. We observe that every firm has aims, objectives and aspirations. There obviously are targets of profits, sales, production, inventory and cash holdings. Concurrently, a firm also has the means, though not unrestricted, of achieving its objectives. It possesses resources of capital, equipment, personnel, information and know how. Every firm has its peculiar strengths and weaknesses in its field of operations. We could also see that a firm is continually being led to a certain destination, be it desirable or otherwise by certain events and trends. The forecasts, in our opinion, indicate the states in which a firm is likely to be in, before giving effects to the active, deliberate actions on the part of a firm. Planning comes into play to match the prospects, means and aims. Planning is the conscious activity of designing, scheming and preparing actions/operations programs with aims, objectives, aspirations and resources available on one hand and the likely situation, circumstances and future prospects on the other, strenuously attempting to exploit a firm's strengths. Planning could be either defensive or offensive in a firm's attempts to survive in the future.

The administrative system communicates the aims, objectives and aspirations to the planning element. In addition, planning guidelines, assumptions, premises and policies are passed to the planning element from administrative system. The means a firm posseses, its strengths and weaknesses are informed to the planning element by the control element and other systems in the firm. The planning element prepares the operations plans on the basis of all the information it gathers as above and the forecasts received from forecasting element and pass them to budgeting element, capital budgeting and capital issue subsystems of finance.

3.4.3 Budgeting Element

The operations plans of sales, production, procurement, personnel, and other activities of a firm are translated into monetary values by this element. This is done to test the financial liquidity and profitability of various plans. The budgets also ensure that various programs are coherent by bringing them together in the master budgets. The planning-budgeting process enters an iterative loop and no plans which are unfavourable in monetary outcomes are adopted. We also observe the presence of control aspects in budgeting. The budgeting element uses standards (financial, physical and operations) in the translation process. These standards, provided they are appropriate and proper, act as motivators and yardsticks for assessment purposes. Besides the requirements in the operations plans are also related to the responsibilities of the persons in the organisation for control purposes. We also note that budgets are prescribed and adopted usually on yearly basis. i.e. of all the plans, short-term ones with planning horizons of one year are prescribed as budgets.

The budgeting element receives the operations plans from planning element. Capital acquisitions and/or construction programs are communicated in financial units from capital budget subsystem. We conceive that the budgeting activity consists of two aspects, capital and revenue operations. The revenue aspects are repetitive and requires flexibility to adapt to changes both internal and external. Capital budgeting is no doubt important but it is more of a one-off task. The plans relating to capital transactions, loans and borrowings are also processed by a distinct subsystem, capital issue, and communicated in monetary terms to the budgeting element. The cost accounting subsystem feeds financial and statistical data for setting standards. The budgeting element also receives actual performance evaluations from control element for use in revisions and updates. The completed budgets are passed to control element for monitoring and reporting.

3.4.4. Perception Element

This element detects and accepts the performance data. Performance data is the stimulus to the corrective machinery of a firm. The actual performance data, if it is to be of any use, needs to be identical in classification with those in the budgets. The perception element checks accuracy as well as the allocations to periods, functions and responsibilities. The intelligence or perception has to be timely for control effectiveness of a planning and budgeting subsystem.

Perception element collects physical and financial data from the financial accounting subsystem and passes them to reporting/control and memory/library elements after making requisite validity checks.

3.4.5. Control Element

We accept the need for the actual performance to be evaluated against the targets for effective control. The comparison, moreover, should pinpoint the areas where below target achievements prevail, their causes and also the responsible persons. It is important that the findings be communicated to all personnel concerned. Peter Drucker says that the right answer to an old riddle asked by the mystics of many religions, i.e. "Is there a sound in the forest if a tree crashes down and no one is around to hear it?" is "No".[8]

Communications take three forms: reports to systems in upper hierarchy about the state of affairs, feedback to planning and budgeting elements for any necessary actions in future plans and budgets, and instructions and directives to the acting systems for arresting the unfavourable pace of events and putting them under control. The control element has the heaviest traffic in communications and this is a significant factor to consider in assigning personnel. Perhaps it would not be out of place to quote simple

8. Peter F. Drucker, Information, Communications, and Understanding in Technology, Management and Society, Heinemann: London, 1970 p.4.

reminders for effective reporting.

"(i) The report should be clearly headed and the period covered shown. The unit, viz. cash, tons, quantity, gallons, etc, should be indicated.

(ii) Like must be compared with like, and there must be no misunderstanding between the Accountant and the recipient as to the nature of the figures.

(iii) Information not relevant to the purpose for which the Control Report is prepared should be omitted, so that conclusions from the report can be drawn quickly and with certainty.

(iv) The report should not attempt to portray so much information that clarity is lost. If the information to be conveyed is complicated, more than one statement may be desirable ...

(v) The names of the person preparing the statement and of the recipients should be given.

(vi) Simplicity should be aimed at and the use of technical ... terms avoided.

(vii) Adequate narrative should be provided and columnar presentation adopted ...

(viii) The information included should be limited to the sphere of the person to whom it is furnished ...

(ix) Promptness in the preparation of statements is to be preferred to excessive accuracy, as their purpose is not merely to convey information but to convey it promptly and to the person who has the necessary authority and responsibility to take appropriate corrective action.

(x) All returns (reports) should be reviewed periodically, to ensure that they are still useful and to ascertain whether they should be expanded, contracted or discontinued."[9]

The control element receives the budgets and performance data from budgeting and perception elements. These inputs are processed and appraisals, reviews and evaluations are reported to the administrative and other relevant systems as well as to cost and financial accounting subsystems. The planning and budgeting elements are also notified of the findings for consideration in the preparation of future plans and budgets and also inrevising

9. Walter W. Bigg, <u>Cost Accounts</u>, MacDonald & Evans, Ltd., London, 1972, p.285-286

the existing ones. Last not least the reports are also passed to the memory element.

3.4.6. Memory (library) Element

All physical entities and conceptual constructs requiring preservation need storage. Abstract ideas, knowledge, and information are no exception. They have to be preserved so that posterity could work and develop on them. Our cultural heritage owes largely to the national archives. The development and progress of human intellect is and will be a continuing stream of past-present-future process. The need for memory banks is beyond doubt and question. The advances made in computer technology in the field of storage devices have been a great assistance in this direction. These are reviewed in Chapter 5. Despite the advances in the storage media, we still need to adopt proper techniques re careful selection, indexing and purging of superseded and irrelevant materials for fast retrieval and effective use.

The memory element may appear to be the least important if judged from its interaction with other elements. This element receives budgets, performance data, evaluations and appraisals from budgeting, perception and control elements. The forecasting element which is a premier to the development of strategies, plans, and budgets draws heavily the historical data from memory.

3.5. PARTICIPANTS IN THE SUBSYSTEM

We would not have done a good job if we depart at this point and left the reader with the impression that planning and budgeting is entirely a finance function. We wish to emphasise that it is a subsystem wherein personnel from all the traditional functional departments participate and take active roles in its process. Moreover, it has gradually come to be accepted as a co-operative endeavour in view of the co-ordination and interlocking required in preparing a coherent plan/budget. This could be observed from a review of contemporary literature:

> "The preparation and administration of budgets is usually the ultimate responsibility of a Budget Committee, the Chairman of which is frequently the Chief Executive of the business. It is a common arrangement for the staff work of this committee to be carried out by a Budget Officer, who is normally a member of the accounting staff. After the Budget Committee has given a preliminary indication of the broad outline of the plan, the work of preparing each section of the Preliminary Budget normally involves collaboration between the Budget Officer and the person who will be responsible for controlling that section of the actual results."[10]

Broad and Carmichael also write:

> "To assist in the co-ordination, control and implementation of budgets, a budget committee may be formed. This usually meets under the chairmanship of the managing director, and may consist of the sales and works managers, the buyer, accountant, personnel manager, chief technician (e.g. designer, chemist) and to assist in implementation, the senior Trades Union Official." [11]

These are the views from this side of the Atlantic. They clearly indicate three points in relation to participants to financial planning and

10. I.C.W.A., op. cit. p.16.

11. H. W. Broad, K. S. Carmichael, A Guide to Management Accounting, H.F.L. (Publishers), Ltd., London, 1960, p.7.

budgeting tasks:

(i) Financial Planning and budgeting is not exclusively a finance function. It is carried out by all responsible personnel in every functional department.

(ii) It demands a concerted, co-operative effort under the supervision and administration of a committee.

(iii) It is an important task often requiring the attention of the managing director.

A quick look at prevailing practices in U.S.A. also shows the co-operative activity necessary in financial planning and budgeting.

> "In some companies, a budget committee composed of executives in charge of the major functions of the business may be found to be a useful device for co-ordinating and reviewing the budget program, particularly as related to general policies which affect the budget."12

3.6. TYPES OF BUDGETS

The type of budgets prepared for a firm, perhaps gives an indication of the involvement of various personnel in their preparation. We give below sectional budgets of a firm.

12. Robert I. Dickey, op. cit. p.20.16

"The policy of a business for a defined period represented by the Master Budget, is detailed in subsidiary Budgets of which the following are in common use:-

(a) Sales Budget.

(b) Production Budget.

(c) Plant Utilisation Budget.

(d) Production Cost Budget.

(e) Selling and Distribution Cost Budget.

(f) Capital Expenditure Budget.

(g) Development and Research Budget.

(h) Personnel Budget.

(i) Purchasing Budget.

(j) Cash Budget.

(k) Budget Summaries."[13]

"Dependent upon the activities of the business being the subjects of comprehensive sectional budgets, such as those heretofore specified, these budgets can be summarised to produce:-

(a) forecasted Profit and Loss Account;

(b) forecasted Profit and Loss Appropriation Account;

(c) forecasted Balance Sheet."[14]

13. I.C.W.A., op.cit. p.8.

14. I.C.W.A., op.cit. p.14.

3.7. SUMMARY

The word 'planning' attaches the 'operations' or 'action' character whereas 'budgeting' suggests the 'financial' aspects in devising and designing a scheme, program, or plan. The financial planning and budgeting systems have as their purposes: planning, co-ordinating and control over a firm's activities. The explicit statement of these aims and objectives implies that they have either been achieved by some or others can expect to achieve them. The financial planning and budgeting functions are carried out by all responsible personnel in a firm and is evident from the appearance of sectional budgets for purchasing, production, administration, selling, research and development, and capital acquisition and/or constructions. The basic elements in financial planning and budgeting subsystem irrespective of wherever and whoever carries them out are: forecasting, planning, budgeting, perception, control and memory.

CHAPTER 4

DEVELOPMENTS IN FINANCIAL PLANNING AND BUDGETING SYSTEMS

4.1. INTRODUCTION

The purpose of this chapter is to follow through the developments in budgeting and examine the prospects and implications of using computers in budget preparation. This begins with a brief survey of the usage, followed by an examination of the developments in the input, processing and output aspects of the budgeting and planning systems. This mode of review is in the traditions of systems approach and is hoped to bring insights into financial planning and budgeting functions. We will make an effort to differentiate between the principles, concepts, techniques and practices involved and also between the various contributions made by accountants, economists, mathematicians, operational researchers, systems analysts and behavioural scientists wherever is the case. However, in view of the approach undertaken, each of the above aspects i.e. input, processing and output, encompasses all and there is no neat, distinct segregation of either principles, concepts, etc., or contributions from various disciplines in the classical sense.

4.2. PRACTICE OF BUDGETING

Budgeting started around the turn of the century. It had its beginnings in the applications to managing the public affairs in the Government.

In the United States, the municipal reform movements made budgeting by state and local government.[1] Budgeting spread to the business sector in the 1920s, picking up substantially in the 1940s and expanding rapidly in the 1950s. National Industrial Conference Board conducted a survey among 294 companies in 1931 and found 55 per cent had budgets of some kind.[2] Then in 1958, a mail questionnaire survey found that 89 per cent of 389 companies operated with a formal budget program. The same study, in an interview of 35 companies found that all of them use budgets.[3] As to this side of the Atlantic, a study of 30 representative British firms in 1958-59 found that 19 of the 30 companies (63 per cent) use complete systems of operating budgets for all income, costs and expense; while three make limited use of such budgets for sales,costs or overheads. Budget programs had been found to be introduced only since the end of Second World War in 17 of the companies then using those budgets.[4] Though the companies included in the above studies were not taken randomly but selected from those representing well managed ones, it seems reasonable to assume that most of the companies would be operating budgets of one kind or another in the 1970s.

1. Frederick A. Cleveland, Chapters on Municipal Administration and Accounting, Longmans Green & Co., New York, 1909, p.72.

2. Budgetary Control in Manufacturing Industry, National Industrial Conference Board, New York, 1931, p.17.

3. Burnard H. Sord and Glenn A. Welsch, Business Budgeting, Controllership Foundation, New York, 1958, p.367-368.

4. J. R. Perrin, Budgetary Planning and Control in Britain. International Executive, Vol. 1. Fall 1959, p.25.

4.3 INPUTS TO THE BUDGETING SYSTEM

There is a well known and generally accepted computer acronym among systems analysts; G.I.G.O. - Garbage In and Garbage Out-in designing systems and preparing computer programs. This concept, we feel, is also applicable to the financial planning and budgeting systems. It is imperative that all the inputs to a system be recognised, identified and their qualities refined.

The inputs to a financial planning and budgeting systems have been studied by various academics and practioners, accountants, economists, psychologists, etc., all within the narrow confines of their respective disciplines. The situation may somewhat be likened to an old fable by Kipling of the five blind men's conceptions of the various parts of an elephant. This is not to blame the various parties. All we wish to emphasise is there is a growing need for a coherent, integrated systems study. In this connection, Tricker's warning "we specialise more and more about less and less until we know everything about nothing."[5] is to be noted.

The inputs to a planning and budgeting system at a high level of generalisation are materials, information and energy. This is too general and lacks content. We are adopting this as a general structure to give us a broad guide and the contents under each are specified and examined in depth as we proceed.

4.3.1. Material Inputs

The specifics under materials include all equipments and material aids to preparation of plans and budgets ranging from early abacus to the

5. P. I. Tricker, The Accountant in Management, B. T. Batsford, Lon, 1967, p.

most up to date fourth generation electronic computers. In chronological order, they are abacus, manually operated calculators, accounting machines, unit record equipments (punch card machines) and the sequential generations of electronic computers. The history of developments dates back to about 150 years. There are many good accounts of this progresselsewhere.[6] Within the contexts of our study, we would confine ourselves to the computers. This is covered in Chapter 5.

4.3.2. Information Inputs

The financial planning and budgeting system is an element of the Management Information System (MIS) of a company. As such, the information inputs assume not only the major but also the most important inputs to the planning and budgeting system. Under this category comes the budget principles, concepts and philosophy, objectives and goals, premises and assumptions and external (environmental and competitive) and internal (a firm's current and historic data) information.

4.3.2. (i) Principles, Concepts and Philosophy

The principles, concepts and philosophies govern the entire operation of a system: input, processing and output. Since they are the starting point, we are reviewing them under the inputs. The philosophy of budgeting at the beginning was control. The early governmental budgets were used as an instrument of control. They were imposed upon the officers and provided four types of control - limit, restraint, clerical and communicative. These

6. See for example, S. H. Hollingdale and G. C. Tootill, Electronic Computers, Penguin England, 1965 chapters 2 and 3, pp. 15-63.
James A. Saxon and Wesley W. Steyer, Basic Principles of Data Processing, 2nd ed., Prentice Hall, Inc., Englewood Cliffs, New Jersey 1967 Chapter 3. pp.36-86.

early budgets were authorisations to spend. They set an upper limit and when that was reached the money was stopped. The upper limit was imposed through the approval of the budget by the governing body - the board, the council, the legislature, etc. The second type of control was 'restraint' control. All payments had to be approved by the chief financial officer who checked and ensured that 1) there is a provision in the budget for such an expenditure; 2) there remains sufficient funds to meet such claims and 3) the necessary documents are presented. The elaborate records required to be kept to ascertain the balance gave rise to the third type of 'clerical' control. The preparation and distribution of interim reports to departmental heads provided the communicative type of control. The early business budgeting philosophy was also control as could be observed from the statement: "During the early and middle 1930s, it became fashionable to speak of budgetary control and to view the budget as both 1) a financial plan and 2) a control over future operations."[7] The philosophy of budgeting was gradually extended to planning for control. This could be observed from extensive literature on budgeting out of which we produced the following two:

> "In all budget planning there is an inescapably ambiguous element. The essence of such planning is an effort to control the firm's future. This implies that the budget sets goals which are expected to be achieved by the means which are spelled out in the document. The corollary is that every effort will be made to adhere to the plan as cast." [8]

"Control cannot properly be separated from planning. Unless you know

7. Eric Kohler, A Dictionary for Accountants, Prentice-Hall, Inc., Englewood Cliffs,NJ., 1957. p.75.

8. Neil W. Chamberlain, The Firm Micro-Economic Planning and Action. McGraw Hill Book Co. Inc., New York, 1962, p.82.

where you want to go, you cannot say how far you have strayed from your path."[9]

But this underlying philosophy of budgeting - planning and control - has been challenged by Morris. He says "today the concept of budgetary control is no longer a viable proposition. The majority of budgetary control systems are attempting to perform two different functions: the functions of forward planning and of control. The information contained in a budgetary control system for planning purposes is not necessarily compatible with the information required for control purposes."[10] He puts forward his arguments relative to the three elements of control:

(i) setting targets at the appropriate level to achieve the required performance,

(ii) measuring actual performance and comparing this with target, and

(iii) taking corrective action in the event of actual results deviating from target results.

Relative to target setting, he argues that budget for planning is a statement of the most likely outcome of events and in some circumstances they may be conservative, i.e., adopted on the assumption that expected improvements in efficiency will not at all be attained and there will be a falling of in achievement in some areas. On the other hand, since target setting for control must be based on some theory of human motivation, he says with reference to Stedry,[11] that tight targets may lead to high lev-

9. Professor H. C. Edey, The Principles and Aims of Budgetary Control, The Accountant, Vol. 156, No. 4824, June 3rd, 1967, p.727.

10. R. D. F. Morris, Budgetary Control is Obsolete, The Accountant, Vol. 58 No. 4874, May 18th, 1968, p.654.

11. Andrew C. Stedry, Budgetary Control & Cost Behaviour, Prentice Hall 1960.

els of performance on the theory that individuals will try hardest if the targets which they are to attain is very difficult.

As regards measurement of performance, he casts a doubt that numerical targets in budgets, very often expressed in financial terms, are of great use for control as much accounting is based on conventions and is far from certain that all managers understand the implications of these. He goes further and states Argyris's[12] suggestion that variances (thrown out by measurement of performance and comparison with targets) are not found to be very useful for control purposes. He cites the comments of factory supervisors in Argyris study.

> "let's say the budget tells me where I was off. I didn't make it. That's of interest. But it doesn't tell me the important thing of why I didn't make it or how I am going to make it next time. Oh sure, they might say all I need to do is increase production and cut out waste. Well, I know that. The question is how to do it?"12

Relative to taking of corrective action, Morris says that "corrective action is a futuristic concept. Action cannot be taken to alter what has happened in the past, it can only be concerned with what is to happen in the future." He therefore advocates that "corrective action with budgets is a matter of revising targets. There is no reason to believe that targets set originally and considered at that time to be most appropriate will continue to be the best after the passage of even a short period of time. The situation needs re-examination in the light of what has happened in this period.

We find no reasons to disagree with Morris. But we are of the opinion

12. Chris Argyris, The Impact of Budgets on People, Controllership Foundation, New York, 1952.

that what he is saying falls within the purview of techniques and practices. The concept of budgeting, planning for control is intact and still there. Moreover he deals with a single aspect of budgetary control - setting of targets or standards. And so far as the necessity of revising the targets, mentioned relative to corrective action, is concerned the revising of budgets has been in vogue some time ago. Sizer in reacting to Morris in what appears to be a rejection of the latter, also is in agreement with a large part, i.e. the practice of seperate budgets for planning and control.[13] The changes in techniques and practices taking place day to day, on the other hand, are only natural and not unexpected. Budgeting started with 'static' or 'fixed' budgets, then the practice of revising ('revised' budgets) and flexing ('flexible' budgets) came into use, and rolling budgets have also been evolved out of practice. These practices are dealt with under processing.

The other concept in the budgeting philosophy formed out of practice is co-ordination. To comprehend this concept, one must realise that budgeting is not just an accountant's exercise. It embraces the setting of goals and objectives, forecasting the future, making assumptions and premises and drawing up operations programmes. It requires participation by everyone (line and staff) in the organisation. What appear in the budgets is the financial expression of those means and ends. In the process of casting the operation's plans for attainment of the organisation's goals and objectives, all the functional, sectional and organisational programmes have to be integrated into a coherent whole. This consolidation process brought in the

13. John Sizer, Budgetary Control is Not Obsolete, The Accountant, Vol. 159 No. 4894, October 5th 1968. pp. 443-446.

concept of co-ordination since all the inter-departmental, inter-functional plans have to be assimilated and made to fit together. The concept of co-ordination is deep rooted in budgeting philosophy as is evident from the rampant use of such terms as 'governing','limiting' or 'principal budget' factor.[14] We conclude on this budgeting philosophy with a quote from Chamberlain:

> "The development of the budgeting procedure in business has necessitated the development of an accompanying philosophy, which is sometimes included and explicitly labelled as such in budget documents. That philosophy emphasizes three characteristics of good budgeting practice: (1) the posing of specific goals, (2) the planning of specific paths to these goals, and (3) continuing attention to changes in the underlying assumptions which may suggest the desirability of modifying both ends and means and alertness to seize unexpected opportunities which were not foreseen at the time of budget preparation."15

<u>4.3.2. (ii) Goals and Objectives</u>

Goals and objectives are another type of information input brought into a planning and budgeting system. It is important to differentiate the two categories of goals and objectives. (1) organisational goals and objectives i.e., those of the firm, and (2) system goals and objectives, i.e. objectives of the planning and budgeting system.

The goals and objectives of firms vary and are many. They could encompass business, social, ethical and political objectives. At a lower level of generalisation, they may be specified as growth, establishment and/or

14. H. W. Broad and K. S. Carmichael, <u>A Guide to Management Accounting</u>. H. F. L. (Publishers) Ltd., London 1960 (Second Edition) write "all budgets are subject to certain limits, called in this book, the governing factors (frequently termed limiting factors or principal budget factors). Thus where 1,000 units of a product can be sold, but only 600 units can be manufactured, the governing factor is manufacturing capacity" (p.9) "The application of ...the governing factor will produce the net probability or level of attainment". (p.10).

15. Neil W. Chamberlain, op cit. p.83.

maintenance of reputation for quality, introduction of new products through industrial research, increased share of market, employee welfare, national security, prestige, etc. The objectives have dual dimensions - time and structure (organisational or functional). The space is limited to go into further details. Objectives form the building blocks of a firm's plans which are expressed numerically in financial terms and fed into the budgeting system.

The goals and objectives of a firm are set on certain assumptions, premises and policies. These, in turn, are established after consideration of external and internal information. Profits, although just one of multiple goals of a firm, are most often highlighted. We observe that profits are expressed as return on sales, on total assets (gross or net of depreciation), on net worth and shown in budgets.

Goals and objectives of planning and budgeting systems are also significant to the operation of the system. They have been dealt with at length on pp.43-46 of Chapter 3.

4.3.2. (iii) Premises and Assumptions

We would be discussing at length on the magnitude and complexity of internal and external information requirements in the following section. Depending on the proximity of the necessary information to a firm projections, estimates and forecasts are made for them to arrive at the assumptions and premises behind the operating plans or budgets. By this, we mean that projections are made in respect of general political, economic and business conditions for the nation as a whole, estimates made of the likely level of activity in the relevant industry, and forecasts are made of corporate activity to be input to the planning and budgeting system.

4.3.2. (iv) External and Internal Information

Both external and internal information are prerequisites to a system of planning and control by budgets. The posing of specific goals and formulating paths to those goals are effected after examining the markets in which a business is operating, the general state of the economy in the coming planning period and also of a firm's strengths and weaknesses. The environment and competitive situations have to be assessed to find the opportunities presented to the firm. The use of external and internal information in budgeting could, perhaps, be implied in the early budgets. In 1939 Scot said:

> "The term budgetary control is applied to the system of management control and accounting in which all operations are forecast and so far as possible planned ahead, and the actual results compared with forecast and planned ones." 16

The implication above is based on the premise that could or would any forecasting be done without information about the environment and also that could or would planning ahead ever be done without assessing one's means, strengths and weaknesses, i.e. internal information, in view of the forecasts.

We feel it scarcely needs emphasis that premises, assumptions, bases and standards which all go in as inputs to a planning and budgeting system are derived from the (external) information about the external systems, within which a firm is embedded and also from the (internal) information about the firm itself. Moreover, they affect the firm on all fronts, procurement (of material, labour, services, capital and entreprenuership), production

16. J. A. Scott, Budgetary Control and Standard Costs. Pitman, Lon, 1962

(transformation function), marketing and distribution.

We observe certain trends in information inputs during the progress of budgeting systems to the present state. They are: (1) tremendous expansion in volume and complexity of information required, (2) differences in relevance and importance of external and internal information relative to the managerial level in the hierarchical structure, (3) different characters of external and internal information, and (4) the need to continually detect and monitor information.

The growing volume and complexity of the information inputs to a budgeting system could be seen from the following:-

> "There was a time when the entrepreneur could, quite reasonably, visualise his business as a unit interacting with his customers. He hired labour, shopped around for supplies, installed plant and, provided he had the necessary know-how and capital, he was ready to trade with his market. The world about his business was a comparatively simple place. His awareness of the environment was sufficient to warn him of an alien factor which would cause him to change his plans.
>
> The business world now is vastly more complex and the counterpart of the old entrepreneur has an infinitely more difficult task. He acts under the impetus and constraints of numerous external forces. A fusillade of data is hurled at him from a multitude of sources which have developed within the last 20 years. Trade associations, government departments, research groups, commercial organisations, consultants, the business press, and experts and advisors of many kinds. From this barrage, he must salvage the information of value to him in making decisions in his specific situation."[17]

The magnitude and complexity of the information input could perhaps be appreciated from the following figure:

17. R. I. Tricker, op cit, p.138

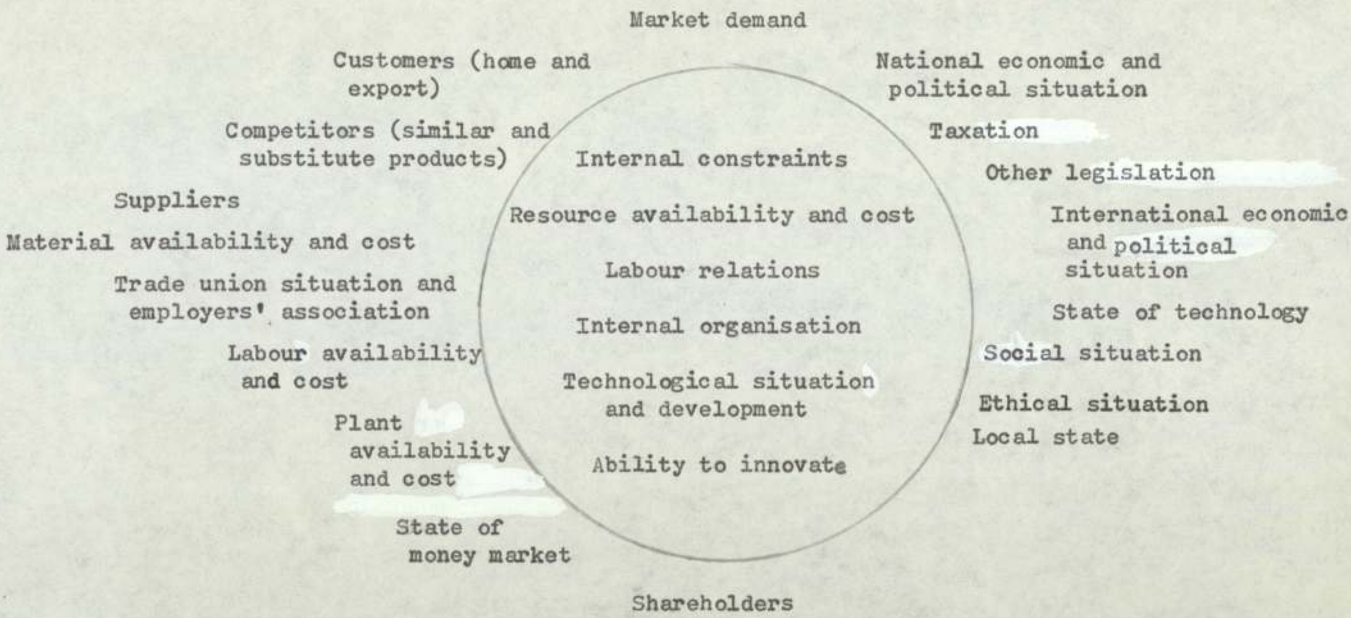

Fig. 4.1. External and Internal Information Needs

The second point we observe is that as the level of management ascends in the hierarchical structures, planning rather than control becomes more and more an executive's task with increasing need for external information. The internal information, on the other hand, is increasingly aggregated with top management receiving the most summarised reports. This observation may best be presented in a diagram.

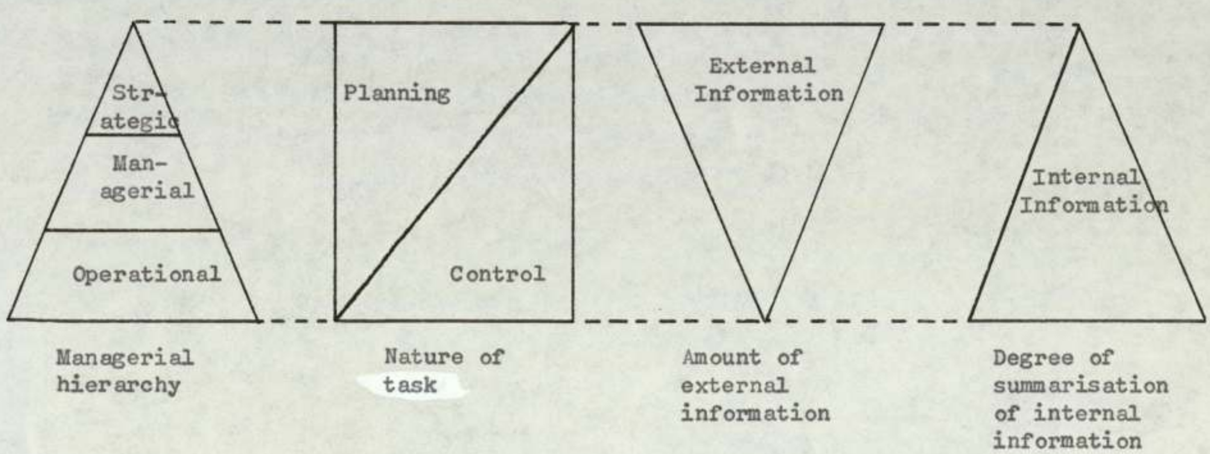

Fig. 4.2. Management Levels Related to Planning, Control and Information

The shifting emphasis from control to planning at higher levels of management could be inferred from Robert N. Anthony's classification and definition of tasks at each level.

> "Strategic Planning is the process of deciding on objectives of the organization, on changes in these objectives, on the resources used to attain these objectives, and on the policies that are to govern the acquisition, use, and disposition of these resources.
>
> Management control is the process by which managers assume that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives.
>
> Operational control is the process of assuring that specific tasks are carried out effectively and efficiently."[18]

The increasing relevance of external information to planning and internal information to control could also be observed from Nichols, who states "most internal data is control oriented and the lower echelons of management are the most control oriented." He goes on to say "the upper levels of management are more planning oriented and ... planning necessitates more information concerning the organization's external environment."[19] In this connection, Peter F. Drucker also states that there exists costs within a firm and executives should look outside the firm wherein lie the opportunities and profits.[20]

We also observe the difference in character of planning and control

18. Robert N. Anthony, Planning and Control Systems: A Framework for Analysis, Harvard, 1965.

19. Gerald E. Nichols, On the Nature of Management Information, Management Accounting. National Association of Accountants, New York, April, 1969,p.10

20. Peter F. Drucker, Managing for Results, William Hienemann, Ltd., London, 1964, p.4.

information. Planning information stresses the future and therefore is inexact, unstructured and not programmable. Control information is otherwise.[21]

The other point we observe is the growing awareness of the need to continually detect and collect environmental information. It is necessary that budgets are realistic under the situations if they are to be of any use for planning, co-ordination and control. The situation and condition in many cases change from those forecast and anticipated at the time of preparing the budgets. Under such circumstances, the budgets require revisions to flex and adapt to changed situations. The firms are aware that these revisions and adaptations could be carried out only by a continual detection of what is happening in the environment.

4.3.3. Energy Inputs

This category of inputs, like an ultimate repository, embraces all the aspirations, attitudes, styles, efforts, forces and the atmosphere that participants bring in to the financial planning and budgeting systems. We like to stress that they are not, like techniques, methods and practices, just recently introduced. They have been inputs to the planning and budgeting systems since the beginning. This does not also mean that there have not been changes. Behavioural scientists have identified and studied them. The quality of inputs have significant bearings on the results of the system. It would, therefore, be inevitable that our review includes effects

21. Jerome Kanter. Management Oriented Information Systems, Prentice Hall Inc., Englewood, Cliffs, N. J. 1967, p.11.

on the system.

4.3.3. (i) Level of Achievement/Standards

All budgets include proposed amount of accomplishment irrespective of whether or not they are accepted as goals by participants. If they are accepted as goals, the levels of achievement become the levels of aspirations.

Level of aspiration is a goal which, when just barely achieved, has associated with it subjective feelings of success; when not achieved, objective feelings of failure.[23] Child and Whiting concluded that:

> "1. Success generally leads to a raising of the level of aspiration, failure to a lowering.
>
> 2. The stronger the success, the greater is a probability of a rise in level of aspiration; the stronger the failure the greater is the probability of a lowering.
>
> 3. Shifts in level of aspiration are in part a function of changes in the subject's confidence in his ability to attain goals.
>
> 4. Failure is more likely than success to lead to withdrawal in the form of avoiding setting a level of aspiration.
>
> 5. Effects of failure on level of aspiration are more varied than those of success." 24

There is a correlation between levels of aspiration and performance. Higher levels of aspiration are followed by greater efforts. In this connection, Becker and Green say:

23. K. Levin, T. Dembo, L. Festinger, and Pauline Sears, "Level of Aspiration", in J. McV. Hunt (ed.), Personality and the Behaviour Disorders, Vol. 1, Ronald Press Co., New York, 1944, pp. 333-378.

24. J. L. Child, J. W. M. Whiting, "Determinants of Level of Aspiration: Evidence from Everyday Life", in H. Brand (ed.), The Study of Personality, John Wiley & Sons, Inc., New York, 1954, pp.145-148

"Maximum effort will be exerted to just reach an aspired-to goal. In fact, according to level of aspiration theory if, for example, five units of effort are required to reach goal x-3, ten units to reach goal x-2, fifteen units to reach goal x-1, and twenty-five units to reach goal x, the level of aspiration goal, an individual will expend the disproportionate amount of energy to achieve at level x to derive that subjective feeling of success." 25

It, therefore, appears that the higher the levels of achievement the better it is for the firm provided they 1. are accepted as goals and 2. are attainable because the backlash of failures could be detrimental.

We now look at the behavioural scientists' contributions as regards the functioning of the levels of achievement as motivating factors. Levels of achievement when used to measure performance become standards and are important as achievement motivators. This is so because it is well known that increased motivation leads to increased effort, a condition usually followed by an increase in performance. Stedry,[26] Stedry and Kay,[27] and Hofstede have done researches covering this area and we quote from one which not only is the most current but also confirms the conclusions of prior works.

Hofstede specifies:

"The fact that standards are set can have a very real meaning for a budgetee's achievement motivation. Need for achievement is a powerful motivator. In order for a standard to function as a standard for achievement it should be tight, so tight there is a real risk of its <u>not</u> being attained. ... On the other hand, it appears that standards which are so tight that they are seen as impossible destroy motivation."28

25. Selwyn W. Becker and David Green, Jr., <u>Budgeting and Employee Behavior</u>, The Journal of Business, Vol. 35, No.4, October 1962, pp. 392-402

26. A. C. Stedry, <u>Budget Control and Cost Behaviour</u>, Englewood Cliffs, N. J. Prentice-Hall, Inc., 1960.

27. A. C. Stedry and E. Kay, <u>The Effects of Goal Difficulty on Performance: A Field Experiment</u>, Sloan School of Management, M.I.T. Cambridge (Mass) 1964.

28. G. H. Hofstede, <u>"The Game of Budget Control"</u> Tavistock Publications Ltd., London, 1968, p.4.

"The level of standards appear to play a role in achievement motivation, apart from any other rewards or punishments connected to it.

The findings prove that:

- loose budgets are poor motivators,
- the motivating effect of budgets become stronger when they become tighter.
- over a certain limit of tightness, motivation is poor gain.
- this limit, and more in general the extent to and the way in which people internalize standards, depends on factors in the situation, in management and in the personalities of the budgetees."[29]

4.3.3. (ii) Participation

It was observed as early as 1930 that imposed budgets "resulted in some dissatisfaction" and participation was introduced at first by the advice "to prepare them (the budgets) in the departments and have them revised or edited in the central offices."[30] Unfortunately this persisted for some time because Argyris discovered such a thing as "pseudo-participation." That is, participation which looks like, but is not, real participation."[31] Participation, in real sense, is "a process of joint decision-making by two or more parties in which the decision have future effects on those making them."[32]

Participation was brought in to the budgeting process to draw together

29. Ibid, p.144.

30. National Industrial Conference Board, op. cit, p.52.

31. Chris Argyris, "The Impact of Budgets on People", Controllership Foundation, Inc., New York. 1952.

32. J. R. P. French, Jr., J. Israel, and D. As, "An Experiment on Participation in a Norwegian Factory", Human Relations, Vol. 13, p.3, 1960.

the knowledge diffused among the participants, promote acceptance of the standards, increase employee satisfaction, morale, motivation to produce and take initiative. The effects of participation have been studied by various psychologists and the results are rather mixed.

In a study by Coch and French,[33] the effects of prior participation on production after the introduction of work changes, were found to be that (i) the non-participation group (NP) reached a level of fifty units per hour, (ii) the participation by representation group (PR) sixty units per hour and (iii) the total participation group (TP) sixty eight units per hour, respectively after relearning, compared to a prechanged standard of sixty units per hour. It was also found that 17 per cent of the NP group quit their jobs in the first forty days after the change, and the remaining members of the group filed grievances about the piece rate which subsequently was found to be a little loose. There was one act of agression against the supervisor from the PR group, none from the TR group and no quits in either PR or TP groups. In another study by French, et al[34] the results indicated that the differences in attainments between participatively set and non-participatively set goals were neither significant nor necessarily in the hypothesised direction, i.e. participation would improve goal attainment. Moreover, it was found in Vroom's study[35] of the relation between participation and productivity, that where employees viewed participation as legit-

33. L. Coch and J.R.P. French, Jr.,"Overcoming Resistance to Change", Human Relations, Vol. 1. pp. 512-532, 1948.

34. J.R.P. French, Jr., E. Kay, and H. H. Meyer, A Study of Threat and Participation in a Performance Appraisal Situation, Gen.Elec.Co., N.Y. 1962.

35. V. H. Vroom, Some Personality Determinants of the Effects of Participation, Prentice-Hall, Inc., Englewood Cliffs, N. J. 1960.

imate, productivity was higher under participative supervision, but, where it was viewed as not legitimate (e.g. evidence of "softness", inability to make decisions), observed productivity was lower. The effects of participation also vary with other personality determinants. The authoritative type would not appreciate the opportunity to participate in making decisions whereas, "people with strong independence needs develop more positive attitudes toward their work and greater motivation for effective performance."[36] The act of participating leads to increased cohesiveness, which depending on the sentiment of the group, produces varying effects on productivity. The effects of participation are still inconclusive and "can lead to one of several outcomes:

(a) High cohesiveness with positive attitudes (goal acceptance), a condition of maximally efficient motivation;

(b) Low cohesiveness with positive attitudes are unlikely but possible conditions that probably would result in efficient performance;

(c) Low cohesiveness and negative attitudes, a condition resulting from unsuccessful participation that would tend to depress production within the limits of the integrety of conscience of each individual; and

(d) High cohesiveness and negative attitudes, the occurrence most conducive to production slow-down."[37]

36. Michael E. Wallace, Behavioural Considerations in Budgeting, Management Accounting, Vol. 47., No. 12, August, 1966, p.7.

37. Becker and Green, op cit, p.399

4.3.3. (iii) Type of Participants

One other important input to the budgeting system is the type of personnel involved in operating the system. Different persons react in different ways to the budgeting system. The reactions of authoritarians and people with independence needs to participation in budgeting have been referred to in the previous section. Age, education, length of service at present position, mental disposition to work (Theory 'x', 'y' in McGregor's term), and cultural background of personnel are, not surprisingly, important to a budgeting system. Hofstede reports that young age and short length of service in present position have preference for use of figures. Also relating to tight standards (whether a person is challenged or discouraged or whether he expects improvements), he suggests "older people tend to report more pressure." "The job rotation (for short time in the present job), ..., which also stands for 'younger people', represents a situation where there is more expectation of improvement, more ready knowledge of figures about performance and standards, and a high correlation between own subjective evaluation of performance and budget variance."[38] However, we wish to state that short lengths of service or rotation would not allow time to build up the experience to do the job in a different way and older people would be more disposed to further aspiration levels on failure of previous ones.

The educational background obviously helps to effective budgeting and Dew and Gee, in the study of the use of budget information, suggests training

38. Hofstede, op cit, p.275.

as one of the measures for effective budgeting.[39]

4.3.3. (iv) Leadership Styles

The styles leaders bring in to the budgeting system have significant inpacts on the motivation of budgetees to fulfill the budgets. It might at first appear that the impacts have more to do with control rather than with aspects of planning. But we felt that impacts on planning are significant in view of its effects on the subsequent cycle of planning following the control over the current period.

We will consider three behaviour patterns of superiors: viz. personal contacts, feedback of performance information and group meetings. Hofstede finds that frequent person to person contacts by the superior increase budget motivation of employees by making the latter see the superior as cost conscious. But he also notes that "it also tends to have some negative affects: high pressure and an indication of a lower job satisfaction. This does not mean that budget attitudes are negative: ... there is no relationship between job satisfaction or pressure and budget attitude."[40] Regarding communication of results, there have been findings that morale, motivation and hence performance is adversely affected by lack of feedback. Within budgeting constructs, Doris M. Cooke finds that "the interest and satisfaction of the participants was directly related to the frequency of feedback" and also that "the degree of success or failure in

39. R.B.Dew & K. P. Gee, Management Control and Information, The MacMillan Press, Ltd., London and Basingstoke, 1973.

40. G. H. Hofstede, op cit, p.252

performance was directly related to the frequency of feedback."[41]

The superiors' meetings with participants in relation to budgets have been reported to be useful, but not indispensable except where subordinates influence results collectively. Hofstede shows "that interviewees who have an experience of successful meetings with their boss are different in a number of respects from those who miss this experience:

1. They have more frequent contact with their boss about budgetary results and see their boss as more cost-conscious.

2. They participate more in the setting of their budget, they think their department's special problems are sufficiently taken account of in budget setting, and they feel they cannot work without standards.

3. They evaluate their own department's performance more in terms of budget results (...); they think their department is not running efficiently enough, and they expect more improvement in the performance of their department.

4. They have better communications with the budget and standards staff departments and feel less dominated by the staff.

5. Finally, they appear to have a more positive attitude to life in

41. Doris M. Cook, The Effect of Frequency of Feedback on Attitudes and Performance, Empirical Research in Accounting: Selected Studies, 1967, Supplement to Vol.5 of Journal 1967, p.218 of Accounting Res, Un.of Chicago, Illinois.

general."[42]

4.3.3. (v) Contributions by Finance and Staff Personnel

The technical and personal contributions made by finance and standards men constitute important inputs to a budget system. They are valueable but nevertheless the following should be noted and acted upon where necessary:

1. The nature of finance mens' work is such that "the success of the finance men derives from finding errors, weaknesses, and faults that exist in the plant." They implicitly place the line in failure by singling out a guilty party on discovery of such conditions.

2. The way the finance man report the line's shortcomings through the superiors causes negative feelings on the part of the line, "not only of being wrong but also of knowing that his superiors know it." This way of reporting is so because "the finance man achieves his success when his boss knows he is finding errors."

3. "The realization of the peculiar position in which they (the finance people) are placed leads budget people to become defensive about their work." "So they react negatively to queries about their methods, their language, their books. Sometimes they even use their technical know-how and jargon to confuse the factory people."[43]

42. G. H. Hofstede, op. cit., p.261-262

43. Chris Argyris, Human Problems with Budgets, Harvard Business Review, Vol. 31, No. 1, January-February, 1953, pp.108-110

Perhaps we might assume that the finance men have changed to some extent, possibly because of continual criticisms as above, for Hofstede says "staff people tend to assume more of a spectator role."[44]

4. Some finance men are 'figure conscious', narrow-minded and rigid. Typical criticisms of accountants by factory people quoted in Chris Argyris' study are:

> "Most of our accountants are narrow and short-sighted. They have a narrow breadth of view. They are what I call 'shiny pants book-keepers'. They're technicians. They don't know how to handle people"
>
> "I might add, right here and now, that I think one of the worst human problems we have is the poor job of 'setting' that is done with cost records and budgetary control. I think our accounting people are very, very poor in ability to get along with people and to sell them correctly. In fact, I'd go as far as to say that the better the accountant, the poorer he is in human relations. I feel quite strongly about this."[45]

Some are very pre-occupied with behavioural aspects and say that the contributions by staff "appear to have more negative than positive potential: the staff departments can easily have a negative impact upon the functioning of a budget system, but their possibilities for positively influencing motivation are limited."[46]

44. G. H. Hofstede, op. cit, p.5.
45. Chris Argyris, op. cit, p.117.
46. G. H. Hofstede; op. cit, p.4-5.

4.4. PROCESSING

Developments have taken place in many directions under processing of budgets. We observe that the procedure of preparing the budgets become quite established and users now appear to adopt a fairly standard practice. Developments took place under processing:

(i) to cope with the need to look and plan further ahead into future consequent on the growth in size and complexity of operations of business;

(ii) to prepare for and make the best of uncertainties in the future;

(iii) to cope with the growing recognition of the different requirements of planning and control;

(iv) to cope with deviations from the original plans for better planning and control;

(v) to foster innovative thinking, independent review and critical appraisal of plans and programs;

(vi) to benefit from the advances of management science and computer technology.

The purpose of this section is to review the above developments under processing.

4.4.1. General Procedure

We observe that the following steps are taken in the preparation of budgets:

(i) Define explicitly goals and objectives of the organisation.

(ii) Formulate functional and other relevant policies in respect of various organisational units of the business, to be followed in the pursuit of goals and objectives.

(iii) Prepare long-term forecasts.

(iv) Prepare long-term plans.

(v) Prepare short-term forecasts.

(vi) Prepare short-term plans.

(vii) Determine limiting factor and finalise short-term plans vis-a-vis the limiting factor.

(viii) Develop organisational operations mix strategy.

(ix) Prepare budgets for each and every unit of the organisation.

4.4.2. Developments to look further ahead into the future.

4.4.2. (i) Current Budget

Business budgeting, following the practice of governmental budgeting, was for short periods at the beginning. This type of budget is variously known as 'current', 'operating', 'short-term' or tactical budget. Such a budget "is established for use over a short period of time, usually one year but sometimes less, and related to current conditions."[47]

4.4.2. (ii) Basic Budget

The tremendous growth in size and complexity of operations force businesses to set up 'basic', 'long-term', 'strategic' budgets. The increased awareness of the benefits of longer range planning re-inforce this practice of long-term planning. Weinwurm and Weinwurm found that one or another of the 82 companies contacted in their field research stated the following benefits to be derived from long-term profit planning.

> "* The process helps the company's managers reach agreement on the directions in which we should be moving and our basic objectives.
>
> * We find that the more effective control of our business that has resulted from our planning process has increased our profitability.
>
> * Most noticeable has been the increased incentive throughout the company to achieve our objectives.
>
> * We find that our long-term profit planning program forces our divisions to think consciously about the future.
>
> * We're just more efficient, that's all.
>
> * Our long-term profit plan provides us with a basis for evaluating alternatives.
>
> * Having a long-term profit plan forces us to use an orderly planning procedure.
>
> * Our management is now forced to think about the future.
>
> * Having goals gives us something against which we can compare our progress and alerts us when some corrective action might be necessary.
>
> * The different functions of our business are now better co-ordinated and focused on common objectives.

47. Terminology of Management & Financial Accountancy, I.C.M.A., 1974, p.46

* We are now better disciplined in our thinking about the future.

* We have been stimulated to take actions that might otherwise have been deferred.

* Our attention is now focused on future opportunities.

* Our long-term profit plan is a major communication device between the corporate and divisional levels.

* Our planning process helps our management avoid unpleasant surprises.

* Planning develops a climate for future thinking.

* Now we can make reasonable long-term cash flow projections."[48]

A 'basic' budget is "based on a long-term plan and used as a basis for developing current budgets. A basic budget is usually much broader in scope and less detailed than a current budget."[49] It is also worth noting that there may be differences in the rates of return stated as objectives in the 'current' and 'basic' budgets. A basic budget, being established for a longer term takes an average over such a planning horizon. The practice of establishing 'long term' plans/budgets is, however, "still a relatively recent addition to the manager's kit bag." Weinwurm and Weinwurm discovered that "about four out of five of the (82) companies contacted in the field research ... have been engaged in short-term planning since before 1960, and a substantial portion since before 1950; in contrast, about four out of the five of the companies contacted have been engaged in long-term planning since 1960 and about three out of ten since 1965."[50]

48. E. H. Weinwurm, and G. F. Weinwurm, Long-Term Profit Planning, American Management Association, Inc., New York, 1971, p.1-2.

49. I.C.M.A., op cit., p.46.

50. E. H. Weinwurm and G. F. Weinwurm, op cit., p.16.

4.4.3. Developments to be best prepared for uncertainties in the future

We observe that the developments to tackle the uncertainties in the future have taken place at two levels. At the upper level, the practice of preparing 'static' or 'fixed' budgets have been replaced by/changed to preparation of 'flexible' budgets in some business and 'probability' budgets (budgets based on probability distributions) in others. The use of sophisticated mathematical forecasting methods and various methods in analysing cost behaviour constitute developments at a technical level.

4.4.3. (i) Static Budgets

At the beginning, businesses set up 'static' or 'fixed' budgets. A 'fixed' budget "is designed to remain unchanged irrespective of the volume of output or turnover attained."[51] These budgets are useful if the level of activity attained is not far off from those budgeted either because of the stability of its operations or of the particular suitability of a particular forecasting technique to its nature of business. In fact, there are many firms which find the 'static' budgets sufficiently useful and are still using them.The developments in forecasting techniques, which we are going to examine later, in one way make the practice of 'fixed' budgets still useful. But once the actual levels of output or turnover varies widely from those budgeted, the budget or budgeted levels of revenues and expenditures become hardly relevant and suitable to measure the actuals for control.

4.4.3. (ii) Flexible Budgets

The industries or businesses which could not forecast the outputs or turnovers sufficiently reliable, therefore, look for alternative 'practices'

51. I.C.M.A., op cit, p.46

and discover 'flexible' budgeting techniques.

A flexible budget, "by recognizing the difference in behaviour between fixed and variable costs in relation to fluctuations in output or turnover, is designed to change appropriately with such fluctuations."[52]

It is a simple matter to flex the revenues and expenditures to respective levels of production or turnover once the variability of income and expenditures are ascertained. Thus the revenue and expenditure budgets would be:

$$\text{Revenue Budget} = \sum_{i=1}^{n} P_i\, q_i$$

$$\text{Expenditure Budget} = F + \sum_{i=1}^{n} C_i\, q_i$$

where, P_i is the selling price per unit of i^{th} product,

q_i is the sales volume forecasts in units of i^{th} product.

F is the total of fixed costs

C_i is the variable cost per unit of i^{th} product

q_i is the output in units of i^{th} product.

A flexible budget, therefore, "complements the engineered work and material measurements in the direct-cost category as part of the standard-

52. I.C.M.A., Ibid., p.46.

cost procedure", but "may also be used by firms which do not practice standard costing."

We observe that though the flexible budgets are more control orientated, they are also useful for planning. "The planning budget, based on some anticipated sales and production level, in effect constitutes a first approximation, on the basis of which financial needs may be estimated, personnel may be hired, materials ordered, and the plant, in general, "tooled up". But if the actual level of production deviates materially from what was planned, it is helpful if a new budget is readily available to substitute for the original one."[53]

4.4.3. (iii) Multiple Outcome Budgets

Multiple outcome budgets are, conceptually, an extension of flexible budgets. These budgets are made to flex not only to changes in levels of output or turnover, as under flexible budgets,but also along different dimensions of other key variables like material prices, wage rates, selling prices and interest rates. The great obstacle to practical application of multiple outcome budgets is the amount of work involved in preparing the required number of budgets (and planning behind them.)

Thus taking three dimensions pessimistic, most likely and optimistic values (let alone the ideal complete probability distributions) of each of only four variables (activity, selling prices, wage rates and material prices), we require 81 (3^4) budgets altogether in various permutations.

53. N. W. Chamberlain, op cit, p.154

Bryan Lowes [54] has made suggestions to reduce the number of budgets required. He proposes the assignment of probabilities (degree of chance) to each dimension of the individual variables and works out the ultimate probability of each budget. He then suggests to select a cut-off probability and discard those budgets below it as unlikely to be worth anticipating. (See Figure 4.3.). He, thereby, reckons that multiple outcomes budgets would be practical and economically feasible.

We observe that despite these suggestions, the number of budgets and planning for them is still numerous. Besides those budgets become probable only when taken together. If the cut-off criteria is to be applied individually to each budget, none suggests likeliness of prevailing. Despite the possible advantages, we have not found its practical application reported in the current literature.

4.4.3. (iv) Forecasting Methods

Sales being the principal source of funds and for which production, the cause of outflows, is geared to constitute the pivot on which profit making activity swings. The budget machinery of a business is initiated by sales forecasts. Unless there are other limiting factors like plant capacity, raw materials and labour availability, sales are the building blocks of entire budgets. Even if the presence of other limiting factors discards sales as the basis of budgeting, this would be for short term budgets only. Sales forecasts are the corner-stones for such tasks as budgeting capital equipment expenditure and projecting future cash flows and sources of funds.

54. Bryan Lowes, Budgeting to Meet Problem of Uncertainty, Management Accounting, Vol. 51. No. 1, England, January, 1973, pp.10-13.

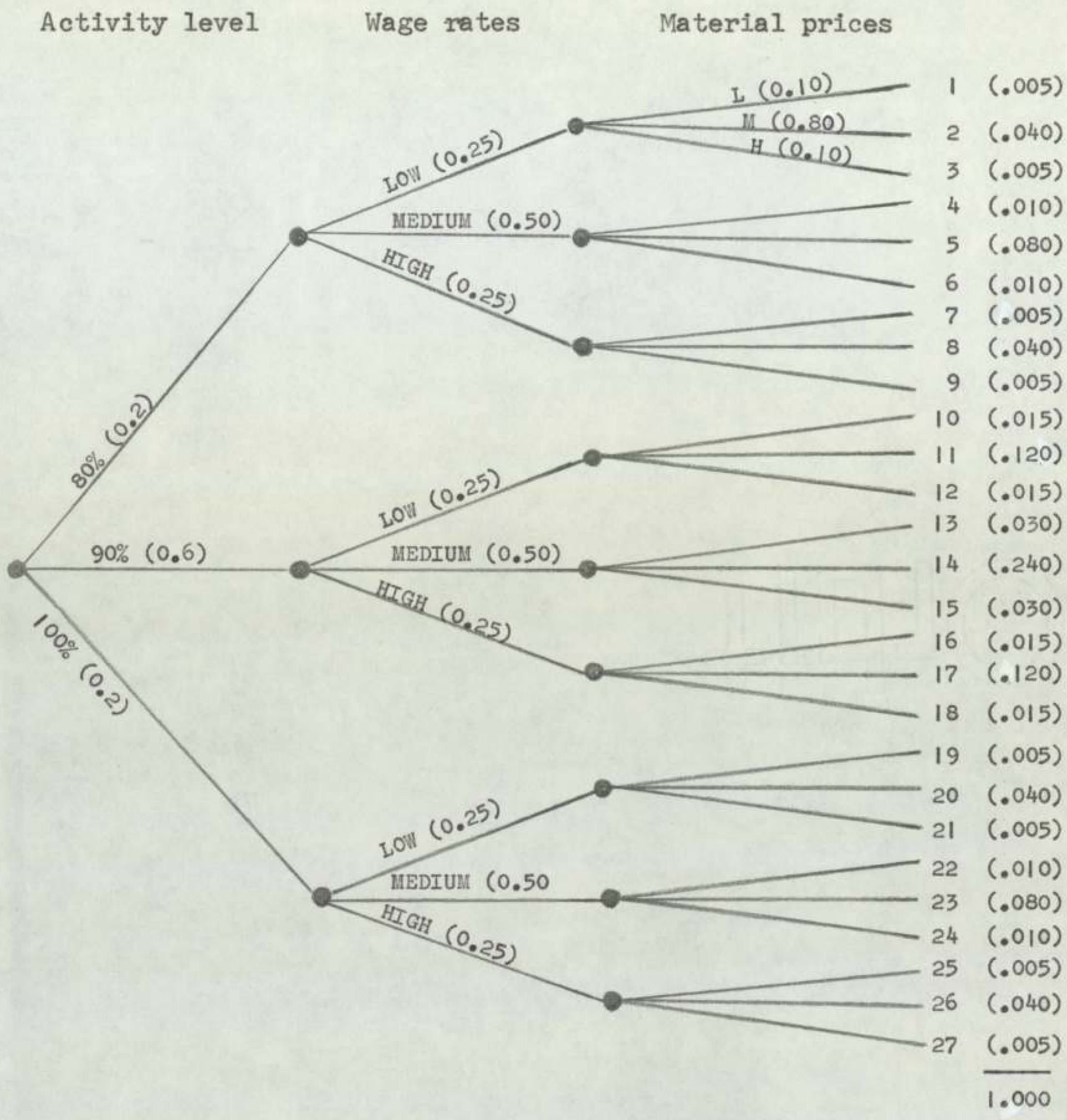

FIGURE 4.3 DECISION TREE SHOWING MULTIPLE OUTCOME BUDGETS

FREQUENCY TABLE

1 Probability	2 Budgets	3 Frequency	(1) x (3)
.005	1, 3, 7, 9, 19, 21, 25, 27	8	.040
.010	4, 6, 22, 24	4	.040
.015	10, 12, 16, 18	4	.060
.030	13, 15	2	.060
		18	.200
Cut off .035			
.040	2, 8, 20, 26	4	.160
.080	5, 23	2	.160
.120	11, 17	2	.240
.240	14	1	.240
		9	.800

They are used in production budgets for equipment and facilities planning, raw material stocks and purchasing plans. The sales forecasts are also used in other corporate areas as planning manpower requirements, setting sales quotas. Again 'fixed' or 'period' expenses are incurred in anticipation of forecast level of sales and flexible budgeting cannot do much about fixed expenses.

There are numerous variants of forecasting procedures in business but it is possible to outline a typical approach. First a projection of general business and economic conditions for the whole country is made. These formed the basic assumptions of company forecasts. The next step is the estimation of the likely level of activity in the relevant industry or industries. Finally there is a forecast of company activity.

We have an impression that only the largest corporations employ their own staff in making economy wide projections. Most businesses adopt forecasts prepared by government agencies, trade associations, private research groups or economic staffs of larger banks. They may adopt estimates from single source but many effect some compromise among several estimates.

In the area of forecasting industrial activity, companies make use of simple or multiple correlation techniques linked to some general economic indexes from economy wide projections. They are supplemented by evaluation of current expert opinion, examination of supply and demand situation and interpretation of historical trends. Usually more than one estimate of demands are made: one derived by the overall GNP approach and the others by an analysis of major industries depending on the industry in question and these estimates are compared and integrated into a single final projection for the total industry. The companies making the forecasts also bring in such factors as new product development, industry sales promotions, other non-economic factors as well as short-term factors as changes in interest rates, current unfilled orders, new order rates and model changeover dates if applicable.

Another pertinent development, which has taken place, is in technological forecasting. Technological forecasting attempts "to predict a technological application" and "potential". It could develop lists of technical opportunities that might be profitably exploited by a firm and also indicates possible improvements in competitors' products or the introduction of different products that could satisfy the same market needs and thus become competitive.

There are two distinct approaches to technological forecasting: opportunity oriented and objective oriented approaches: The first looks at a particular functional capacity. It estimates the growth of the technologies relevent to the accomplishment of that function and examines the likely impact of future technological potentials. Objective oriented technological forecast starts with the decision to accomplish some end and then seeks to identify those technological potential that will permit realising the goal. Within each class, we observe some useful techniques, viz. analytical modelling, informed judgement, precursive analyses and trend analysis.

Analytical modelling has shown that exponential growth includes a self-limiting factor and results in a S-shape curve. "This curve appears to be typical of the specific technical area. There is an early period of growth when relatively little advance is made, followed by a very sharp increase, and then a flattening out as some limiting natural law or other inhibiting factor is approached."[55]

Informed judgement. The most likely time for achieving some technological capability is based primarily on the consensus and distributions of many informed judgements. The intuition of the best-informed individuals often turn out to be the most useful source of technological forecasts even when the techniques employed in generating individual opinions are obscured. This technique is also known as 'Delphi' technique.

Precursive analysis first establishes appropriate and highly significant relationships with the precursive events and forecasts by analysing them. This technique is particularly amenable to single point predictions - that is forecasts like "Such and such will occur in the year so and so."

Trend analysis extrapolates the long-range trend for a function by fitting a line to the upper halves of the S-curves representing a family of techniques used for accomplishing a common function. The curves have, of course, to be plotted on the same chart.

It is in the field of forecasting company sales that many companies devote their attention . Basically there are three methods. (i) the accustomed or target percentage share of expected industry sales, (ii) the jury of executive opinion which is the pooling of the expectations of the company's executives, and (iii) mathematical approaches.

The method of taking the accustomed or target percentage share of expected industry sales is a common method. But companies realise that forecasts of industrial activity are useful only as a bench mark to judge or test their own forecasts. Besides, it could not simply be taken for granted that company activity would move at the same rate and in the same direction

55. Raymond S. Isenson, Technological Forecasting: A Management Tool, Business Horizons, Vol. 10, No.2, Indiana University, Summer 1967, p.41.

as that of the industry. We therefore seldom find a company relying entirely on this method. More often, the results obtained by this method are checked against those obtained by other routes.

The jury of executive opinion method has taken two directions. In the beginning this method relies on the sales division and in particular the field staff. The sales forecast is a composite of all the territorial 'hoped for' sales item by item, customer by customer.

The mercurial nature of salesmen i.e. highly optimistic one day and overly pesimistic the next and their tendency to avoid paper work and time-consuming surveys and adoption of such short cuts as giving this year's figures as next year's expections led to relying on product managers. The product manager as a specialist, co-ordinating the functional activities relating to a particular product or line or group of products, has knowledge of the uses of products and the state of the markets. These are pieced together to arrive at estimates based on product lines. The 'jury of executive opinion' method, no matter on whom it is based, is not free of subjective opinion.

Many companies, therefore, if not abandoning these methods altogether, supplement them with mathematical techniques. A survey of 389 companies reveal that 80 per cent calculate the sales forecasts by extrapolating the trend based on historical data.[56] Sophisticated mathematical methods used in analysing data and forecasting future sales are numerous: time series

56. B. H. Sord and G. A. Welsch, op cit, p.

analysis, least squares, simple correlation, multiple correlation to extrapolation. It is beyond the scope of this thesis to go into their details.

The above portrays the position of sales forecasting with respect to the internal business environment. In fact, it goes further to integrate "the external business environment with the internal forces of the company. It reduces to workable management dimensions the external business environment over which management has relatively little control. It delimits those constraints that establish the boundaries within which a company must make decisions and operates and translates them into company programs."[57] The sales forecasting as an aid to integrative planning may be summarised in a diagram.

Noncontrollable and partially controllable external factors.

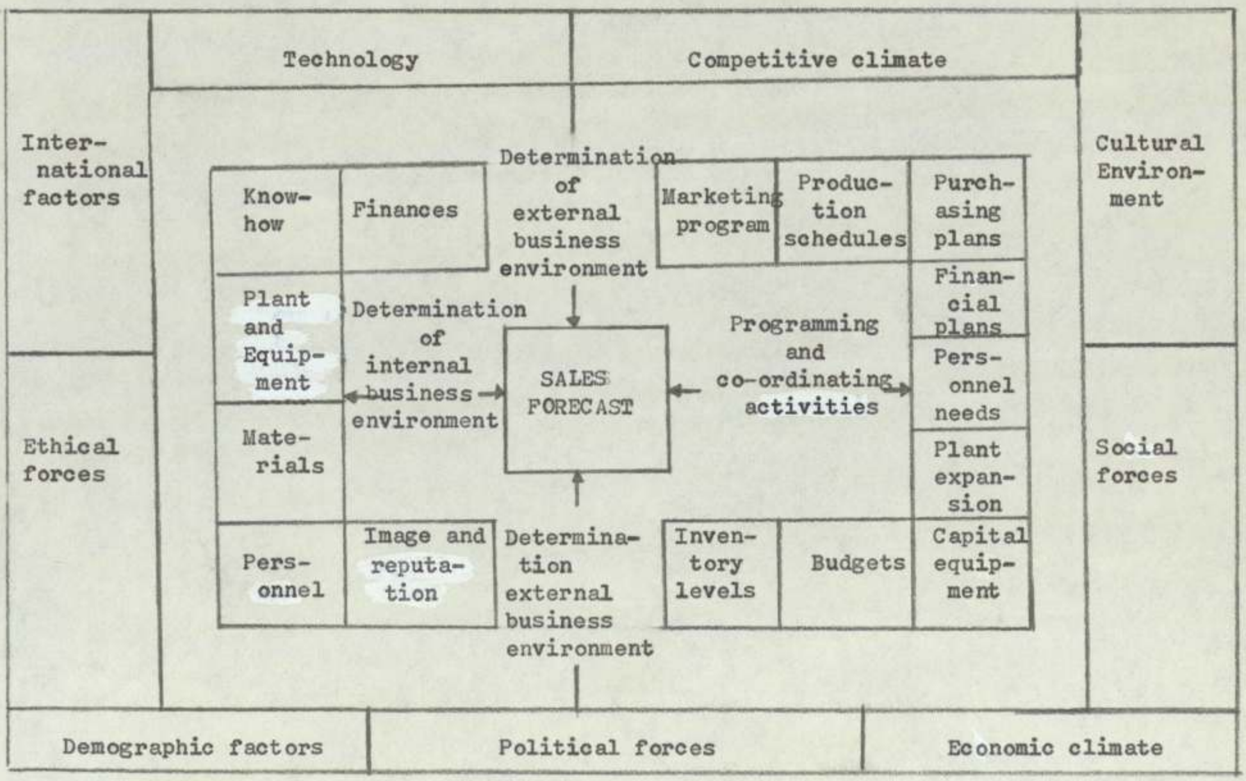

Fig. 4.4. Sales Forecasting: A Focus for Integrative Planning

57. William Lazer, <u>Sales Forecasting; Key to Integrated Management</u>, Business Horizons, Vol. 2, No. 3, Fall 1959, Indiana University, p.62.

4.4.3. (v) Predictions of cost behaviour

Projections of individual costs are based on prediction of cost behaviour which embraces:

1. determination of the basic nature of cost items, and
2. measurement of cost changes relative to activity.

It has long been recognised that there are three basic categories of costs, classified by behaviour: variable, fixed and semi-variable/fixed or mixed costs.

Variable costs change in proportion to fluctuations in sales, production volume or some other measure of activity.

Fixed costs are of two kinds: (i) those which remain stationery irrespective of fluctuations in volume of activity in a budget period, and (ii) those which do not vary within the relevant range of activity but step up with higher ranges of activity. Fixed costs are again recognised as being made up of committed costs and discretionary costs. Committed costs consist largely of those fixed costs which arise from a basic, irreversible decision for a certain capacity (size of plant, equipment and basic organisation). Discretionary costs, also called managed or programmed costs, arise from periodic appropriation decisions reflecting top management policies.

Semi-variable or mixed costs contain both fixed and variable elements. The fixed element represents the basic minimum cost of attaining a service. The variable element is affected by changes in activity. The behaviour of these costs appears somewhat like below:-

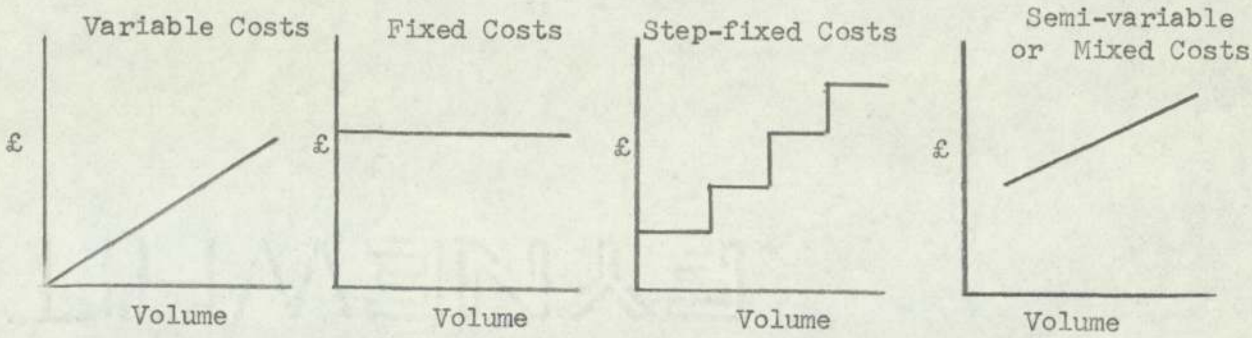

Figure 4.5. BEHAVIOUR OF COSTS

It appears from the basic nature of costs that the behaviour of variable and fixed costs could be discernable without much problems. But some exhaustive approaches have to be undertaken to detect the variability of mixed costs. A combination of the following approaches are used to measure cost changes in relation to volume.

a) Analysis of historical data.

b) Direct estimates.

c) Industrial engineering studies.

<u>4.4.3. (v) a Analysis of historical data</u>

The estimation of cost behaviour patterns begins with a scatter chart, a graph on which respective costs at different volumes are plotted. This scatter chart shows the cost behaviour and if the position of the plotted points indicates that cost follows volume, a line is fitted either by visual inspection or statistical methods of least squares or multiple regression. The slope of the line reflects the rate of change of particular cost with respect to volume. In the case of semi-variable or mixed costs, the intersection of the line with the vertical 'y' axis indicates the amount of fixed-cost component. There is a simplified version of the scatter chart known as high-low two-point method. This method plots only the highest cost point and the lowest cost point over the contemplated range of activity. The slope of the line connecting those two points shows the rate of change and its intersection with the vertical axis indicates the fixed cost. There is also a rough and ready method under analysis of past experience approach, which is:-

$$\text{Variable cost rate} = \frac{\text{Change in costs}}{\text{Change in activity}}$$

$$\text{Fixed cost at particular level of activity} = \text{Total costs} - (\text{Variable cost rate} \times \text{Activity level})$$

These two methods are not sufficiently accurate for wide use but we mention them to avoid ommission.

We wish to remind that analysis of historical data is concerned with the past which provides an idea but may not accurately predict the future. Besides the historical correlation between cost and activity may be changed or hidden by factors[59] like:

1. Mechanisation or reshuffling of plant and equipment.

2. Changes in products made, materials used, or methods of manufacture.

3. Changes in organisation, personnel, working hours or conditions and efficiency.

59. Charles T. Horngren, Cost Accounting: A Managerial Emphasis, 2nd edition, Prentice Hall Inc., Englewood Cliffs, N.J. 1967.

4. Changes in prices paid for cost factors.

5. Changes in management policy toward costs such as: layoffs, voluntary labour turnover, purchasing policies, research and advertising.

6. Lag between cost incurrence and measurement of volume.

7. Random fluctuations in costs by reasons of wars, strikes, labour slowdowns, changes in supervisors, etc.

8. Seasonal costs.

4.4.3. (v) b Direct Estimate

Direct estimate approach is resorted to when historical analysis is not possible by reasons of presence of 'factors' as above, unavailability of data and/or next to impossibility of using other approaches. A typical procedure in estimation is to work out an average from a representative period and adjust this for trends and plans expected to affect the item in the coming period. These estimates are agreed after discussion among foreman, supervisor, works representatives and budget personnel.

4.4.3. (v) c Industrial Engineering Studies

The engineering approach is the most systematic study of cost behaviour. It is normally adopted by firms using standard cost and budgetary control systems in establishing cost standards. Engineers state physical requirements after systematic review and evaluation of material, labour, services and facilities derived from time and motion studies. The budget personnel transformed these physical requirements into respective costs by the application of appropriate price factors.

4.4.4. Developments to cope with the different requirements for planning and control

It is obvious from our discussions of the principles, concepts, philosophies and levels of standards that the requirements for planning and control are different. We would not reiterate the details but state them briefly.

Budgets and the underlying standards for planning should be at levels which are most likely to prevail. These might be different from attainable levels. They are sometimes conservative and lean towards the lower side. Budgets and standards for control, on the other hand, should be tight for motivating the participants. Some have advocated for such high levels so that there might even be chances of not achieving them. The growing awareness of different requirements for planning and control has led to the proposals for preparation of dual budgets instead of a single one.

The following are some suggestions of how to proceed with them.

> "If it is impossible to perform the two functions of control and planning using the same set of figures, it is necessary to have two sets. For discussion here, they will be named the control records and the planning records."
>
> "The basic record would be the targets set for the purposes of control. These targets will differ from those set for planning purposes in several ways.
>
> Firstly, they will differ in time scale. The time scale for which they are set, the frequency with which performance is monitored and compared with target; and finally, the frequency with which they are reviewed and revised, will be a function of the factors surrounding each individual process. This frequency may be very different for different targets within any one department.
>
> Secondly, these targets would be more numerous and detailed in some areas than is conventional when using budgets. The purpose of control targets is to enable the individual to examine his own progress. The result will be to involve the lowest levels of management in the control process; a result which would bring great benefit in view of the research evidence which exists showing that this level of management can

significantly affect a company's costs.

Thirdly, the targets set would be of a different nature. Targets would be set which demanded the highest possible levels of achievement. In addition, they would be set in terms which are significant for the individual for whom they are set. They would still be quantitative but they would be much less likely to be in financial terms. This would overcome the problems inherent in using tools for which individuals are inadequately trained.

This would result in a control record which was continually being updated, which used measures designed to be intelligible to the individual whose performance was being monitored, and which set targets not what can be attained on average, but the best that can be achieved.

From this control record a seperate budget record would be produced which was more conservative. The basic information in the control record would be converted into financial terms. Factors would be applied to the targets set for control to adjust them to an average level of performance which could be expected to be maintained.

The rate of change of the planning record would be more modest. It could be updated in line with the frequency at which financial information was available. It would take account of allocated costs, a factor which is largely irrelevant in the control record. Targets would only need to be adjusted when some significant change occurred in the level of performance, and this change could be maintained.

This planning record would be the source of marginal costs or standard costs, or such other management accounting information as is used for the company's normal planning, forecasting and decision-taking exercises." 60

Professor Sizer makes a different emphasis. He takes a different approach but is less specific in suggesting that:

"It would appear that one set of budgets cannot combine successfully both roles, i.e. planning and control. It would seem that the budgets for planning must be established first.

These planning budgets would not necessarily conform with the organization structure but look across departments and boundaries at

60. R. D. F. Morris, op cit, p.656

systems. They would not necessarily be prepared by a budget officer. They may well be prepared by a planning team with an econometric or operational research bias. A systems analyst would probably be required as such a team would certainly make extensive use of the computer."

"The planning budgets flowing from the computer-based models will be translated into operating or control budgets with responsibilities clearly defined by individuals and agreed with the responsible executives. The level of attainment may vary between budgets, some may have to be tighter than others. This would be necessary in order to try to ensure that every optimizing action, by an individual responsible for a control budget would be an optimal action for the firm as a whole. In preparing these control budgets, the motivational influences of the different levels of attainment would have to be taken into account." 61

Though the concepts and techniques of dual budgets have been laid out for as long ago as a decade, we have not seen their application reported in the current literature. This could perhaps be due to the reason that the firms are hard pressed already by the preparation of single budgets. Besides, they may be concerned also of the negative behavioural consequences of having more than one goal. In this connection, Becker and Green express some doubts as follows:

"Stedry, recognizing the possible motivating forces produced by budgets, seems to suggest that "phony" budgets be prepared while the real budget is kept secret. The "phony" ones would be designed to induce maximum motivation through a manipulation of level of aspiration. This plan would require different phony budgets for each department and, indeed, for each individual. If different budgets are viewed as discriminatory and unfair devices, company morale might suffer. Further, if already disgruntled employees learn that they were striving to attain phony goals, the effectiveness of future budgets, real or phony, might be seriously impaired." 62

61. John Sizer, op cit, pp. 444-445

62. Selwyn W. Becker and Donald Green, Jr., op cit p.401

4.4.5. Developments to cope with deviations from plans.

The budgeting process is a wholly integrated operation resulting in a master budget comprised of forecast profit and loss, forecast cash flows and a forecast statement of financial position. A departure from any part of the budgetary plan will have repercussions all throughout the budgets. Deviations can occur in any of the detail plans viz. sales, marketing, selling and distribution, production, inventories, administration, research and development, capital programmes. They affect revenues, costs, profits, cash and all other assets, liabilities and capital.

Deviations from plans may be due to changes in circumstances which could not be foreseen at the time of making the plans or deliberate management actions conceived and undertaken after establishing the original plans. These departures, when significant, irrespective of their causes, throw out the budgets, either as a planning device or control media.

The unforeseen departures could have taken place either by changes within a firm or by changes in the environment. The changes taking place internally within a firm are normally foreseen. Unanticipated internal changes occur only as a response to changes in the external environment. The changes in external environment are the main cause of departures from plans. These changes can be international or domestic such as those we experienced recently, the energy policy of the Arab countries; a shift in the distribution of world income between the developing and developed countries; a continuing escalation in world commodity prices; rampant domestic wage and price inflation; the three-day working week and the three domestic budgets of 1974. The departures from plans by such unexpected and uncontrollable causes are represented by:

1. Variations in sales, in total or by products, territories or other sales categories.

2. Cost efficiency variances

   a) in the factory

   b) in the sales organisation

   c) in other segments of the organisation.

3. Variations in flow of production.

4. Variations in the acquisition of inventories of direct material and supplies.

5. Variations in collection of receivables and payment of invoices.

6. Variations in the rate of capital and research and development expenditures.

These deviations, when they are significant and likely to prevail in the remainder of the budget year, are incorporated in the revised budget.

Management itself is the master of the controlled changes in the budget after its promulgation. We do not, therefore, necessarily have to rely on budget variances to know of their existence. Instances of deliberate management actions instituted after the establishment of budgets are:

1. Institution of a cost reduction program.

2. Changes in direction or amount of sales effort.

3. Cut back or expansion of production schedules.

4. New managerial decisions in regard to capital or research expenditures.

Such known changes are also given effect to in the budget revisions.

Budget revision is, in fact, a way of flexing the budgets to changed circumstances and programmes. It is, however, broader than the conventional 'flexible' or 'variable' budget in that it embraces variations not only of volume or turnover, but also of prices, cost rates, efficiency, capacity and all other relevant factors. Moreover, it is carried out during the budget year.

There have been so many fast, frequent and material changes in the external environment that the values of traditional budgetary planning and control systems are questioned. Managements are urged to anticipate future sales, costs and cash flows continuously. Professor Sizer suggests the following types of control comparisons, based on a continuous forecasting ahead for effective planning and control. He also attaches the type of appraisal which each would render to management.

"Budget v. actual	How are we doing? Are we on the track towards our objectives?
Budget v. forecast	Will we remain on track towards our objectives? What will happen if no action is taken? Do we need to take action?
Budget v. revised forecast	Will proposed action put us back on track?
Latest forecast v. previous forecast	Why has the forecast changed? Is the situation improving/deteriorating?

Actual v. past forecast	Did things turn out as expected? If not, why not? Are we being too optimistic/pessimistic in our forecasting?"[63]

John Sizer does not mention the formal incorporation of the changes into the budget. Nevertheless, the type of control comparisons, he suggested, emphasises the importance of the deviations with a view to maintaining the objectives.

One direction which has taken out of the unexpected and uncontrollable changes in the environment is the practice of "continuous", "running" or "rolling" budgets. A rolling budget has a perpetual time horizon and operates with continuous revisions and extensions at the close of every period which may be a quarter or a half-year on the basis of forecasts made thereat. A firm operating on quarterly rolling budgets have a four-quarter budget covering the current and three succeeding calender quarters. Before the close of the current quarter, forecasts are made for a year ahead and three succeeding quarters' budgets are revised and a new quarter added for the remainder of the budget's perpetual time horizon. The technique of rolling budgets is not new though we hardly find it in text-books on budgeting. Some companies, probably an increasing number, are stated to be moving toward continuous budgeting.[64] There has also been a report of successful practice in a fruit and vegetables canning firm in U.K.[65]

63. John Sizer, <u>How to Control Budgets</u>, Management Today, September 1975, p.74.

64. Neil W. Chamberlain, op cit, p.314.

65. David Allen, <u>Tapping the Cost Barometer</u>, Accountancy Age, 12 July, 1974, p.14

4.4.6. Development to foster initiative

Most companies use the current budget as a starting point in budgeting for the next year. This amounts to accepting all those spendings as necessary without examination, and the persons in charge have to justify only the increase which they seek above last year's budgets. This procedure is easy to follow but implies complacency, obstructs initiative and programs may be carried on unjustifiably only because they were undertaken last year. It is likely that substantial savings may result if the persons concerned were asked to make cases for their budgets every year, just as if the programs were entirely new. This, in other words, is to start the budgeting for next year from scratch or from ground zero and is called 'zero-base' budgeting.

It may appear that zero-base budgeting will not be feasible by reasons of the amount of work it adds to budget preparation. But Texas Instruments Inc., has developed and applied a technique with considerable success since 1970. It claims that "this kind of budgeting need not add heavily to the burdens of budgeting-making. In fact, efficiently planned and properly managed, it can actually reduce them."

The technique as employed at Texas Instruments Inc., in a nutshell, is:

> "As developed at T.I., this kind of budgeting separates out the basic and necessary operations from those of a more optional or discretionary character so that management can focus special attention on this second softer group. The basic steps to effective zero-base budgeting are:
>
> * Describe each discrete company activity in a "decision" package.
>
> * Evaluate and rank all these packages by cost/benefit analysis.

* Allocate resources accordingly."[66]

4.4.7. Advances in management sciences and computer technology

One useful tool in management sciences, highly pertinent to budgeting, is the technique of model building. Models explain and predict the behaviour of the phenomena. Developments in computer technology made it practicable to test numerous assumptions and alternatives via models. The concepts and techniques of models have made their inroads into budgeting and we have now media like computer budget models, a blend of budgeting, modelling and computer techniques. They could be useful especially in the current state of rapid and drastic changes in the environment. These developments constitute an important section and is the subject of Chapter 6.

4.5. OUTPUT

Budgeting systems are designed to produce outputs which contribute towards planning, co-ordinating and controlling the activities and operations of organisations. During the process, the system produces documentary output and certain behaviour patterns. In this section, we are reviewing them only in so far as they are related to or influenced by the process of preparation of budgets.

4.5.1. Documented Output

Statements of plans, programs and reports come under documentary output. We have shown in Chapter 2, the various types of budgets turned out by the system. We wish to remind, in this connection, that these paper

66. Peter A. Pyhrr, Zero-base Budgeting, HBR Vol. 48, No. 6, (November-December, 1970), p.112.

outputs are not ends in themselves, they are means to ends. The manner and contents of their presentation should assist to fulfill the main purposes of planning, co-ordinating and controlling the operation of a firm.

Developments have also taken place in this area. Executives concerned long realised the essential principles and practices of helpful and effective reporting.[67] We have covered the prerequisites of useful statements and reports on p.53 of Chapter 3. And now we look at the findings in this area from a different angle viz. the factors or reasons attributable to non-use (useless as opposite to useful) of certain information. A study[68] in seven companies showed that as much as 46 per cent of the information produced was not used and the reasons, in order of importance, for non-use were:

(i) The information arrived too late for effective action,

(ii) The subjects on which the information was provided were outside the control of the managers,

(iii) The information which was provided was insufficiently detailed to be helpful,

(iv) The information was considered to be inaccurate, and

67. See K. C. Tiffany, Reports for Management, Paper presented at the annual meeting of the American Accounting Association, Ann Arbor, on 9th September, 1949 and also appeared in The Accounting Review, April, 1950.

68. R. B. Dew and K. P. Gee, Management Control and Information, Macmillan, London, 1973, pp.43-49

(v) The information was not presented in a form which could be readily understood.

It is also interesting to find that "two reasons evidently dominated the rest and accounted for two-thirds of the information which managers did not use. Of roughly equal importance to untimeliness, ..., was that the subjects on which the information was provided were outside the control of the managers."[69]

Related to documented output, we also wish to make the following points.[70]

(i) Managers suffer more from an overabundance of irrelevant information though it is true in many cases that they lack a good deal of information they should have.

(ii) Managers in many cases do not know their information requirements and tend to overstate them out of lack of awareness of the type of decisions, they should make and do, and adequate conceptions of models of such decisions. Ackoff says, "Most managers have some conception of at least some of the types of decisions they must make. Their conceptions, however, are likely to be deficient in a very critical way, a way that follows from an important principle of scientific economy: the less we understand a phenomenon, the more variables we require to explain it. Hence the manager who

69. Ibid, p.48

70. Russell L. Ackoff, Management Misinformation Systems, Management Science, Volume 14, Number 4, December 1967, pp.B.147-151.

does not understand the phenomenon he controls plays it "safe" and with respect to information wants"everything"."

(iii) It is not always true to assume that a manager will improve his decision making once he is given the information he needs. Management problems pose too many possibilities to expect experience, judgement, or intuition to provide good guesses, even with perfect information. All we need to do is to determine how well managers can use needed information and provide decision rules and performance feedback in cases of complex decision processes when they could not use the information well.

(iv) Management Information Systems provide managers with better current information about the activities of other managers and their departments and divisions. But better inter-departmental communication does not necessarily and seldom enable managers to co-ordinate their decisions more effectively and hence improves the organisation's overall performance. Organisation structure and performance criteria are important variables in the usefulness of the free flow of information between various parts of an organisation. It is not uncommon that communication between organisational units hurt, let alone help, their performance when such units have inappropriate measures of performance which put them in conflict with each other.

4.5.2. Behavioural Consequences

Certain behaviour patterns ensued following the way the various inputs are handled and brought to a budgeting system, viz. level of standards, participation, type of participants, leadership styles and the attitudes of staff personnel. We have discussed them at length under inputs.

There are other studies looking into the behavioural consequences of budgetary control systems. They are concerned more with the use of budgets, rather than related to aspects of preparing them.[71, 72] We would therefore leave them at this point.

4.6. CONCLUSION

Many advances have been made in all the three aspects: input, processing and output of budgeting systems. There certainly are developments which make room for the application of computers and related technology. This is particularly noteable in the case of developments in processing.

71. Don T. DeCoster and John P. Fertakis in Budget-Induced Pressure and Its Relationship to Supervisory Behaviour, Journal of Accounting Research, Vol. 6 No. 2, pp.237-246, Autumn 1968 examine the relation between budget-induced pressure and (1) leader behaviour characterised as production-oriented, and (2) leader behaviour characterised as employee-oriented.

72. Anthony G. Hopwood in An Accounting System and Managerial Behaviour, Saxon House/Lexington Books, England 1973, studied the use of budgets for performance evaluation and tested the following hypotheses:
"1. If a manager preceives that he is evaluated on the basis of a Budget Constrained style he is (a) more likely to experience job related tensions; (b)more likely to report having poor relations with his supervisor; (c) more likely to report having poor relations with his peers; (d) more likely to engage in falsification of the accounting records and dysfunctional decision making, than if he perceives that he is evaluated on the basis of either a Profit Conscious or a Non-accounting style." (p.26.)
"2. If a manager participates in setting the budget he is (a) less likely to experience tension; (b) less likely to report having poor relations with his supervisor; (c) less likely to report having poor relations with his peers; (d) less likely to engage in falsification of the accounting records and dysfunctional decision making.
3. If the accounting information is less accurate for the purpose of performance evaluation, the manager is (a) more likely to experience tension; (b) more likely to report having poor relations with his supervisor; (c) more likely to report having poor relations with his peers." (p.30.)
4. If a manager reports a Budget Constrained style of evaluation and if he has high upward mobility aspirations he is (a) more likely to experience tension; (b) more likely to report having poor relations with his peers; (c) more likely to engage in falsification of the accounting records and dysfunctional decision making." (p.31.)
"5. A manager is more likely to be seen as using a Budget Constrained style of evaluation if (a) he is himself evaluated on the basis of a Budget

We observe inter alia., the following directions, to lend specially to the use of computers.

(i) The need for dual budgets to cope with different requirements for planning and control,

(ii) The practice of rolling/continuous budgeting to adapt to the changes in environment,

(iii) The concept and ultimate implementation of multiple outcome or probability budgets,

(iv) The application of mathematical and statistical techniques in forecasting the future,

(v) The use of quantitative tools in cost behaviour studies, and

(vi) The need for timely provision of budgets.

The developments come not without some which emphasise the human aspects in budgeting. These aspects put a check if not altogether prohibit the computerisation prospects of budget preparation. The inputs to a budgeting system in the form of setting standards, process of participation, type of participants, leadership styles and attitudes of staff personnel have important bearings on the success of a budgeting system. We wish to conclude at this stage that the developments, as usual, have mixed prospects, with human factors and

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Constrained style; (b) he has a leadership style which is characterised by low Consideration and high Initiation of Structure (p.34).

personnel involvement likely to impinge significant implications on computerisation moves.

CHAPTER 5

STATE OF COMPUTER TECHNOLOGY

5.1 INTRODUCTION

The purpose of this chapter is to review the developments in computer technology. We examine the developments in computer technology under hardwares[1] and softwares.[2] Hardware is further examined into central processors[3] (mainframes) and peripherals.[4] Softwares are similarly looked at into languages, application packages[5] and operating software.[6]

The developments in computer technology have been so remarkable that it is fashionable to speak of in generations. We are at present in the fourth generation of this development. It is, however, rather unfortunate that many generally conceive only of hardware developments when 'generation' is mentioned. The generations actually have reference to the entire state of computer technology, hardwares as well as softwares.

5.2 HARDWARE DEVELOPMENTS

5.2.1 Central Processors

The computer is essentially an automatic calculating machine with an

1. Hardware: The apparatus, as opposed to the program or method of use. Readily detachable portions of apparatus may be termed Equipment Units.(IFIP)

2. Software: Programs and procedures associated with a data processor in order to facilitate its use. (IFIP.)

3. Central Processor: The central processor is that part of an automatic data processing system which is not considered as peripheral equipment. (IFIP)

4. Peripheral: All of the input-output units and auxiliary storage units of a computer system. (AUERBACH).

5. Application Package: A computer routine or set of routines designed for a specific application (e.g. inventory control, on-line savings accounting, linear programming, etc.) Note: In most cases, the routines in the application packages are necessarily written in a generalised way and will need to be modified to meet each users' own specific needs. (AUERBACH)

6. Operating Software: A generic term to cover those general programs and

internally stored program. The representation of a computer by the following diagram reveals the basic design principles as well as the components.

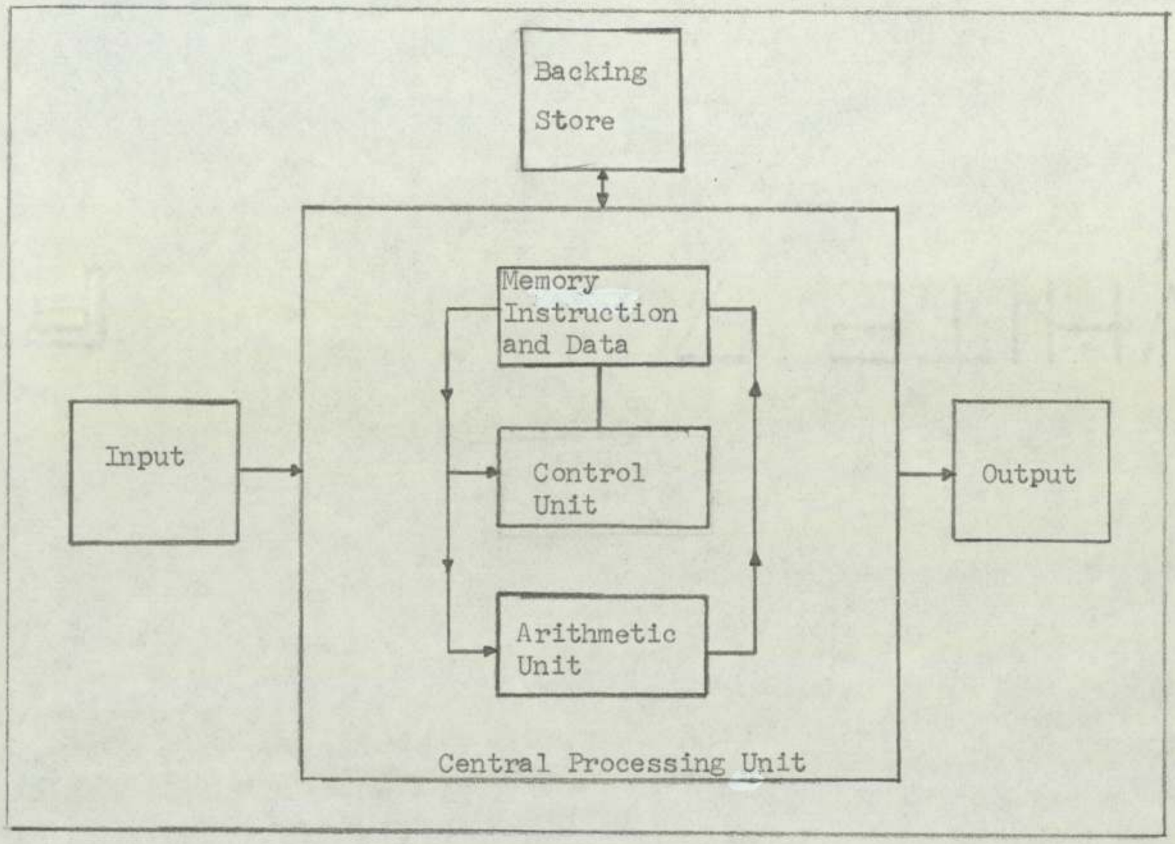


FIGURE 5.1 MAIN COMPONENTS OF AN ELECTRONIC COMPUTER SYSTEM

5.2.1. (i) Basic Circuitry

The circuitry of the arithmetic unit carries out the basic operations (addition, multiplication, and so on) that the computer can perform. The control unit takes instructions from the program in the store, interprets them and initiates the appropriate operations.

The technology employed in the logic circuits of computers has changed from thermionic valve (in the first generation), to transistors (in the second generation), and to integrated circuits, i.e. a number of transistors and associated circuit components in one transistor type encapsulation

routines necessary to the operation of a computer. Frequently provided by the computer manufacturer.

(in the third generation). The further advance comes from a higher degree of integration - large scale integration LSI (fourth generation). LSI incorporates many devices, transistor, diode and resister on a single integrated circuit chip. The advantages of these changes are: increased number of computer circuits, decrease in physical size, increased speed, substantial reductions in cost, and increased storage capacity.

The significance of each generation of computers from CPU aspects may perhaps be best shown

"by an examination of the factors of (1) size, (2) speed, (3) cost, and (4) information storage capacity.

Size: The earliest computers used vacuum tubes and were large enough to store grain in (ENIAC weighed 30 tons.) Using transistors rather than tubes, second-generation computers were significantly reduced in size. Compact tube equipment contained an average of 6,000 components per cubic foot. By using cooler operating and more reliable transistors, however, it was possible to pack an average of 100,000 circuits into the same space. And the third generation computers ... make use of microelectronic or integrated circuits, making it possible to jam 10 million circuits into the same cubic foot of space. Furthermore, the extension of microelectronic concepts holds forth the promise of future large-scale integration (LSI) of circuits which will make it feasible to again increase the number of circuits by many times. Such size reductions make it possible to build, in an ever smaller package, a machine with the computing power of the earlier monsters. That many currently produced computers are also rather large merely gives an indication of the growth in computing capability.

Speed: Component minitureization has brought increased speed of operation to the latest increased speed of operation to the latest computers. Why is this? It is because size reduction means shorter distances for electrical pulses to travel, and thus processor speed has increased. Current machines are 900 times faster than 1950 models. A job taking one hour to finish in 1950 could be completed now in three or four seconds. Early computer speed was expressed in milliseconds (thousands of a second): second-generation speed was measured in microseconds (millionths of a second): and third generation hardware has internal operating speeds measured in nanoseconds (billionths of a second).

Cost: The cost of performing a specific number of operations has declined dramatically. Professor Jay Forrester, of M.I.T., has estimated that the cost of performing a million calculations twenty-five years ago on precomputer machines was $30,000; he notes that computers can do the same number of calculations today for 30 cents! And

E. L. Harder of Westinghouse Electric Corporation illustrates the reduction in computing cost with these words:[3]

> I use a measure which I adopted many years ago, a calculation requiring two weeks on desk calculators by two engineers at a cost of $300 that gives you an idea of how long ago it was. This calculation can be done today for seven-tenths of a cent on a very large high-powered computer.

Nor does it appear that the end is in sight in computational cost reduction. Basic hardware-component costs will continue to decline. For example, in 1965, it cost about 20 cents to provide internal storage capacity for one binary number (down from 85 cents in 1960 and $2.61 in 1950). The comparable cost in 1970 is estimated to be from 5 to 10 cents, while the 1975 figure is set at ½ cent!

Information Storage Capacity: Information may be stored for use by a computer in a number of ways. The central processor of the computer holds data and the instructions needed to manipulate the data internally in its primary storage or main memory unit. This primary storage capacity in early computers was quite small (2,000 to 4,000 "words"). With second generation hardware, internal storage was available which exceeded 30,000 words; and current computers can store hundreds of thousands of words in primary storage."[7]

5.2.1. (ii) Rapid Access Stores

The control unit and the arithmetic unit operate at very high speeds (up to 10m operations per second). The speed of operation of the computer, however, is limited by the time it takes to obtain data from the store to operate on (access time). Rapid access times are expensive and so it is usual to divide the computer storage capacity between a small, rapid access store (memory) and cheaper stores with slower access, called backing stores.

The developments in rapid access store (memory) take two directions in the organisation of the store and the recording material of the store.

3. E. L. Harder, The Expanding World of Computers, Communications of the A.C.M., Vol. 11.

7. Donald H. Sanders, Computers and Management, McGraw Hill Book Company New York, 1970, pp. 60-62.

The early concept of multi-level storage whereby a relatively small amount of immediate access storage was backed by a large amount of relatively slow backing storage is being extended to the organisation of the immediate access storage itself. A relatively large but very fast store is being introduced to serve as a buffer between the central processor and the larger slower main store. Storage at the main and buffer levels is often divided into a number of blocks so that the access of data (and instructions) from different blocks can be interleaved. The organisation of stores have taken various forms each serving special functions.

The associative stores address the store locations by context rather than by their positions in a matrix of storage elements. The purpose is to make the holding of data and its access an active element in the operational processes of the computer.

The active stores developed by the Royal Radar Establishment at Malvern lead to a significant gain in efficiency over software provision for list processing. It enables lists to be processed by hardware at an average instruction time of 600ns (nano seconds). This is important in complex information retrieval systems.

Read only memories (ROM) implement the micro-programs which combine to make up the instructions order code of the computer. ROM thereby replace some of the wired-in logic by relatively flexible form of logic. ROM enable the instruction code of the computer to be more nearly matched to the particular problems it has to solve and enhances the speed of some complex processes carried out by software.

The materials used for memory devices in order of reducing costs, speeds (increase in access time) and increasing storage capacity are:-

		Capacity	Cycle Time	Remarks
1.	LSI			
	MOS (Metal Oxide Silicon)	1000 words	5 ns	Volatile, Min external circuitry requirements
	Bipolar	smaller	10ns	
2.	Thin Film			
	Planer Thin Film Plated wire	1000-2000 words 4m words medium	100ns 1 micro-sec.400ns	Non-destructive readout (NDRO), less complex electronics output, less power consumption
	Rod memory	524,000 characters	800 ns	NDRO not possible
3.	Ferrite core store	512-2m words	3 micros 300 ns	
4.	Fabricated memories Thin permalloy sheet	10m bit	10 micro secs.	NDRO Power requirement low. Cost .4p per bit

5.2.2. Peripherals

5.2.2. (i) Backing Stores

We observe that the medium for backing stores are magnetic tapes, discs, drums and magnetic cards. The chief development in this area confine to exploitation of information bit packing potential of the magnetic medium and mechanical design features to minimise tape wear and facilitate ease of operation. Various recording techniques have been searched for and the position is as follows:

	Density	Remarks
Magnetic tapes		
Phase encoding recording technique	3200 rows per inch on 9 channel tapes	5,000 r.p.i. have been achieved in labs.
Analogue recording technique	30,000 r.p.i. on 36 channel tapes	Research undertaken for 90,000 r.p.i. & 180,000 r.p.i.
Transverse recording technique	700,000 bits to the square inch (9 track 3,200 r.p.i. have a density of 57,600 bits/sq.in.	Extension to double this is practicable. Search speed 1000 ins/second. Transfer rate 6m bits/second
Disc and drums	4,400 bits per inch and 200 tracks per inch	15,000 bits per inch has been achieved in labs and 300 t.p.i.
New disc file	200 M bits	Transfer rate 326K bytes and head positioning time between 50M sec. (max.) and 6M sec. (min.)
Magnetic Cards	Over 10^{10} bits	Suitable when activity rate is low

"Extensive research is carried out into a wide range of physical phenomena and associated systems which appear to offer potential for the development of backing stores of immense capacity. The use of the laser beam, a source of coherent light capable of being fused with a very high degree of resolution, figures prominently in many of the developments; drawbacks are that it requires optical and mechanical systems of a very high order of precision, special environmental conditions, and in most instances, a separate development process.

Unicon Store

... This store is based on the use of an argon laser to burn minute holes in the coating of a helically transported 16mm tape. The holes represent binary '1's. They are read by directing a lower power laser beam onto them; the light emerging is then converted by photomultiplier units into electrical impulses. A capacity of 645 million bits per square inch is claimed; on this basis one 2,400 foot reel of tape would hold enough binary information to fill many thousands of reels of magnetic tape. The read-out process is apparently the greatest difficulty in the development of this store.

Magneto-optic Store

... This store utilizes the laser beam to change the direction of magnetism in very small areas of a ferro-magnetic film of manganese bismuth. Each area stores a binary bit. Read out is achieved by use of the magneto-optic Faraday Effect whereby polarized light passed through glass parallel to a magnetic field is rotated in proportion to the degree of magnetization. Clockwise or anti-clockwise rotation will occur depending on the polarity of the magnetization, and thus enable '0' or '1' bits to be identified. A packing density of between 6 and 24 million bits per square inch with a read out rate of 100 million bits per second are considered feasible. Honeywell have an interest in the development work. A body of opinion considers that the prospects for the success of this technique are greater than for others using the laser beam.

Laser-Hologram

... Development work is apparently being undertaken on this technique and reports in the technical press suggest that some form of viable holographic store is likely to result. Briefly, the technique uses an helium/neon laser to store binary bits on a place, usually photographic, in the form of a large array of mini-holograms. The information is read out by the use of another laser beam which reconstitutes the original image of discrete information bits at a read out plane comprised of sensitive photo-transistors. This store has the great advantage that dust settling on the hologram storage plate has little effect on the retrieval of the stored binary information. A store comprising 1 million bits with a read out time of 20 microseconds has already been produced. All the disadvantages (requirements of optical and mechanical systems of a very high order of precision, special environmental conditions and a separate development process) apply to this store. But several developments are at present in hand to overcome them. RCA are working on the production of holograms on a manganese bismuth coated mica film, using the physical effects described in the preceding paragraph on the magneto-optic store. If successful, this approach will overcome the limitation of the photographic storage plate which has virtually confined the Laser-Hologram store to the read-only category. A storage capacity of 100 million bits per square inch is considered feasible, with a writing time of 10 microseconds and an erasure time of 20 microseconds. I.B.M. Ltd., is known to be developing a new cheap light deflector switch believed capable of the precision needed in this application but it is a relatively slow device. Bell Laboratories in America are developing a deep, or volume, holographic store and claim that 1 million bits may be stored in a one centimetre cube of lithium niobate. In the U.K., Plesseys are also known to be interested in the development of this type of store. Although the outcome of this intensive research cannot be predicted, there can be no doubt of the significance of its success for the establishment of large data banks.

Sonic Memory

... This store is in the very early stages of development by R.C.A. One of the main advantages claimed for it is a read out time of less than one microsecond. The store comprises magnetic film strips deposited on glass substrade such as fused silics. Sets of conductors, wired to amplifiers, are suspended above the film. The writing and reading digital information to and from the store is achieved by the 'piezo-magneti' effect. Advantage is taken of the fact that a state of magnetization can be more easily changed if the material magnetized is subject to strain. Strain in this store is produced by the passage of some pulses through the substrate.

Other Backing Store Research

... For some years, research has been carried out to determine whether a high capacity store can be based on the phenomena of superconductivity at very low temperatures. There has been little success with the development of the cryogenie store based on this phenomena. The cryoelectric store, which also requires temperatures approaching to absolute zero, may possibly be more successful. Research continues. One of the major drawbacks with these stores is the use of expensive liquid helium to maintain the very low temperatures required. Other research is being carried out into the use of magnetic bubbles for storage purposes; into the possible use of optical delay lines using light as the storage medium; and into the possibility of establishing biological stores."[8]

5.2.2. (ii) Output Peripherals-Printers

There are two distinct types of printers: line printers and character

8. C.S.D. Management Studies 2, Computers in Central Government Ten Years Ahead, Her Majesty's Stationery Office, London, 1971, pp.148-149

printers. Line printers are of two main categories, the impact type, and the non-impact type. Impact type predominates and prints by the impact of a print hammer against a character font embedded in a rotating drum, or in a slug fitting into a chain loop or oscillating bar. The improvements in print hammer design, in the method of inking the hammers, in printer paper and in the manner in which the paper is fed to the printer make it possible to achieve a maximum speed of 3,000 lines per minute with a 48 character sets.

Non-impact printers print by chemical, electrostatic or similar means. The advantages of non-impact printers are large character repertoires, high speeds and significant noise reduction. The size and shape of font can be changed to create drawings and graphs as well as to reproduce various print styles. The non-impact printers also produce constant format lines and thus print form outlines. These printers produce OCR (Optical Character Recognition) quality print at 18,000 lines per minute and the speed could go up to a maximum of 26,000 l.p.m. with a reduced line width.

Character printers fall into two main categories: those associated with keyboards and those not so associated and driven either directly by the computer or by paper tape. Developments have been made doubling the speed of keyboard character printers to 20 characters per second. The character printers without associated keyboard are of two classes like line printers: the conventional impact type and the non-impact chemical, electrostatic, etc. type. The former costs in the region of £3,000 for a speed of 60 characters per second and produces good quality print. Machines working at 20 characters per second are available and substantially cheaper. The non-conventional machines offer a wide variety of choice with differences in convenience and print quality but essentially working at speeds of 60 characters per second.

5.3. SOFTWARE DEVELOPMENTS

The term software is very general and encompasses all programs and routines associated with the use of computer hardware. I.C.L.[9] identifies software into four categories:-

1. Programming languages: We presume they refer to the translating programs (assemblers and compilers) related to languages at different levels. Machine codes, the language of hardwares are at the lowest level. Next comes the machine oriented symbolic languages, i.e. auto codes as the low-level languages using assemblers to translate into machine language. The high-level languages are machine independent and procedural and use compilors for translation into machine language.

2. Software Packages: These are complete programs designed to carry out complex commercial and technical operations.

3. Utility Software: Utility programs carry out standard operations such as the input and output of data, conversion of data, sorting of records and transference of data between magnetic tape and the central processor.

4. Operating Systems: These are programs that organise and control work performed by the computer. They also organise the running of all other

9. I.C.L. Introduction to Computer Systems, Technical Publications Service, I.C.L., London, 1969.

programs to ensure sufficient use of the machine configuration.

5.3.1. Programming Languages/Translation Programs

The progress of programming languages from machine codes to machine oriented symbolic auto codes (low level languages) and then to machine independent procedural high level languages represents the developments that have taken place under this category of software. It is to be noted that these translation programs or software takes over not only the translation task from a programmer and convert his instructions into machine-usable form but also the detailed job of keeping track of the storage locations of data items and instructions.

It might perhaps be useful to look into the program translation process or the way translation software perform in the operation of a typical computer system. The translation program/language translator is stored in auxiliary memory on cards or on magnetizable medium. It is read into the computer where it controls over the translation procedure. The source program written by the programmer is converted into a machine-readable form (e.g. punched cards) and is read into the computer a card at a time under the control of the language translator. This operation produces an object program in machine language. This is then read into the computer to process the problem data. This process appears somewhat like below:

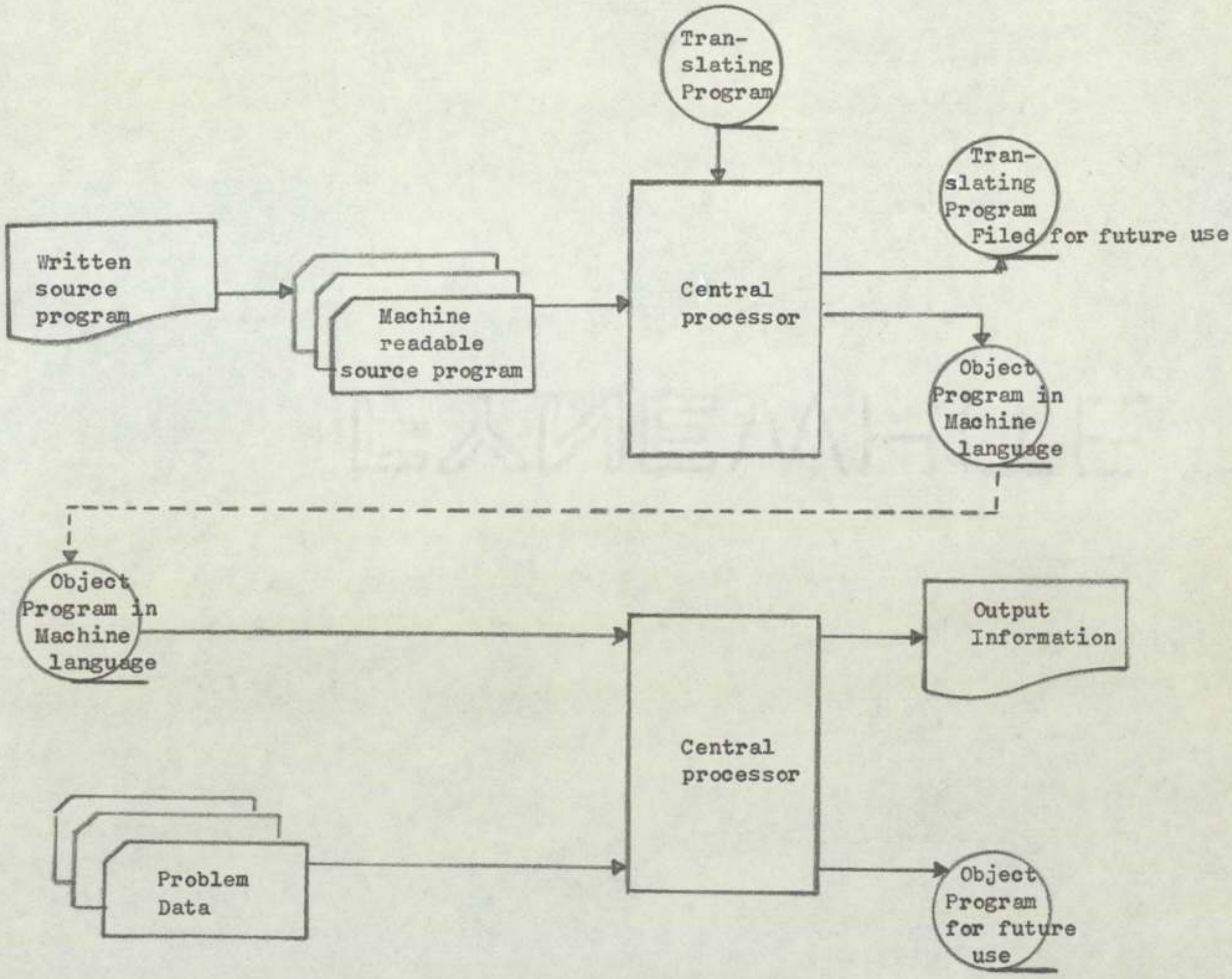


FIGURE 5.2 LANGUAGE TRANSLATION PROCESS

The high level languages perform an important compatibility function. Programs prepared in these languages are essentially machine independent i.e. they can be used with a number of different hardware makes and models with little or no modifications. The compatibility function (1) reduces the need to rewrite programs when a new computer is acquired, (2) permits greater exchange of programs, information, and data among computer users, and (3) encourages the commercial development of packaged programs designed to process a particular application in a given industry. The other advantages of these higher level languages are the quicker production and easier testing of programs. However, the higher languages are less efficient than machine and auto code and increase store usage and computer running time. It is opportune that there has been increasing sophistication in central processor logic and much larger immediate access stores to counter these gross inefficiencies. Many languages have failed to keep pace with developments in system design. "COBOL, FORTRAN and ALGOL were all developed in the days when magnetic tape with its serial processing implications for systems design was dominant. They were therefore not powerful enough to meet the later demands of real time working or the full demands of direct access processing (none can handle variable length working on disc, and FORTRAN cannot handle access in the indexed sequential mode.)"[10] We observe that manufacturers have realised these shortcomings and there has been gradual introduction of new versions of the languages to remedy the lack of facilities revealed by system developments, ALGOL 68, for example provides for direct access working as well as some features needed in commercial applications. There have also been developments to provide facilities for modular programming (USASI COBOL). A number of new higher level languages have also been developed to intensify the orientation towards problems e.g. LISP for list processing; SPECOL for information retrieval; SIMON, SIMULA for simulation; APT for the numerical control of machine tools; TELCOMP and POP2 for time sharing.

5.3.2. Software Packages

Programs are prepared to solve the particular processing jobs on computers. These programs are usually prepared by each user organisation to process such jobs as payroll, billing and accounts receivable, inventory control, costing, production control, project scheduling, etc. The needs and purposes of users in processing such jobs are often unique. But many in the same trade employ essentially the same accounting procedures for such tasks. It, therefore, is a waste of programmer time to duplicate

10. Ibid, p.134

programs prepared in other companies. These factors brought into vogue the preparation of packaged programs by computer manufacturers, software houses and bureaus.

The kinds of packages available to users are many and vary within a wide range of generality/specificity of applications. There are absolutely general statistical or mathematical packages at one end and tailor-made unique user program suites at other end. It is beyond the scope of this thesis to go into the developments in this area and all we wish to say is that, despite the benefits and contributions by packages falling short of those being claimed, they foster faster implementation of applications with some 25 per cent savings in costs.

5.3.3. Operating System

Operating system connotes all programs and facilities which oversee the entire operation of a computer system. An operating system performs the following functions:

(1) The selection of jobs to be run on a priority basis with a view to balancing input/output and processing.

(2) The allocation of storage space and suitable peripheral to selected jobs.

(3) The control of input and output housekeeping operations.

(4) The calling up of other programs including assemblers, compilors (translating programs), and the installation's file of application's programs.

(5) The execution of utility routines i.e. loading programs, clearing storage, sorting and merging of data, and diagnostic testing of new programs, etc.

(6) The assignment of storage locations to object programs and data.

(7) The proper handling and shifting of data, instructions and intermediate processing results when a high-priority program interrupts the processing of a lower-priority program.

(8) The timing of each job processed and the allocation of processor time to user stations.

(9) The communication of control messages to human operators.

We observe that the following represents the most important developments under operating systems.

(i) Micro-programming or extracoding
(ii) Multiprogramming
(iii) Multi-processing
(iv) Tele-processing, and
(v) Time sharing systems.

5.3.3. (i) Micro-Programming

This in the simplest terms is the simulation of complex instructions within the machine by a sequence of primitive instructions, rather than directly implementing them by special-purpose electrical circuits in the machine. Multi programming build complex instructions such as multiplying, from primitive instruction sets like addition. The micro-programs are held in special read-only store and not in the memory like other data. The ability to access ROM at a speed higher than the basic rhythm of the machine make it possible to execute micro-programs at much higher speeds than normal sub-routines. The development of micro-programming enable general purpose computers to be oriented to a scientific or commercial performance under the control of the computer itself. Thus the nature of the machine can be changed conveniently and inexpensively by replacing the micro-program or selecting those required from a store.

5.3.3. (ii) Multi-Programming

We have seen tremendous improvements in the speeds of central processing units. The unit of time in fourth generation units is nano-seconds. The speed of input/output units, because of the electro-mechanical nature of these equipments, on the other hand have not kept pace with CPU developments. There is thus an imbalance between processor and peripheral speeds. Moreover jobs differ in their demands of various facilities. One job demands a large memory; the next generates a large volume of printed output; others may be devoted to reading and checking input data. All of this create a sitution where the full speed of the processor is seldom used and some or other of the facilities of the installation are always left idle when jobs are run sequentially. Multi-programming on the processing of two or more streams of work inparallel is developed to resolve this situation.

There are two or more jobs sharing a computer installation in multi-programmed operations. Each job has its allocation of storage and peripheral and the central processor switches from one job to another, being always directed at one which is not awaiting a peripheral. When a job is completed, its core allocation and peripheral are freed and used by a subsequent job, while the other concurrent streams continue in operation. We appreciate that an ideal balance of jobs and frequent re-direction of central processor to parallel streams of jobs are essential to keep all the peripheral channels active. The re-direction might require to be in the order of 100 times per second even with the smallest multi-programming configuration. At the beginning, irrespective of the balance of jobs, the number of streams were limited by the available printing devices because most jobs produce some printed output even if the volume is small. This is overcome by the development of facilities for "off-lining" input and output. This facility stores information on magnetic media (tape or disk) intermediary to transcription by standard routines onto input or output devices.

5.3.3. (iii) Multi-processing

Multi-processing essentially means processing by the employment of more than one processor in a single installation. There are two main trends under multi-processing: (1) the use of specialised stored-program processors for functions often associated with input-output, and (2) the bringing together of two or more similar processors to provide extra power or improved reliability.

The use of a specialised stored-program processor represents multi-processing on the smallest scale. The specialised processor controls a peripheral or communications subsystem with the objective of relieving the main processor of repetitive interruptions. In these cases, a fairly small but separate computing system is employed to handle messages. This type of processor is known as front end processor. It operates as a sophisticated terminal controlling for example, a reader keyboard and slow line printer. A resident program performs checks on data transfers, buffers messages and directs the operations of the attached devices after communications with the main computer.

The use of dual or multiple processors with a common main store is looked at as a means of increasing the capacity of a configuration. A supervisor program in the common store oversees the simultaneous operations of jobs. There are problems in accessing the store and the use of the supervisor. Safeguards are necessary against mutual interference in the event of a fault. The whole installation may effectively become useless by a fault in one processor when the peripherals are connected through the main processors rather than through separate channels to the main store. Nevertheless, this type of multi-processing is popular for real-time applications because of the inherent safety duplication which is really effective when necessary attention is paid to hardware and software.

5.3.3. (iv) Tele-processing

Tele-processing extends access to a central system from remote points by using the existing telephone services. This is effected through a data link control system which incorporates the following facilities:

(i) Devices known as modems for modulating and de-modulating the data signals to pass through the telephone circuits.

(ii) Detection and correction either by re-transmission or by sophisticated error correction coding techniques of errors caused by circuit deficiencies of telephone system.

(iii) Supervisory and control signals to control the operation of the remote terminal in working with the computing system.

(iv) Multiplexors to merge the several low speed circuits from terminals onto a common high speed circuit; and concentrators to edit out redundant information like blanks inserted by terminals in transmitting data.

5.3.3. (v) Time-Sharing Systems

The multi-programming, multi-processing and tele-processing discussed above have all contributed towards the use of time-sharing systems. Time sharing system is one of the most sophisticated forms of real-time systems in use today. These time-sharing systems are also called as interactive or multi-access systems to describe their method of use and the nature of their applications.

In time-sharing systems, the response to each terminal appear as though it is dedicated entirely to it alone. This is required despite the large number of terminals connected concurrently to the system. This is based on a regular scan of all users who are currently requesting service from the system (entry, compilation, job run, output). Every active user is given predefined time slice of attention in turn while inactive users are passed over quickly. This basis ensures that every one's waiting time is predictable though the response to requests varies with the crowdedness of the system. The breakthrough to time-sharing systems came with the management of storage space required by each user 'logged on'. This was a major problem at the beginning because an allocation of the main storage adequately to each user demand storage capacities considerably in excess of those available. It was solved by dividing each and every program of users into smaller segments, usually known as 'pages', and hold them in a backing store known as systems residence file. The active page of the user program relating to active terminals is shifted back and forth between the main store and backing store. A device known as Dynamic Address Translator (DAT) keeps track of all storage allocations, notes the availability of space and translates the addresses used by the actual programs to fit the page to that space in the main storage allocated to it. This is known as virtual store (v/s) and can assume a capacity considerably in excess of the physical capacity of the actual main store.

The breakthrough in developing time-shared computing provided the key to the management's use of the computer as a decision-making tool. The multiple-user access to a major computer installation provided the needed economies; the user paid only for the time used and was relieved of the problem of computer operation. No fixed investment commitment was necessary. The computer terminal was portable and could be installed in the manager's office or some adjacent location. The dependence on service schedules of a central computer group and intermediaries in the form of machine operators, keypunch operators, and programmers was eliminated.

5.4. CONCLUSION

We have seen accelerating technological developments in computers with expectations to continue to the year 2000. There are also advances in software though they certainly lag behind hardware developments. We could even find firms running their third generation computers with first generation software as recently as the late 1960s.[11]

11. Chresten A. Bjerrum, Forecast of Computer Developments and Applications 1968-2000. Futures, Vol.1, No. 4, June 1969. Quarterly Published by Iliffe Science and Technology Publications, Ltd., U.K. in co-operation with the Institute of the Future, USA.

On the whole, the tremendous developments in technology have reduced costs, increased the speeds and storage capacities so as to place computers within the reach of many. A typical growth which largely contributed to the latter has been the tele-processing and time sharing systems, characterised by networks of terminals connected to some large computers. The time shared systems are accompanied by introduction of interactive high level languages which make users all the more easier to design and develop EDP systems. The fact that users now have part share, fast response and direct contacts with computers at comparatively small costs is encouraging to apply computers to adaptive budgeting practices.

CHAPTER 6

THE APPLICATION OF COMPUTERS TO BUDGETING AND FINANCIAL PLANNING

6.1. PLANNING APPLICATIONS VIA MODELS

The planning applications are carried out through models. This applies to all types of planning irrespective of whether computers are or are not used in the process. Models represent particular aspects of reality. Models explain and predict the behaviour of the phenomena which they represent, thereby assisting the planner in decision making tasks. The core of computer applications to budgeting and financial planning lies in constructing the logic to represent the financial aspects of the operations, transactions and activities of an organisation and converting that model in a specific computer language into machine processable form (computer program). In this chapter, we examine the state of computer applications to financial planning under: types of models, model logic and approach, ready made and tailor made programs, computer languages used, modes of operation, and the benefits derived from applications.

6.2. TYPES OF MODELS

Models in general may be classified into physical models and abstract/symbolic models.

6.2.1. Physical Models

Physical models are carefully scaled replicas of certain objects under study. However, there need not always be changes in size. Physical models may be analogue or iconic and are widely used in various branches of natural/physical sciences, engineering and in industry. We find these models used for designing aircrafts, ocean liners, bridges, water supply systems and all sorts of products from automobiles to stage scenery. This class of models, therefore, does not concern us and we are mentioning them to avoid an omission.

6.2.2. Symbolic Models

Symbolic models represent a certain process of abstraction and conceptualisation. Models used for budgeting and financial planning are a subset of symbolic models. We would hereafter refer to this subset as budget/financial models. Financial models are representations of the financial aspects and impacts of a firm's transactions to facilitate financial projections. They are employed in applying computers to a firm's budgeting and financial planning operations. We are, therefore, looking into the various types to see which is most often used for such purposes.

The application of computers to budgeting and financial planning employ two types of symbolic models: optimisation/analytical models and simulation/heuristic/case-study type models.

6.2.2. (i) Optimisation Models

Optimisation models seek the best course of action/plans under a given set of assumptions. These models search for solutions with optimum objective function either by minimising costs or maximising revenues or both. Optimisation models use operational research methods of mathematical programming to derive optimum solutions. A basic pre-requisite of optimisation models is that the operations of a firm should be reducible to definite mathematical relationships. Budgeting and financial planning, however, are done at a level of aggregation, the complexity of which do not often enable expressions to be made in precise mathematical formats. Moreover, managements find it difficult to appreciate the mathematical sophistication behind optimisation models. They have wider applications to operations at lower levels such as stock control, production and marketing functions.

6.2.2. (ii) Simulation Models

Simulation models imitate the behaviour of the financial flows of a firm. These models produce projections for a certain course of action under given assumptions. Simulation models are still useful even though they do not produce a best solution. Plans can be made for alternatives under given assumptions and each alternative can be tested under different assumptions. The fact that managements do not have to make explicit statements of the objective functions in mathematical terms make it easier to model and simpler to understand, and contributes to their wide use. They are found to be used by 98 per cent of the 65 U.K. companies in 1973.[1] Simulation models can be deterministic or probabilistic/stochastic. Deterministic models use single estimates of input data whereas probabilistic models are run with multiple estimates of input data with relative probabilities attached to each set. It is not surprising that deterministic models are the ones most widely used because multiple estimates attached with probability distributions demand a lot of time, attention and thoughts of managers.

1. Peter H. Grinyer and Jeff Wooller, Corporate Models Today, The Institute of Chartered Accountants in England and Wales, 1975, p.24.

Aspects which equally apply to all models are their nature and behaviour. Simulation models may be information compilor or information generator type in nature and also at the same time static or dynamic in behaviour. Unlike scientific models, financial simulation models perform less calculations, more reporting and so are of essentially information compilor type. Dynamic models interact with time and have time varying mechanisms built in them. Static models are stationary. It is obvious that financial simulation models are dynamic to be of any use.

6.3. MODEL LOGIC

The logic behind models is the matter which determines the character and success or failure of models. There have been developments in model logic to such sophistication that practice has still to catch up with theory. Notably among them are Forrester's work on 'Industrial Dynamics' and Bonini's 'Simulation of Information and Decision Systems in the Firm.' The essential features of these management control models and their appropriateness to computerised budgeting and financial planning are perhaps best summed up by Mattessich as follows:

> "The simulation through control models is characterized by expressing the organizational pattern of a firm as realistically as possible in a mathematical model. In actual practice this results in a gigantic framework with an unwieldy number of equations and variables, reflecting minutious causal relationships of all the decision processes involved. This, not only enforces an integration of separate functional areas such as marketing, investment, personnel, production, accounting, etc., but leads to the exploitation of the various flows of orders, money, material, personnel and capital equipment. It is the coordination of these flows into an integrated information network which, by means of its feedbacks, delays, and amplifications often impresses upon the system its own dynamic and individuality. Thus the major concern of these models must be sought in the analysis of the organizational structure and in the goal of improving upon the established decision rules of a specific enterprise. Since the focus

of investigation is usually directed toward testing responses and fluctuations of the internal components of a firm, the goal is not short-run planning and prediction but rather 'enterprise construction', that is long range planning of the organizational pattern. Thus the control model may serve as a formidable high-speed vehicle for recording, elaborating and supplying current data; or if used for simulation purposes the control model may become an excellent tool for research in large scale enterprises who have an EDP installation on their own premises. But this approach might prove too costly and cumbersome for practical, periodic application in medium and small-sized firms; furthermore it cannot be evolved out of an existing budgeting system since its hypotheses are based on minutious causal relationships that require data which are prohibitively expensive to determine." 2

The budgeting and financial planning applications, being at levels of aggregation at corporate, subsidiary, and division as the lowest, in addition to the foregoing observations are found to be based predominantly on accounting conventions and hypotheses. We observed that Potlatch Forests, a large integrated forest products company in U.S.A. having 44 plants and 36 sales offices with annual sales of $335m and 12,000 personnel in employment used the following logic in their models.[3]

Plywood Model

Preliminary Calculations (See P1, V1, etc in Data List)

Desired plywood production	DPP	=	V1
Pressing capacity	PC	=	P4 and
		=	P4 x (1 + P6) if time P5

2. Richard Mattessich "Budgeting in the Computer Age" in Budgeting (pub. by The Budget Executives Institute) Vol. 12 No. 1, September 1963, p.30

3. James B. Boulden and Elwood S. Buffa, Corporate Models: On-line, Real-time systems, HBR, July-August 1970, p.74

Actual plywood production	APP	=	Min (DPP, PC)
Required veneer	RV	=	APP/P17
Veneer capacity	VC	=	P7
		=	P7 x (1 + P9) if time P8
Veneer produced	VP	=	Min (RV, VC)
Purchased veneer	PV	=	RV - VP
Required logs	RL	=	VP/P16
Lumber produced	FLP	=	VP/P18
Chips produced	CP	=	VP/P19
Own logs	FOL	=	P12 x RL
Forest service logs	FSL	=	RL - FOL

Line No.	Description	Logic
.01	Plywood sales	APP x V2
.02	Chips sales	V4 x CP
.03	Lumber sales	V3 x FLP
.04	Sales eliminations	-(.02 + .03) x P25
1.00	Total sales	.01 + .02 + .03 + .04
1.01	Discounts and allowances (plywood)	(.01) x P13
1.02	Commissions on plywood	(.01) x P14
1.03	Freight-out for plywood	APP x P15
2.00	Total allowances	1.01 + 1.02 + 1.03
3.00	Net sales	1.00 - 2.00
3.01	Raw materials	(P10x P12 x RL + P11 x (1-P12) x RL) x GROWTH (P2, 0)

Line No.	Description	Logic
3.02	Veneer purchase	PV x V5
3.03	Operating supplies, mfg. overhead	(VP x P20 + APP x P21) x GROWTH (P2,0)
3.04	Labor	(VP x P22 + APP x P23) x GROWTH (P1,0)
3.05	Raw materials cost eliminations	-P12 x VP x GROWTH (P3 ,0) x P26 x P10/P16
7.00	Total direct expense	3.01 + 3.02 ... +3.05
8.00	Gross profit	3.00 - 7.00
9.00	Fixed costs	V6
10.00	Selling expenses	V7
11.00	General and administrative expenses	V8
12.00	Other expenses	V9
13.00	Total indirect expenses	9.00 + 10.00 + 11.00 + 12.00
14.00	Net profit before tax	8.00 - 13.00
22.00	Gross profit/net sales	8.00/3.00
23.00	Indirect expenses/net sales	13.00/3.00
24.00	Net profit/net sales	14.00/3.00
25.00	Plywood production (MM sq.ft.)	APP
26.00	Veneer production (MM sq.ft.)	VP
27.00	Lumber production (MM board feet)	FLP
28.00	Chip production (units)	CP
29.00	Percent of new veneer capacity needed	(RV-VC)/VC

30.00	Percent of new pressing capacity needed	(DPP-PO)/VC
31.00	Labor (1,000 man-hours)	VP x P22 + APP x P23

Data List - Parameters (written as P1, P2 and so forth)

Parameter Number	Description
1	Labor growth rate
2	Operating supplies growth rate
3	Raw materials growth rate
4	Initial pressing capacity (millions of sq.ft. per month)
5	Month number (1-72) of pressing capacity increase
6	Increase in P4 as a fraction of P4
7	Initial veneer capacity (million of sq.ft. per month)
8	Month number (1-72) of veneer capacity increase
9	Increase in P7 as a fraction of P7
10	Price of own logs (dollars per log MBF)
11	Price of forest service logs (dollars per log MBF)
12	Fraction of logs from own supply
13	Discounts and allowances for plywood as a fraction of sales
14	Selling commission for plywood as a fraction of sales
15	Freight-out for plywood (dollars per MBF)
16	Yield MSF veneer per log MSF
17	Yield MSF $\frac{3}{8}$-inch plywood per MSF veneer
18	Yield MBF lumber per MSF veneer produced
19	Yield chip units per MSF veneer produced
20	Operating supplies (dollars per MSF veneer produced.)

21 Operating supplies (dollars per MSF plywood produced)

22 Labor hours per MSF veneer produced

23 Labour hours per MSF plywood produced

24 Labour cost (dollars per hour)

25 Sales eliminations of chips and lumber (percent as decimal)

26 Cost eliminations of own logs (per cent as decimal)

V-arrays (written as V1, V2 and so forth)

Array Number	Description
1	Desired plywood sales-production (millions of sq.ft. per month)
2	Plywood prices (dollars per MSF)
3	Lumber transfer price (dollars per MBF)
4	Chip transfer price (dollars per unit)
5	Veneer purchase price (dollars per MSF)
6	Fixed costs ($1,000 per year)
7	Selling expenses ($1,000 per year)
8	General and administrative expenses ($1,000 per year).
9	Other expenses ($1,000 per year)

Read: MBF = thousands of board feet; MSF = thousands of square foot

We also observe the following accounting logic being used by Associated Television Management Services (ATV) in their financial models which produce profit and loss account, cash flows and balance sheet.[4]

Code	P = Profit and loss account
Year Z = This Year	C = Cash flows

4. Peter H. Grinyer and Jeff Wooller, op. cit. pp.68-70

Year N = Year (Z-1) B = Balance sheet

I No	II Steps		III Detailed accounting logic
P1	Profit before interest	=	P1(N) x growth factor
P2	Depreciation	=	B11(N) x depreciation rate + depn. on new assets
P3	Profit before interest and depreciation	=	P1 + P2
P4	Loan interest	=	B6(N) x rate of interest
P5	Overdraft interest	=	C17
P6	Profit before tax	=	P1-P4-P5
P7	Tax on profit	=	P6 x rate of taxation
P8	Profit before dividends	=	P6 - P7
P9	Dividends	=	P9(N) x growth factor
P10	Carry forward to Reserves	=	P8-P9
C1	Profit before interest and depreciation	=	P3
C2	Plant replacements	=	P2 x growth factor
C3	Plant additions	=	Fed in as separate data
C4	Land, buildings additions	=	Fed in as separate data
C5	Repayment loan stock	=	Zero except for specified years when it will be B6(N)
C6	New company acquisitions	=	Fed in as separate data
C7	Increase in working capital	=	Fed in as separate data
C8	Loan interest less tax	=	B6(N) x rate of interest x distribution proportion
C9	Taxation	=	B5 (N) x payment proportion
C10	Dividends	=	B4 (N)

C11	Outwards cash flow	=	C2 + C3 + C4 + C5 + C6 + C7 + C8 + C9 + C10
C12	Cash flow before overdraft	=	C1 - C11
C13	Opening overdraft	=	B7 (N)
C14	Cash flow before overdraft interest	=	C12
C15	Closing overdraft before overdraft interest	=	C13 - C14
C16	Average overdraft	=	(C6 + C13 + C15) ÷ 2
C17	Overdraft interest	=	C16 x rate of interest
C18	Closing overdraft before new loan stock	=	C15 + C17
C19	New loan stock	=	£500 if C18 exceeds £1,000
C20	Closing overdraft	=	C18-C19

B1	Issued shares at 25p	=	B1 (N)
B2	Reserves	=	B2 (N)+ P10
B3	Capital and Reserves	=	B1 + B2
B4	Dividends payable	=	P9
B5	Taxation	=	B5 (N) + P4 + P7 - C8 - C9
B6	Loan stock	=	B6 (N) - C5 + C19
B7	Overdraft	=	C20
B8	Total liabilities	=	B3 + B4+ .. + B7
B9	Goodwill	=	B9 (N)
B10	Land and buildings	=	B10 (N) + C4
B11	Plant cost	=	B11 (N) + C2 + C3
B12	Plant depreciation	=	B12 (N) + P2
B13	Investments	=	B13 (N)
B14	Working capital & cash	=	B14 (N) + C7

B15	New company acquisitions	=	B15 (N) + C6
B16	Total assets	=	B9 + B10 + B11 - B12 + B13 + B14 + B15
B17	Loan% to capital and Reserves	=	(B6 - B7) x 100/B3

6.4 COMPUTER MODELS

The logic in a particular application is transformed into machine processable set of instructions. These instruction sets are written in languages acceptable to the machines. They are called "computer programs." Firms have two choices in this connection. They can either adopt ready-made models or design tailor-made models.

6.4.1. Ready-made Models

Ready made models are immediately ready for use without the need for programming. They are designed by computer manufacturers, software houses, consultants and bureaus building in general routines like those on discounted cash flows, balance sheet calculations and so on to suit a number of users. Ready-made models were offered on the market presumably because programming was once a specialist job. The languages were very mechanistic 'un-English like', error reporting facilities in compilors were poor and the mode of operation was solely 'batch'.[5] It was then very time consuming and painful to get working programs. But now the state of technology has changed and the question of reflecting the unique accounting conventions

5. Batch mode is that approach to processing data whereby jobs are 'batched' and put in a queue for submission to the computer, usually via punched card or tape. Once accepted the jobs normally stay on the computer until completed, and output is usually delivered to the ultimate user as reports typed by line printer.

of the company in the models have come to the front line. A ready-made model is not designed specifically for one company and the general routines are incorporated without reference to the unique accounting conventions of the company. The ready made models are therefore not popular and it was found to be used by 2 out of 65 companies in a survey. Of the 2 with ready-made models, one also used other systems so that only one relied solely on ready-made models.[6]

6.4.2. Tailor-made Models

A tailor-made model is designed specifically for a company and incorporates logic unique to the company. The importance of tailor-made models is apparent from the finding that 64 of the 65 companies in UK live with them.

The size of models vary from company to company, with the smallest ranging from tens of program statements to largest reaching over 10,000. Majority of companies adopt a modular approach which means the main model is broken into a series of sub-models. This approach renders the advantage of easy testing and updating. The number of modules again depend on the complexity and size of the model.

6.5. COMPUTER LANGUAGES

Languages with which the programs may be written fall broadly into four categories: general-purpose programming languages, modelling systems, simulation languages, and special optimisation codes.

6.5.1. General Purpose Languages

General purpose languages have a wide range of mathematical, scientific

6. Ibid, p.197

or business applications and may be used with at most very minor modifications on computers from different manufacturers. The well-known and widely used general-purpose languages are: FORTRAN (FORmula TRANslator), COBOL (COmmon Business Oriented Language), ALGOL (ALGOrithmic Language), PL/1 (Programming Language 1), BASIC (Beginners All-purpose Symbolic Instruction Code), and APL (A Programming Language). Each of these languages lend itself to particular applications.

6.5.2. Modelling Systems

Modelling systems[7] are designed to reduce programming effort by providing routines to perform operations frequently required for corporate financial models, which would otherwise have to be programmed in detail in a general purpose language. These routines provide typical facilities such as various forecasting techniques (like linear regression, multiple regression, curve fitting(least squares), arithmetic progression, geometric progression, moving averages, exponential smoothing and step functions), discounted cash flows, sensitivity analysis, significance testing, consolidations, graphical and histogram output. Modelling systems also have data handling routines built in them. One of the useful features of modelling systems is the ease with which they handle the time dimension. The user merely specifies the time periods he requires and the modelling system handles the number, width of columns, etc. There is some flexibility in modelling systems and the user is free to build his own logic in the model and link together the built-in routines in ways most appropriate to his needs. The most widely

7. J. C. Hull and B. M. Wheeler, Financial Planning: Terminal Case, Management Today, December, 1973, pp. 39-47

used of these systems in U.K. are: FORESIGHT, ORACLE, PA300, PROSPER and STRATPLAN.

6.5.3. Simulation Languages

Simulation languages have many similarities with the modelling systems. They have built-in routines to perform simulation operations. These routines spare the user from the tasks of writing in detail those operations in general-purpose language. Like modelling systems, the error reporting facilities or 'diagnostics' are superior to those generally found in early general-purpose languages. One outstanding feature of the simulation languages is the mechanism for moving ahead the model in small time intervals. The well known simulation languages are: SIM SCRIPT, GPSS (General Purpose System Simulator), GASP and DYNAMO.

6.5.4. Optimisation Codes

Optimisation codes incorporate special linear programming codes to minimise programming required. They permit the use of powerful software such as matrix generators. But in some cases optimisation models may be written in general-purpose programming languages like APL.

It is obvious from brief accounts above that different categories of languages lend themselves to different type of applications viz. modelling systems to financial models, simulation languages to simulation models and optimisation codes to optimisation models. However, general-purpose languages and modelling systems are the most often used in U.K. Grinyer and Wooller in their survey of 65 companies found "that 25 companies used a general-purpose language only, 20 a modelling system only, 12 both a general-purpose language and a modelling system eight both general-purpose language and optimisation code models. Three of these latter companies also used a modelling system. One of the two companies with a ready-made model also used a modelling system."[8] Simulation languages, being suited more to physical mappings, are not used often for financial models.

The major differences between general-purpose languages and modelling systems are summarised below:

Characteristic	General-purpose language	Modelling System
-Computer used	Own or bureau	Own or beureau with greater emphasis on latter
-Mode of operation	Batch, conversational, remote batch (historically batch usually)	Batch, conversational, remote batch (greater use of conversational approach)
-Size	Fewer constraints	More constraints
-Need for skill in programming	Medium to high	Medium to low
-Ability to closely represent specific relationships	Higher	Lower
-Speed of programming and model development	Slower	Faster
-Ease of updating	Lower	Higher
-Cost of model development	Higher	Lower
-Cost of updating	Higher	Lower
-Cost of operation	Lower	Higher

8. Peter H. Grinyer & Jeff Wooller, Op.cit, p.198

6.6. MODES OF OPERATION

There are three modes of operating the models:

(i) Batch,

(ii) Remote batch and Remote Job Entry (RJE), and

(iii) Conversational/interactive.

6.6.1. Batch

The batch mode of operation is the one first used with financial models. The input data is inserted normally in the form of cards or tapes and is queued until such time as the computer is free to accept the jobs. When a job is accepted, it stays on the computer until completely run as a complete batch. There are no interactions between the computer and user or promptings associated with the conversational mode. Jobs are processed away from users and output is delivered after completed runs.

The batch processing is slow to the ultimate user. There comes in such a term as 'turnaround' time in this mode of processing. 'Turnaround' time is the time which elapses between despatch of input data and receipt of output. Turnaround times could be a maximum of 72 hours to a minimum of half an hour with averages around 18 hours. The lack of immediate response in batch mode is the main reason for longer times taken to correct, develop and bring into use new systems.

Batch mode of processing, however, is cheaper to operate because it makes more efficient use of computer time by grouping transactions into jobs which are run successively in the first place and also by using fast line printers for models producing a lot of output data. This could perhaps be the reason that despite the relatively slow response to input, 34 out of

65 companies or 52 per cent are resorting to this mode of operation.[9]

6.6.2. Remote Batch and Remote Job Entry (RJE)

These two modes of operation are characterised by the feeding of input data through terminals and the processing of models in batch mode. The terminals are located away from the main computer installation and can be any distance when normal GPO telephone facilities are available for transmission of data. It is not uncommon to link terminals and computers sited in different countries.

The difference between remote batch and remote job entry methods lies in the terminals used for respective methods. Terminals used for remote batch operation normally accept cards as input, and read these into a buffer store at the main computer where the job enters a queue. RJE operation uses a conventional (i.e. one generally used in conversational mode) keyboard printer or VDU (Visual Display Unit) terminal to feed input to the computer. The input may either be typed on-line (i.e. the terminal is connected to the computer) or punched onto paper tape off-line and then read at the start of the run by the paper tape reader attached to the keyboard printers. The first method is expensive but allows detection of errors before a run is commenced instead of after a batch run has either proved abortive or produced garbage because of errors. The second method of data entry considerably reduces connect time. Apart from these differences in the feeding of input data, remote batch and remote job entry modes process the jobs in 'batch' and print out the results at main computer installation

9. Ibid, p. 199.

for despatch to users or more usually on fast line printers at users' premises. These modes of operation are found to be adopted by 18 out of the 65 companies or 28 per cent with corporate models.[10]

6.6.3. Conversational

In conversational mode of operation, the user is connected to the computer by keyboard printer or VDU.

Keyboard printers are also known as teletypes (ITT trade name) and offer many choices. Some are rather like typewriters with alphabetical and numerical characters plus a few keys to facilitate control. Others have attachments which permit punching and reading of paper tapes. Some more sophisticated terminals enable input of data on punched cards, magnetic tape, magnetic cassette or by optical character recognition. VDUs, on the other hand, resemble television sets in appearance with keyboards and provide faster response to users not requiring hard copies (printed output). All terminals are linked to computers by telephone lines. Users receive prompts from computers in question and answer manner which gives the impression that they are conversing with computers. Instructions and input data are given to computers through keyboards, paper tape readers, or other input devices. Messages from computers and output from models are returned to users via terminals.

The models have to incorporate additional logic to explore a range of 'what if' questions. These models are usually more complex and involve more statements than comparable models for batch processing. Besides, not all general-purpose languages are suitable for conversational models. Special

10. Ibid, p.199

languages like BASIC, JEAN and APL are devised for conversational mode. The speed of response is attractive and the conversational mode is found to be in fairly wide use in that 39 out of 65 or 60 per cent of the UK companies with corporate models are using them.[11]

6.7 BENEFITS OF COMPUTER APPLICATIONS

The application of computers to financial planning must surely bring some benefits with them. The growing body of literature that accompanies the spread of applications claimed among others the following benefits.

"* Greater accuracy and speed of forecasting company performance.

* A means of quickly checking on the internal consistancy of planning assumptions.

* A reduction of clerical effort involved in evaluating alternative proposals and in preparing long-term financial plans.

* As a result, freedom to explore a wide range of alternatives, as opposed to the few possible with manual calculations.

* Release of management time, by reduction of routine calculations, for thinking about strategic problems and their solution.

* Fuller allowance for links with other aspects of the business when evaluating a proposal.

* Fuller understanding of the internal complexities of the company by decision takers.

* Deeper insight into the risks inherent in proposed projects.

* A means of highlighting the key aspects of both existing business and new projects.

* A tool for showing managers the extent to which reported performances will be affected by errors in estimates." 12

11. Ibid p.199
12. Ibid, p.6

CHAPTER 7

PREPARING OPERATIONAL LEVEL BUDGET MODELS

7.1. INTRODUCTION

In the previous chapters, we have looked at the budgeting and planning systems in the contexts of the firm as a whole, their developments to improve system effectiveness encompassing philosophical, technical and behavioural aspects. We have also examined the current state of computer technology with its applications in planning and budgeting systems. But as we observe in the first chapter, the opportunities opened up by the computer technology still remain to be exploited. Even among the largest of the UK companies, computers were used for budgeting and financial planning in at most 7 out of 100 companies. It is our purpose to find out the requirements, problems and implications in applying computers to budgeting and financial planning functions. We carry this out in an open-ended way by developing computer budget and financial planning models for the confectionery group of Cadbury Schweppes Ltd. This is the subject of the present and subsequent chapter. This chapter introduces the company, describes the existing budget system and deals with our work on developing computer-aids to budgeting at operational level.

The work consists of selecting a section, ECLAIRS, which represents one of the 240 cost centres in the confectionery group. Detailed study of the budget working papers is made and budget models are prepared and run on IBM/CALL 360 time-shared system. We used a modelling system language-'STRATPLAN'-in the beginning for three reasons: (i) ready availability of a terminal at the Confectionery Finance Department, (ii) familiarity of finance personnel with STRATPLAN, and (iii) desirability of an 'interactive' mode in computer operations. Serious shortcomings of STRATPLAN are uncovered in the process and we switched over to a general purpose conversational language 'BASIC'. We developed computer models for creation of data and preparation of sales, production, materials, direct wages, indirect wages, direct fixed salaries, and associated employee costs budgets for this selected section.

7.2. COMPANY BACKGROUND

Cadbury Schweppes Ltd. is a parent company with an authorised capital of £100 million. Of this £76.6 million is issued in Preference (£3,278,696) and Ordinary (£73,291,457) stocks and Ordinary shares (£5,598). The group turnover, excluding inter-company royalties and sales, U.K. VAT and overseas sales tax was £438 million resulting a group profit of £34 million in 1973. The company had in the same year, 59 subsidiaries, the holding interests of which were held either by Cadbury Schweppes Ltd. or its subsidiaries. The company's interests lie in all the continents of the world with subsidiaries in USA, Canada, Australia, New Zealand, India, Ghana, Nigeria, Zambia, Rhodesia, Kenya, South Africa, Eire, Germany, France, Sweden, Italy, Austria and Spain. The company operates in confectionary, drinks, tea and foods, health and chemical products, concentrates and essences, wines and spirits, and health foods. We wish to point out that we are modelling for the confectionery group.

The confectionery group of Cadbury Schweppes Ltd. is organised like a separate company with a share capital of £30,675,000. It has a turnover of around £170 m with pretax profits of £12.5 million. It is the largest confectionery company in U.K. The Cadbury group included J. S. Fry, another of the four major chocolate suppliers, and Pascall-Murray, one of the leading manufacturers of sugar confectionery. Its position was further strengthened by £222 million merger of Cadbury and Schweppes in February 1969.

The company's market consists of three sectors: chocolate and chocolate confectionery, sugar confectionery and count lines. Chocolate confectionery includes solid plain, blended and milk chocolate bars, filled blocks, bars, chocolate assortments and chocolate novelties. Sugar confectionery includes boiled sugars, toffees and caramels, jellies and pastilles, and medicated confectionery. Count lines are individually wrapped products like chocolate-covered biscuits. There are as many as 5,000 different products competing in small subdivisions of the overall confectionery market. The Cadbury group has about 250 products and accounts for about a third of total chocolate market. The market share in sugar is around 4 per cent. Cadbury's Dairy Milk and Bournville plain chocolate continues to dominate those sectors and the company is also a brand leader in other types of chocolate bars. It claims about 50 per cent of the sales of milk chocolate assortments (with Milk Tray, Roses, Fry's Turkish Delight, etc.) and has several important count lines - Cadbury's Flake, Fry's Crunchie, Picnic, Curly Wurly, Amazin Raisin and Fudge. In the sugar confectionery range, Murraymints and Murray Fruits present strong competition to established brand leaders. Since the last couple of years, the company has adopted a policy of following profitable brand leaders into the market, introducing Aztec (which increased the total market rather than taking sales from Mars Bars) and Royal Mint as a challenge to Rowntrees After Eight. New products are brought in yearly and continue to make importent contributions to sales. Rumba, Welcome, Cabaret and Hanky Panky are a few examples.

The company's products are distributed through a number of outlets, ranging from small newsagent/confectioner/tobacconists through department stores, variety chains and grocers to specialist confectioners. The company also distributes through wholesalers but on the whole, almost three-quarters of the company's sales are made direct.

The confectionery group of the company suffered from fairly large cost increases, both in raw materials and wages. Cocoa prices spiralled to unprecedented heights with no forward covers at known prices. The same situation prevails for sugar in that physical shortage is possible and prices cannot be forecasted accurately. The rates of increase in salary and wages are higher than ever experienced before. The introduction of the Contributory Earnings Related Scheme bring unprecedented increases in associated employee costs. Prices have had to be increased, and in many cases, weight adjustments have been made in packaged confectionery to maintain prices at previous levels.

Strong advertising and promotion is essential to maintain market share in highly competitive markets like confectionery. The company recognises the need of product/brand differentiation by high-above-the-line advertising usually concentrating on individual lines rather than the whole production range. The marketing expenditures even under restrictions in the abnormal conditions of rising costs are somewhere in the regions of 5-6 per cent of sales. Expenditures are concentrated in media advertising (TV) and directed to products having growth potential or marked elasticity of demand.

7.3 EXISTING BUDGET SYSTEM

7.3.1. The Format

The system of budgeting in Confectionery Group takes, more or less, a top down approach. It starts with an indication by the Board of the sales revenue and profits anticipated in the budget period. The tentative sales and profit targets are set after reviewing the history of sales and profits, examining the current year forecasts, market share and the economic environment and assessing the company's position in relation to longer term objectives in view of the likely situations. This broad guideline by the Board forms the basis of preparing brand strategies which simply are detailed sales estimates and plans. The preparation of brand strategy is an iterative process of working out preliminary estimates of sales quantities, selling prices, direct marketing expenditures and profits by product groups until they become acceptable. When acceptable, brand strategy, sales and advertising budgets form the basis of preparing production, material, variable cost, fixed overhead-factory, fixed overhead-group department budgets.

In the process of preparing the budgets, standards are set and adopted in all relevant cases. The factory managers together with industrial engineers review product standards and set agreed levels for losses, staffing and efficiencies in the light of historical performances and future capital investments. As for material purchases, buyers set standard prices on the basis of requirements. The estimated material purchase prices over the whole budget period are averaged to arrive at the standards.

The fixed factory overheads budgets are built on plans prepared by the group department and factory services department. These plans are often based on previous year's experiences adjusted for changes to be brought in or expected in the budget period.

The finance department is responsible for the overall preparation, consolidation and presentation of budgets. In the discharge of this responsibility, it (i) evaluates managers' budgets, (ii) apportions and allocates indirect costs, (iii) calculates overhead absorption rates, and (iv) works out the budgeted product costs. The budgeted product costs are then set against the sales prices to obtain the budgeted profits. The total profit budget is arrived at by computation of the profits for the budgeted sales volumes. The finance department fully reviews the costs at all stages to ensure that the final budgeted profit is in line with that set by the Board. There are two courses of action in the presence of a discrepancy i.e. either to revise the objectives/targets or to instruct certain budget holders to amend and adjust their budgets. We observe that the budget time table makes allowances to correct this type of discrepancy since either course of action means reworking the various elements of the budgets. The next step is the preparation of departmental budget summaries which show the allowed annual totals of various categories of expenses by budget centres. The budgeted annual costs by categories relating to respective budget centres are used as yardsticks for cost control purposes. The departmental budget summaries, after approval, are finally consolidated to arrive at master budgets.

The above is a brief and summarised sketch of the budget operations, essentially pointing at the approach and format. The detailed operations involved in preparing the budgets are shown against responsible personnel in Appendix 1 of the thesis.

7.3.2. Responsibility

The budget practice in confectionery group of Cadbury Schweppes Ltd. lies somewhere in between the two extremes of complete centralisation and full participation. By complete centralisation, we mean budgeting is carried out centrally in isolation to the views of managers or at most after discussions with key functional heads. In a fully participative system, each manager completes his own budget for areas he is responsible. We observe that the preparation of budgets in the confectionery group is participated by factory managers, industrial, divisional and factory engineers, personnel from marketing and marketing services and accountants. Though the sales and profit targets are initiated by and handed down from the Board, many of the budget forms for production and manning are completed by the shop floor. Budget preparation, therefore, is a process where in all line and staff personnel are involved and is a joint responsibility.

The budgets, however, are witnessed on documented plans, for which accountants are finally held responsible. It might therefore be pertinent to examine the organisation of finance for budget preparation.

The accountants in confectionery finance report to the financial controller who is responsible to the finance director. We observe that there is a functional division of financial planning, preparation of divisional budgets, and co-ordination of budgets and monitoring of budget activities to complete budgets within the target dates. Financial planning is carried out by the financial planning accountant whereas divisional budgets are prepared by the divisional factory accountants. The budget officer looks after the co-ordination and control of budget preparation process. The organisation of finance for budgetary control appears as in Figure 7.1.

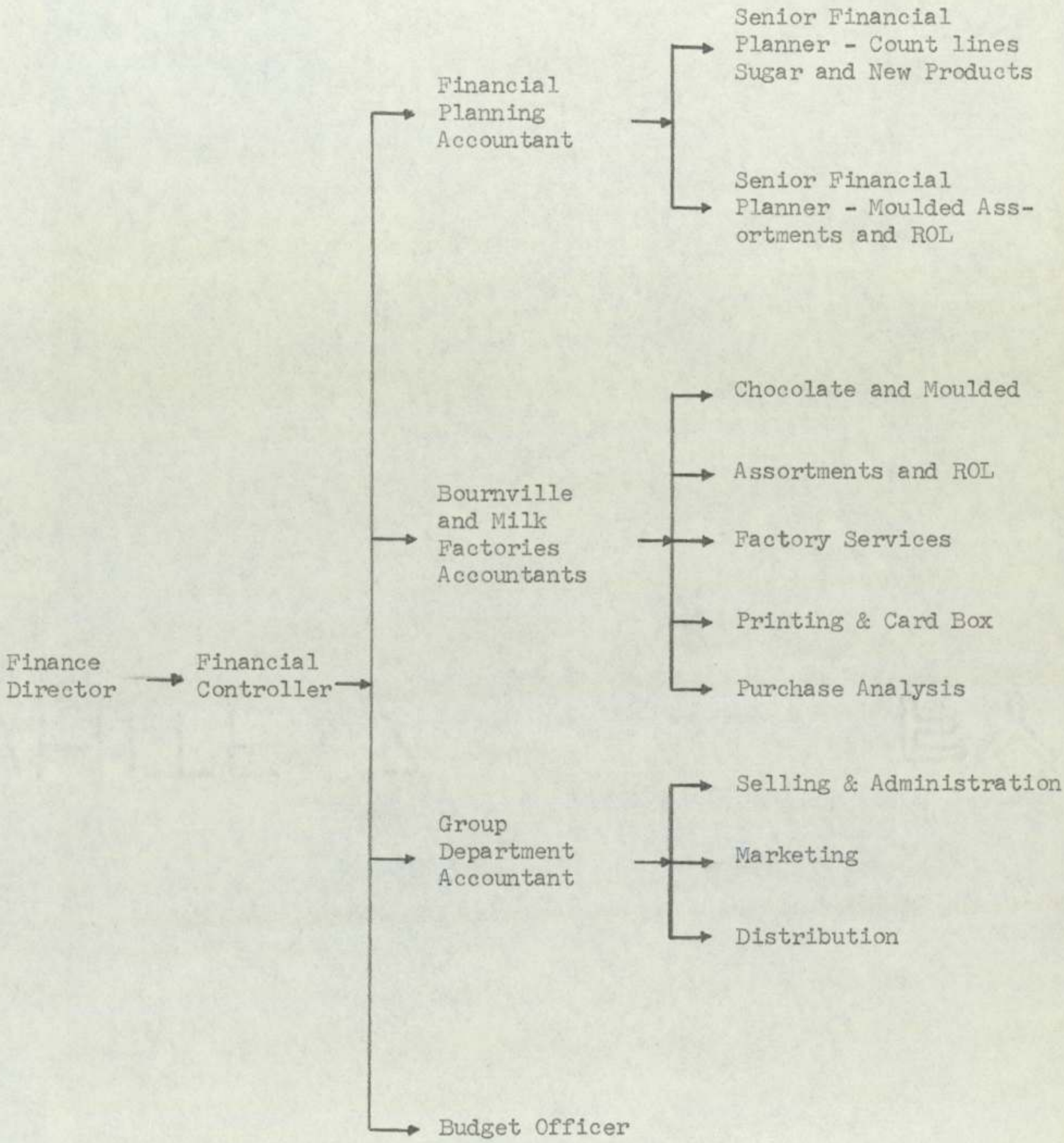


Figure 7.1. ORGANISATION OF FINANCE FOR BUDGETARY CONTROL

7.3.3 Basis and Forms Flow

A total of 68 forms are used as work sheets in preparing the budgets. There are altogether 8 budgets emananting from these forms. The factory budgets, however, are the main constituents of the group budgets. The relationships and dependencies of 68 forms grouped under respective budgets are shown in Figure 7.2.

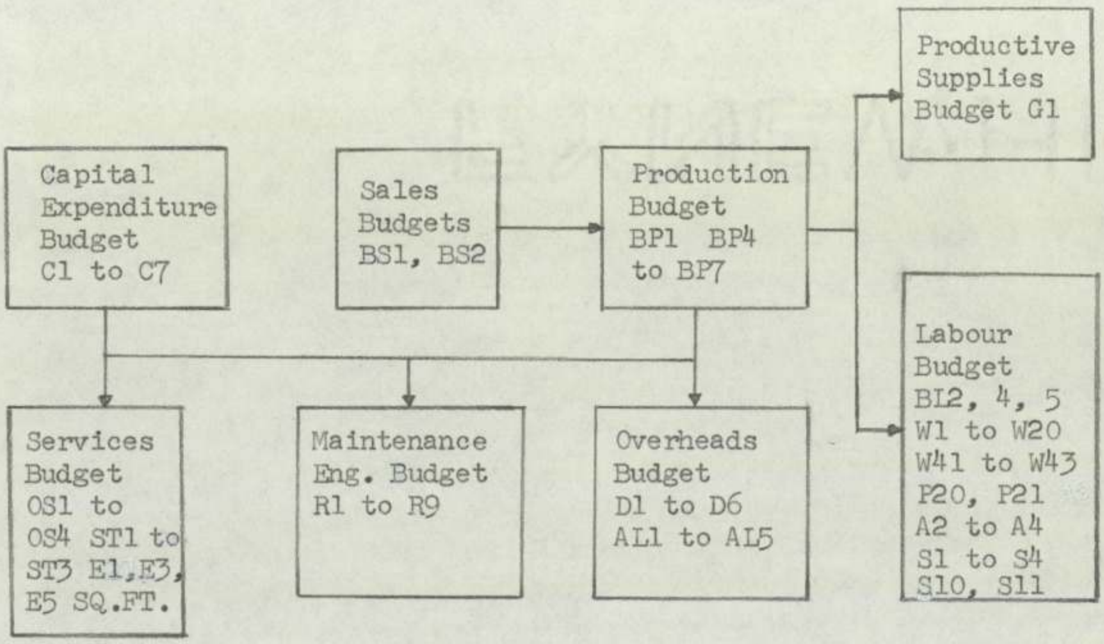
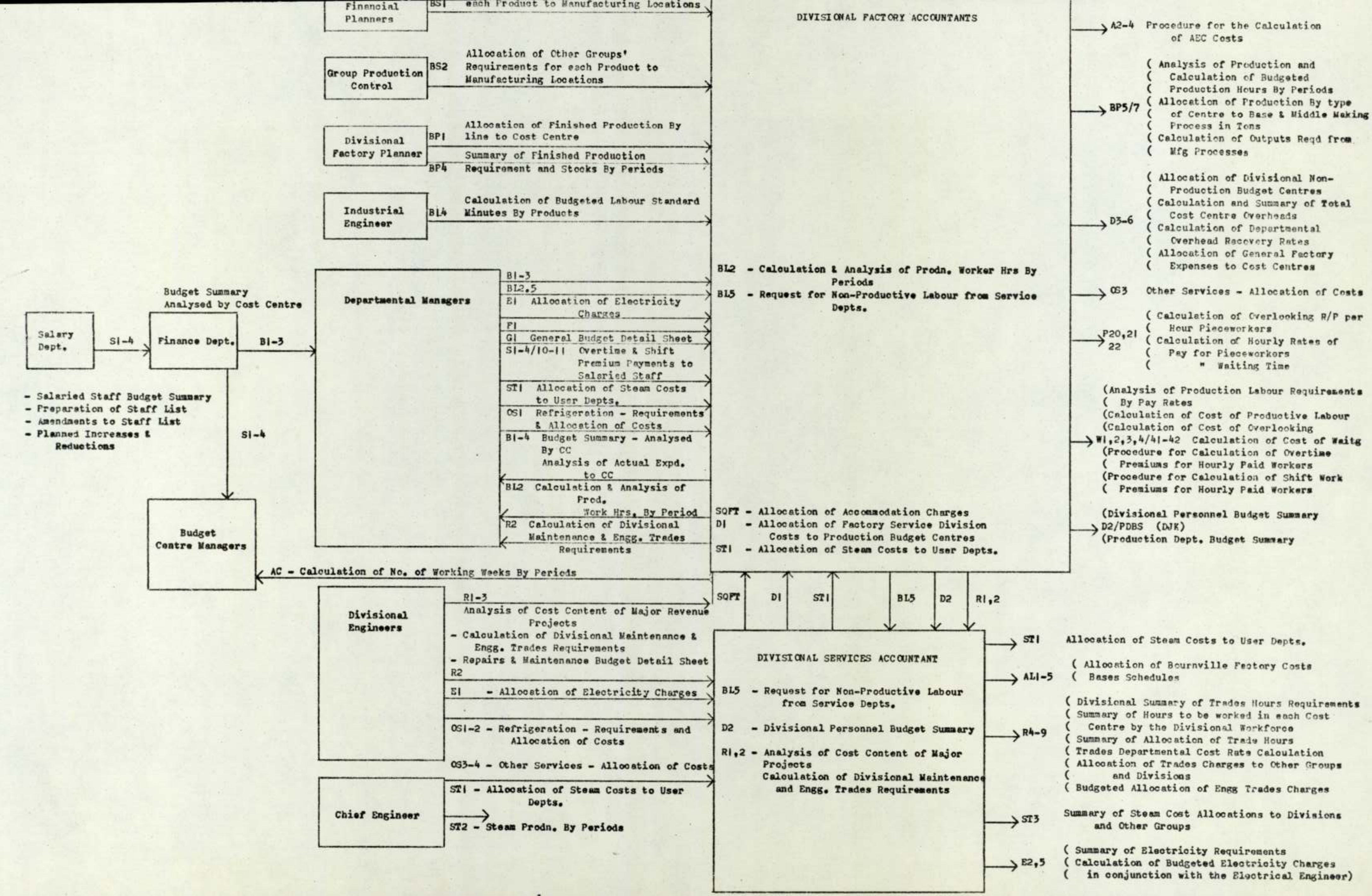


Figure 7.2. RELATIONSHIPS & DEPENDENCIES OF BUDGET FORMS

There are broadly 12 groups and categories of personnel involved in preparing the budgets. Figure 7.2 gives a general outline of the structure. The preparation of budgets has been documented in Budget Manual. The various flows of forms between the parties participating in the making of factory budgets are shown in Figure 7.3.

7.3.4. Budgets and Reports

The confectionery budgets culminate in 'G' forms submitted to the group board. Although the number of 'G' forms runs to 30, they are essen-



Financial Planners
BS1 each Product to Manufacturing Locations
Group Production Control
BS2 Allocation of Other Groups' Requirements for each Product to Manufacturing Locations
Divisional Factory Planner
BP1 Allocation of Finished Production By line to Cost Centre
BP4 Summary of Finished Production Requirement and Stocks By Periods
Industrial Engineer
BL4 Calculation of Budgeted Labour Standard Minutes By Products
Salary Dept.
S1-4
Finance Dept.
Budget Summary Analysed by Cost Centre
B1-3
- Salaried Staff Budget Summary
- Preparation of Staff List
- Amendments to Staff List
- Planned Increases & Reductions
S1-4
Budget Centre Managers
Departmental Managers
B1-3
BL2,5
E1 Allocation of Electricity Charges
F1
G1 General Budget Detail Sheet
S1-4/10-11 Overtime & Shift Premium Payments to Salaried Staff
ST1 Allocation of Steam Costs to User Depts.
OS1 Refrigeration - Requirements & Allocation of Costs
B1-4 Budget Summary - Analysed By CC
Analysis of Actual Expd. to CC
BL2 Calculation & Analysis of Prod. Work Hrs. By Period
R2 Calculation of Divisional Maintenance & Engg. Trades Requirements
AC - Calculation of No. of Working Weeks By Periods
Divisional Engineers
R1-3 Analysis of Cost Content of Major Revenue Projects
- Calculation of Divisional Maintenance & Engg. Trades Requirements
- Repairs & Maintenance Budget Detail Sheet
R2
E1 - Allocation of Electricity Charges
OS1-2 - Refrigeration - Requirements and Allocation of Costs
OS3-4 - Other Services - Allocation of Costs
Chief Engineer
ST1 - Allocation of Steam Costs to User Depts.
ST2 - Steam Prodn. By Periods
DIVISIONAL FACTORY ACCOUNTANTS
BL2 - Calculation & Analysis of Prodn. Worker Hrs By Periods
BL5 - Request for Non-Productive Labour from Service Depts.
SOFT - Allocation of Accommodation Charges
D1 - Allocation of Factory Service Division Costs to Production Budget Centres
ST1 - Allocation of Steam Costs to User Depts.
A2-4 Procedure for the Calculation of AEC Costs
BP5/7
(Analysis of Production and
(Calculation of Budgeted
(Production Hours By Periods
(Allocation of Production By type
(of Centre to Base & Middle Making
(Process in Tons
(Calculation of Outputs Reqd from
(Mfg Processes
D3-6
(Allocation of Divisional Non-
(Production Budget Centres
(Calculation and Summary of Total
(Cost Centre Overheads
(Calculation of Departmental
(Overhead Recovery Rates
(Allocation of General Factory
(Expenses to Cost Centres
OS3 Other Services - Allocation of Costs
P20,21 22
(Calculation of Overlooking R/P per
(Hour Pieceworkers
(Calculation of Hourly Rates of
(Pay for Pieceworkers
(" Waiting Time
W1,2,3,4/41-42
(Analysis of Production Labour Requirements
(By Pay Rates
(Calculation of Cost of Productive Labour
(Calculation of Cost of Overlooking
Calculation of Cost of Waitg
(Procedure for Calculation of Overtime
(Premiums for Hourly Paid Workers
(Procedure for Calculation of Shift Work
(Premiums for Hourly Paid Workers
D2/PDBS (DJK)
(Divisional Personnel Budget Summary
(Production Dept. Budget Summary
SOFT
D1
ST1
BL5
D2
R1,2
DIVISIONAL SERVICES ACCOUNTANT
BL5 - Request for Non-Productive Labour from Service Depts.
D2 - Divisional Personnel Budget Summary
R1,2 - Analysis of Cost Content of Major Projects
Calculation of Divisional Maintenance and Engg. Trades Requirements
ST1 Allocation of Steam Costs to User Depts.
AL1-5
(Allocation of Bournville Factory Costs
(Bases Schedules
R4-9
(Divisional Summary of Trades Hours Requirements
(Summary of Hours to be worked in each Cost
(Centre by the Divisional Workforce
(Summary of Allocation of Trade Hours
(Trades Departmental Cost Rate Calculation
(Allocation of Trades Charges to Other Groups
(and Divisions
(Budgeted Allocation of Engg Trades Charges
ST3 Summary of Steam Cost Allocations to Divisions and Other Groups
E2,5
(Summary of Electricity Requirements
(Calculation of Budgeted Electricity Charges
(in conjunction with the Electrical Engineer)

tially budgets of cash flows, profit and loss, and balance sheet with detail schedules for some individual items. The 'G' forms are built up on budgets prepared at divisional level. Divisional budgets are mainly:

(i) Factory Master Budgets shown by product divisions, (Chocolate and Moulding, Assortment and ROL, Factory Services, Printing and Card Box, and Purchases.)

(ii) Group Overheads Budgets shown by functions and offices (Finance, Research and Development, Marketing, Product Advertising, Product Advertising Provision, Selling, Distribution (Fixed Overheads), Development Engineers, Group Production and Office Services (Fixed Overhead Expenses, Stock Discrepancies - Outside Stores), Group Directorate, Company Charges (Pension Variances)).

(iii) Capital Expenditure Budgets, and

(iv) Cash Flow Budgets.

The monitoring and control is effected by the submission of reports as below by the second week after the end of each of the 13 4-weekly accounting periods.

Level	Report Title	Recipient
Factory and Group	Group Board Returns	Board
Division	Divisional Cost Variance Analysis	Divisional Factory Manager, Factory Director, Appropriate Departmental Manager
Budget Centre	Cost Comparison Statement	Divisional Manager, Production Superintendant, Factory Manager, Appropriate Departmental Manager
Cost Centre	Analysis of Statistics and Financial Information	- same -

7.4. DEVELOPING COMPUTER AIDS FOR OPERATIONAL LEVEL BUDGETS

The group expense budgets are built up from cost centres budgets at the shop floor level under each product division. There are approximately 240 cost centres in the Bournville factory. A cost centre which is not very complicated in production process but at the same time representative of others is picked out and a detailed study of the budget operations and working papers made to build computer models.

The IBM STRATPLAN package is used at the beginning to code programs but has to be abandoned later mainly because of the necessity to code for all products and grades of operatives. This could be avoided without problems in other general purpose languages. Other shortcomings are also observed in running the STRATPLAN programs. The use of a general purpose language is considered and BASIC is chosen because of its interactive character and the existence of an IBM terminal at Confectionery Finance Department of the group.

Computer programs are written in STRATPLAN and BASIC, covering sales, production, materials and requisite units breakdown, direct wages, indirect wages, direct fixed salaries and associated employee costs. Maintenance expenses, the materials and labour requirements for which vary from job to job are more of a judgemental nature. They have not, therefore, been experimented for computerising their compilation.

7.4.1. Selection of 'Eclairs' Section

The 'Eclairs' section comprising cost centres 164 (U4E - Upper Floor 4 East) and 158 (U5E) is selected for detailed study and experimentation. This section produces 'chocolate' and 'blackcurrent' eclairs, each of three packings - seepak, 4lb jars and 10lbs export. Chocolate eclairs are made of caramel (71%) and centre (29%). Black current eclairs comprise caramel (60%), nougat (25%) and jam (15%). Both eclairs undergo four processes; boiling, extruding, wrapping and bagging. Boiling is carried out in U4E which draws the necessary ingredients from confectionery stores. There are 8 kettles in U4E and is allocated for boiling chocolate (2), black current (2) and caramel (4). U4E operates on double shifts with 7 males on day and 5 males on nights. All the workers are remunerated on piece-rates. Extruding, wrapping and bagging are carried out in U5E which processes on based materials passed from U4E. There are 2 machines for extruding and wrapping which are continuous and operated by 6 males working on day shifts at 85% efficiency. Bagging is done on two machines attended by 7 females working on double shifts at 75% efficiency. A section manager and a section supervisor take charge of the eclairs section.

7.4.2. Budget Working Papers

The budget forms used for 'eclairs' section are examined for computerising budgets preparation at operational level. Since the factory is organised as 'cost' and 'budget' centres rather than 'profit' centres, the study related to expense budgets.

The budget forms for 'eclairs' handled at Divisional Factory Accountant's office totalled 28 in all. They relate to production, productive supplies, labour and some of maintenance and engineering budgets.

(i) Production Budgets

There are 5 budget forms pertaining to this area. Although each of these functions separately to show finished production requirements and stocks, production in hours, production in tons, requisite units break-down, bases and pre-made ingredients make up, they are linked to one another. (See Appendix 2). We observed that quite some time is taken to prepare them.

(ii) Labour Budgets

Many of the forms in use relate to labour budgets. There are altogether 19 forms covering direct wages, indirect wages, direct fixed salaries and associated employee costs. Their functions spread from establishing bases for arriving at the rates to reconciling requirements and availability, ending up with wages budgets. Although each form exists to fulfil a distinct purpose, some overlappings and duplication of data are observed and we felt that many forms could be combined to simplify the process and speed up the preparation time. See Appendix 2.

(iii) Productive Supplies and Maintenance Budgets

The forms relating to other direct expense budgets - G1 for productive supplies and R1 to R3 for maintenance and engineering are found to be completed by section suprintendents with subjective estimates. This denotes the complexity, judgemental nature and numerous considerations involved in their completion. See Appendix 2.

7.4.3. STRATPLAN Models

The development of computer aids to the preparation of budgets for the 'eclairs' section begins with computerising the preparation of budget forms. The programs are coded in STRATPLAN for two reasons: desirability of an interactive mode and familiarity of STRATPLAN to the staff at Confectionery Finance Department.

STRATPLAN is a modelling system package developed and owned by IBM. The package has its own rules of syntax to prepare programs. There are some routines built in STRATPLAN for facilities like: backward iteration, graphical output, histogram output, discounted cash flows, Monte Carlo facilities for risk analysis, and many forecasting techniques, viz. Linear regression, multiple regression, curve fitting, arithmetic progression, geometric progression, moving averages, exponential smoothing and step functions. The package can accommodate some huge programs of 800 statements (rows) and 120 time periods (columns) with maximum input and output variables of data matrix size of 12,000 items. It is claimed that programs can be written in STRATPLAN for purposes of financial planning, project evaluation, cash flow analysis, production control, and marketing decisions. STRATPLAN programs have to be run on IBM CALL Timesharing Service with the use of a terminal. The processing of models can be done in "conversational" or "remote job entry" modes.

Models are developed using STRATPLAN package to prepare production data, labour costs and direct fixed salaries. The characteristic features i.e. program name, function, program size, input data, limitations and plan details of these models are:

(i) Calculation of output required from manufacturing process.

Row model name TESTMOD1

Function Calculates the requisite units from production in tons and breaks down the main requisite unit into component ingredients.
Replaces BP6 and BP7 which take about 2 weeks to prepare.
Shows material requirements of production.

Plan details 13 four-weekly periods

Program size	26 statements
Input data	1 data line for 13 periods - production in tons for each period.
Limitation	Requires separate programs for different products because of different types and percentages of composing requisite units.

(ii) Calculation of budgeted production hours by periods

Row model name	TESTMOD4
Function	Calculates the product in hours from production in tons. Replaces BP5 which takes about 2 weeks to prepare.
Plan details	13 fourweekly periods
Program size	2 statements for each product
Input data	1 data line for 13 periods for each product-production in tons
Limitation	Separate coding for different products.

(iii) Calculation and analysis of labour costs

Row model name	TESTMOD 2
Column model name	TESTMOC 2
Function	Calculates productive, overlooking and waiting wages, overtime premiums from number of operators Replaces BI2, W1 to W4, W41, W42
Plan details	24 columns of various descriptions
Program size	1 statement for each grade of operative in row model 24 statements in column model.

Input data — 12 data elements (i) average number of operatives (ii) normal weekly hours (iii) overtime weekly hours (iv) number of weeks per annum (v) absent hours (vi) productive per cent (vii) productive wage rate (viii) overlooking per cent (ix) overlooking wage rate (x) waiting per cent (xi) waiting wage rate (xii) overtime rate for each grade of operative.

Limitation — Numerous data input.

Shifts premiums cannot be included.

* We have also developed TESTMOD3 and TESTMOC3 to carry out the same functions but with better report format.

(iv) Calculation of Direct Fixed Salaries

Row model name — TESTMOD6

Column model name — TESTMOC6

Function — Calculates salaries overtime and shift premiums for the managerial staff for the budget year. Replaces S1 to S4, S10, S11

Plan details — 1 column describing each grade of managerial staff.

Program size — 21 statements in row model

1 statement for each grade in column model.

Input data — 8 data elements (i) total salary on list, (ii) salary for new staff, (iii) salary for staff reduced, (iv) number of personnel on overtime, (v) average hours per week per person on overtime, (vi) overtime rate per hour, (vii) number of personnel on

	shift work, (viii) staff premium rate per week, in respect of each grade.
Limitation	The components to arrive at salary still requires previous detailed listings.

The various models are shown in Appendix 3. The reports produced from these models could be found on pp. 186-191. We observe the following points from the models developed in this phase of the study.

(i) Column models are required in addition to row models when reports go outside the normal formats of showing relevant information in time periods. This also necessitates the use of numerous 'scratch' files in STRATPLAN although they could be erased after each run. However, it makes consolidation and linking of various models impossible since they have different planning details.

(ii) The input data to the models are numerous even though that might be partly attributable to (a) overlappings and redundencies by spreading over separate models, and (b) treatment of some parameters as variables which could otherwise have been incorporated in these models as constants.

(iii) The mathematical operations in the models are not that numerous and complicated as to fully exploit the processing power of computers.

(iv) Despite these unfavourable points, the reports produced from the models seem satisfactory. It could be justified as having utilised the ability of computers for generating reports. This has motivated us to continue modelling with STRATPLAN for preparing budgets at the operational level.

We develop three models to produce sales, production, material costs and direct wages budgets at this stage. The budgets from these models are shown on pp.192-197. In this phase, we design them to conform to common planning details besides attempting to integrate and combine the relevant working papers. The inputs to the models have also been kept to a minimum and we expect that when these separate models are chained together, the entire suite of programs could be run with less data inputs. The salient points of the three models are:

(i) Sales Budget

The name of the model is SALES. It operates on sales volume forecasts for 13 periods, fed in as input data and unit selling prices incorporated as constants in the model. Three program statements are required for each product.

(ii) Production and Material Cost Budgets

The model name is MATL. The inputs to this model are opening stocks for first period and closing stocks for all 13 periods. It works on common accounting hypothesis of : closing stocks + sales = required stocks - opening stocks = production. The unit of measure is in '000 outers' and the resultant production is converted to tons and hours by application of conversion factors. It requires 9 statements for each product.

This model sums up production in tons of all products within a subgroup which is grossed up for packing wastes and making loss to arrive at enrobed tons. The gross requirements are then broken down into requisite units, to which cost per ton is applied to obtain material costs for each composite unit. These are summed up to arrive at material costs budget. The model requires 4 statements to arrive at enrobed tons and 3 statements for each requisite unit within each product sub-group.

(iii) Direct Wages Budget

We have named this model as DIRWAGE. The data inputs to this model are: number of males and females employed on respective day and night shifts, average hours in each week, number of weeks and total productive hours in each 4-weekly budget period. These input data form the basis of working the productive per cent and non-productive per cent which is analysed into waiting per cent and overlooking per cent. There are 12 statements required to do this. The model then goes on to analyse the hours of each grade of operatives into productive, waiting, overlooking and overtime hours and arrives at respective wages by application of relevant rates. It requires 16 statements for each grade of operatives.

By now, we have made some observations in relation to computerising budget operations at operational level. But limitations of STRATPLAN appear and become very serious and we have to look for a general-purpose language to continue with the development of budget models.

7.4.4. Disadvantages of STRATPLAN

The following shortcomings of STRATPLAN are observed in developing budget models.

(i) Meaningless row numbers

The reports from STRATPLAN models bear row numbers. It is, therefore, desirable that row numbers are meaningful and represent products, workers' grades, etc., to facilitate debugging program errors and interpreting reports. The serial processing of rows prevents this despite considerable time and thoughts are given in designing the models. Later package developments, however, enable suppression of row numbers in reports.

(ii) Limited digits in reports

During certain runs of the models, reports are produced without relevant data elements. There are no errors in the models but is finally found to be due to the excess of some data over seven digits. This is a significant limitation for if results are required to the accuracy of pences, they could not approach ten thousands of sterling pounds.

(iii) Inability to do loops

The program sizes in all STRATPLAN budget models are enlarged because the same algorithm for different products and grades of operatives has to be coded repetitively. The sizes of models would have been far smaller if loops could be done within STRATPLAN. The gravity of this disadvantage multiplies with increases in the number of products or labour grades. It is unimaginable to think of the extra work in programming for 250 products and 48 possible grades of operatives in the Confectionery Group.

(iv) Package amendments

There have been certain amendments to STRATPLAN in December 1974. In addition to enlargements to model size, there have also been some changes in operating modes and facilities. The necessity to adapt to package amendments is a disadvantage generally applicable to all modelling systems.

We are compelled by the above shortcomings to switch to a general-purpose language. The use of BASIC in coding similar programs further uncover the following disadvantages.

(v) Expensive processing

A STRATPLAN run requires three operations ANALYSE, MODEL and REPORT in PLANNING phase, besides any operations in DATA phase, to produce necessary reports. All operations use CPU time. The usage varies naturally with the size of models. CPU times for STRATPLAN models are found to be more than those of programs coded in BASIC. The comparative CPU times for 3 models are:

	STRATPLAN	BASIC
SALES	9 units	1 unit
MATL	23 units	2 units
DIRWAGES	10 units	1 unit

The CPU times for STRATPLAN models are around 10 times greater than BASIC models. This is also a decided disadvantage in view of a charge of 12 pence per unit of CPU time.

(vi) File maintenance necessities

Every STRATPLAN model requires a minimum of 4 files (row specification, row analysed, data and row report files) in addition to a scratch file usable for all models having common planning details. Where there are column models as in TESTMOCS 2, 3 and 6, three additional files are necessary for column specification, column analysed and column report. A normal STRATPLAN model run requires from 4 to 7 files. A BASIC model run on the other hand requires only 2 files. The charges for file maintenance is 50 pence per unit per month.

7.4.5. Programs in BASIC

The disadvantages of STRATPLAN compelled us to look for a general purpose language. FORTRAN and COBOL were considered but finally BASIC was chosen for two reasons. An interactive/conversational language could be useful and is desirable to test alternative policies and assumptions with fast response. Besides an IBM 2741 terminal linked to CALL/360 system is readily available at Confectionery Finance Department.

Our aim is to develop a comprehensive model which would generage various budgets. This approach would avoid the overlappings in data creation and also exploit the computing powers of computers. We have adopted a modular approach, wherein we designed separate models to be chained together subsequently. This would facilitate debugging, easy understanding and later amendments for extensions and updating.

We have developed and run a total of 14 programs in BASIC language to generate sales, production, material costs, direct wages, indirect wages, direct fixed salaries, and associated employee costs budgets. There are two programs in respect of each budget: one to process data and produce reports and the other to create input data. It, therefore, makes up a total of 14 programs, which are as follows:

Models to process and produce report	Models to create input data
IMPROVE 1 processes and produces Eclairs Sales Budget showing sales in outers and values (£)	DATA 1 prompts and creates Product name Unit selling price Sales volumes for 13 periods

Models to process and produce report	Models to create input data
IMPROVE 2 Production Budget showing production in outers, production in tons, and production in hours (BP4, BP5)	DATA 2 Conversion factor 1 Conversion factor 2 Opening stock at P1 Closing stocks for 13 periods Sales volumes for 13 periods
IMPROVE 3 Material Budget showing material breakdown, extruded tons, packing waste, making loss, enrobed tons, Requisite unit breakdown tonnage, unit cost, total costs (BP6, BP7)	DATA 3 Product name Production in tons for 13 periods Waste % Making loss % Requisite unit composition % Unit costs
IMPROVE 4 Direct Wages Budget showing productive wages, overlooking wages, waiting wages, overtime premiums, and shift premiums (BL2, W1 to W4, W41, W42, P20, P21)	DATA 4 Number employed. Number of weeks in each period, Average weekly hours for 13 periods. Labour classification. Average number employed Weekly hours

Models to process and produce report	Models to create input data
IMPROVE 5 Associated Employee Costs Budget (A2 to A4)	DATA 5 Labour classification Pension, Sick pay, Holiday pay, and Gift rates, Wages for 13 periods
IMPROVE 6 Indirect Wages Budget showing wages, overtime premiums, and shift premiums (BL5, W41, W42)	DATA 6 Number of weeks in each period, Labour classification, Average number employed, Normal weekly hours, Overtime weekly hours
IMPROVE 7 Direct Fixed Salaries Budget (S1 to S4, S10, S11)	DATA 7 Staff classification, Number on staff, Annual salaries, Increases/Decreases, Thresholds and Budget Increase %

The above programs together with runs to create data are shown in Appendix 4 of the thesis. The logic and functions of models producing sales, production, material costs and direct wages budgets have been examined earlier. Models to prepare indirect wages, direct fixed salaries and associated employee costs are based on simple accounting relationships.

We are, therefore, leaving it to interested readers to pursue either in relevant budget working papers (Appendix 2) or in the programs (Appendix 4). It could be observed that though separate statements are written in programs for reporting purposes as distinct from processing, programs in general purpose language BASIC are much shorter than comparable ones in STRATPLAN. This is due to 'loops' available for both processing and reporting. Program runs to create input data proceed on 'prompts' or question-and-answer modes. We believe this reduces the data creation tasks to simple routines and makes easy for anyone to perform them.

7.5. SUMMARY AND CONCLUSION

In this chapter, we have looked at the company, products, markets and costs and have also studied the existing budget system by examining the format, responsibility, basis and flow of forms, and budgets/reports produced. A section from Assortments Division was selected and the flow of forms and operations thereon examined in detail. The possibilities for computerising the preparation of sales, production, material costs, direct wages, indirect wages, direct fixed salaries and associated employee costs were observed and pursued further by programming, testing and running models. Programs are first coded in a modelling system language, STRATPLAN which was later abandoned because of fundamental adverse factors. A general purpose conversational language BASIC is used and found to fulfill our purposes.

The results were satisfactory and we feel that they have given us leads and guides to proceed with computerising the preparation of the mentioned budgets at comparable levels within all divisions in the confectionery group. The situation at Confectionery group in having about 240 cost centres, 250 products and 48 possible grades of labour demands a lot of repetitive operations in preparing budgets. The volume of data processed and handled is also great, as in other sub-systems of the financial information system, to warrant computerisation. But we note that computerisation would not help much to establish equitable budgets. The process of establishing basic input data is necessarily and essentially a social process. The detrimental effects of centralising, de-humanising and imposing budgets on personnel would be out of all proportion to benefits to be achieved by doing so and shortening the budget preparation cycle. The social interaction required would also prevent us from achieving great savings in the time taken to prepare the budgets. We also wish to point out that there are not many interacting complex variables in budget preparation. The use of computers would rather be more like using an automatic programmed typewriter or printer.

page no. 1

calculation of output reqd from mfg: processes
report produced: 2 oct 1974
start date: jan 1974

row	description	1 jan 1974	2 feb 1974	3 mar 1974	4 apr 1974	5 may 1974	6 jun 1974	7 jul 1974	8 aug 1974	9 sep 1974	10 oct 1974	11 nov 1974	12 dec 1974	totd
1	material breakdown													
10	total tons	484.00	475.00	600.00	577.00	647.00	494.00	665.00	268.00	439.00	403.00	428.00	392.00	5872.0
20	overweight 1.6%	8	8	10	9	10	8	11	4	7	6	7	6	94
30	packing waste 4.0%	20	19	24	23	26	20	27	11	18	16	17	16	23
40	enrobed tons	511	502	634	610	684	522	703	283	464	426	452	414	626
50	requisite units													
60	strawberry 9.44%	48	47	60	58	65	49	66	27	44	40	43	39	5[illegible]
70	orange 9.51%	49	48	60	58	65	50	67	27	44	40	43	39	5[illegible]
80	coffee 9.51%	49	48	60	58	65	50	67	27	44	40	43	39	5[illegible]
90	caramel 8.44%	43	42	54	51	58	44	59	24	39	36	38	35	5[illegible]
100	coker nut 7.67%	39	38	49	47	52	40	54	22	36	33	35	32	4[illegible]
110	nut crunch 7.59%	39	38	48	46	52	40	53	21	35	32	34	31	4[illegible]
120	nougat ls 6.28	32	32	40	38	43	33	44	18	29	27	28	26	3[illegible]
130	nut whirl 7.89%	40	40	50	48	54	41	55	22	37	34	36	33	4[illegible]
140	turk delight 9.29%	48	47	59	57	64	48	65	26	43	40	42	38	5[illegible]
150	hazel cream 6.04%	31	30	38	37	41	32	42	17	28	26	27	25	3[illegible]
160	hazl in tofe 9.05%	46	45	57	55	62	47	64	26	42	39	41	37	5[illegible]
170	fudge 9.29%	48	47	59	57	64	48	65	26	43	40	42	38	5[illegible]
180	enrobed tons	511	502	634	610	684	522	703	283	464	426	452	414	626
190	unit breakdowns													
200	strawberry													
210	waste 7.5%	4	4	4	4	5	4	5	2	3	3	3	3	4
220	enrobed tons 1	52	51	64	62	69	53	71	29	47	43	46	42	6[illegible]
230	chocolate 1 31.15%	16	16	20	19	22	17	22	9	15	13	14	13	1[illegible]
240	middle 1 68.85%	36	35	44	43	48	36	49	20	32	30	32	29	4[illegible]
250	base cream 94.83%	34	33	42	40	45	35	47	19	31	28	30	27	4[illegible]
260	egg whip 4.74%	2	2	2	2	2	2	2	1	2	1	1	1	2

page no. 1

calculation of bgt production hours by periods
report produced: 8 oct 1974
start date: jan 1974

row	description	1	2	3	4	5	6	7	8	9	10	11	12	total
10	10p choc eclairs	35.20	37.10	37.10	33.40	37.10	27.80	37.10	18.50	32.00	27.80	27.80	27.80	378.[illegible]
11	choc ecl 29.80	1049	1106	1106	995	1106	828	1106	551	954	828	828	828	112[illegible]
20	b41 choc ecl jars	6.60	3.50	7.00	5.00	7.00	3.50	7.00	3.50	5.20	7.00	3.50	3.30	62.[illegible]
21	ch ecl jars 23.29	154	82	163	116	163	82	163	82	121	163	82	77	14[illegible]
30	101b export plybag	0.00	1.20	0.00	1.20	0.00	0.60	0.00	0.30	0.90	0.00	1.20	0.00	5.[illegible]
31	expo pbag 49.03	0	59	0	59	0	29	0	15	44	0	59	0	2[illegible]
40	10p b_current	17.60	18.60	18.50	16.70	18.60	13.90	18.60	9.30	22.20	9.30	9.30	9.30	181.[illegible]
41	b_current 29.80	524	554	551	498	554	414	554	277	662	277	277	277	54[illegible]
50	b41 b_c jars	6.60	7.00	7.00	4.00	7.00	3.50	7.00	3.00	5.20	7.00	7.00	7.00	71.[illegible]
51	b_c jars 23.29	154	163	163	93	163	82	163	70	121	163	163	163	16[illegible]
60	b101 b_c polybag	0.00	0.60	0.00	0.60	0.00	1.20	0.00	0.60	0.90	0.00	0.60	1.20	5.[illegible]
61	b_c polybag 49.03	0	29	0	29	0	59	0	29	44	0	29	59	2[illegible]
70	choc eclairs	104.17	108.33	109.38	102.08	109.38	81.25	109.38	56.25	96.88	85.42	84.38	82.29	1129.[illegible]
71	choc ecl 16.58ton	1727	1796	1814	1692	1814	1347	1814	933	1606	1416	1399	1364	187[illegible]
80	choc eclair p_mix	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	10.[illegible]
81	ch ecl p_m 16.58t	14	14	14	14	14	14	14	14	14	14	14	14	1[illegible]
90	b_c eclairs	60.42	66.67	63.54	56.25	63.54	50.00	63.54	33.33	73.96	38.54	41.67	43.75	655.[illegible]
91	b_c ecl 16.13&pton	975	1075	1025	907	1025	806	1025	538	1193	622	672	706	105[illegible]

page no. 1/01

calculation & analysis of labour costs
report produced: 8 oct 1974
start date: jan 1974

row. description	10 av no operat ors	20 normal wkly hrs	30 o'time wkly hrs	40 tot no rml wk ly hrs	50 tot o' time w kly hr	60 tot av ail wk ly hrs	70 no of wks p. a	80 annual avail hrs	90 absent hrs	100 tot pd atten hrs	110 produc tive%	120 prod t ime	130 prod w age ra te
1 prod labour req													
10 male 6 day	0	0	0	0	0	0	0	0	0	0	0	0	0
20 male 5 day	6	40	10	240	59	299	49	14790	48	14742	93	13741	1
30 male 4 day	0	0	0	0	0	0	0	0	0	0	0	0	0
40 dale 3 day	0	0	0	0	0	0	0	0	0	0	0	0	0
50 fem 6 day	0	0	0	0	0	0	-0	fg 60 fem 5 day			0	c	0
70 fem 4 day	2	40	10	80	20	100	49	4930	48	4882	93	4550	1
80 fem 3 day	5	40	10	200	49	249	49	12325	48	12277	93	11443	1
90 male 6 night	0	0	0	0	0	0	0	0	0	0	0	0	0
100 male 5 night	6	40	10	240	62	302	49	14918	48	14869	93	13860	1
110 male 4 night	1	40	10	40	10	50	49	2486	48	2438	93	2272	1
120 male 3 night	3	40	10	100	26	126	49	6216	48	6167	93	5749	1
130 fem 4 eve	1	16	2	16	2	18	49	906	32	873	93	814	1
140 fem 3 eve	3	16	2	49	6	55	49	2717	32	2684	93	2502	1

page no. 1/02

calculation & analysis of labour costs
report produced: 8 oct 1974
start date: jan 1974

row	description	140 prod labor cost	150 o'looking%	160 o'looking time	170 o'looking rate	180 o'looking cost	190 waiting%	200 waiting time	210 waiting rate	220 waiting cost	230 o'time rate	240 o'time cost
1	prod labour req											
10	male 6 day	0	0	0	0	0	0	0	0	0	0	0
20	male 5 day	12514	5	750	1	589	2	251	1	182	0	734
30	male 4 day	0	0	0	0	0	0	0	0	0	0	0
40	dale 3 day	0	0	0	0	0	0	0	0	0	0	0
50	fem 6 day	0	0	0	0	0	0	0	0	0	0	0
60	fem 5 day	0	0	0	0	0	0	0	0	0	0	0
70	fem 4 day	3146	5	248	1	157	2	83	1	49	0	245
80	fem 3 day	7244	5	625	1	378	2	209	1	117	0	612
90	male 6 night	0	0	0	0	0	0	0	0	0	0	0
100	male 5 night	12622	5	757	1	594	2	253	1	184	0	766
110	male 4 night	1867	5	124	1	93	2	41	1	29	0	128
120	male 3 night	4531	5	314	1	245	2	105	1	70	0	319
130	fem 4 eve	563	5	44	1	28	2	15	1	9	0	24
140	fem 3 eve	1659	5	137	1	83	2	46	1	25	0	72

page no. 1

calculation & analysis of labour costs
report produced: 8 oct 1974
start date: jan 1974

row	description	10 m 6 d	20 m 5 d	30 m 4 d	40 m 3 d	50 f 6 d	60 f 5 d	70 f 4 d	80 f 3 d	90 m 6 n	100 m 5 n	110 m 4 n	120 m 3 n	130 f 4 eve	140 f 3 eve
10	av no operators	0	6	0	0	0	0	2	5	0	6	1	3	1	3
20	normal wkly hrs	0	40	0	0	0	0	40	40	0	40	40	40	16	16
30	o'time wkly hrs	0	10	0	0	0	0	10	10	0	10	10	10	2	2
40	tot norml wkly hrs	0	240	0	0	0	0	80	200	0	240	40	100	16	49
50	tot o'time wkly hr	0	59	0	0	0	0	20	49	0	62	10	26	2	6
60	tot avail wkly hrs	0	299	0	0	0	0	100	249	0	302	50	126	18	55
70	no of wks p.a	0	49	0	0	0	0	49	49	0	49	49	49	49	49
80	annual avail hrs	0	14790	0	0	0	0	4930	12325	0	14918	2486	6216	906	2717
90	absent hrs	0	48	0	0	0	0	48	48	0	48	48	48	32	32
100	tot pd atten hrs	0	14742	0	0	0	0	4882	12277	0	14869	2438	6167	873	2684
110	productive%	0	93	0	0	0	0	93	93	0	93	93	93	93	93
120	prod time	0	13741	0	0	0	0	4550	11443	0	13860	2272	5749	814	2502
130	prod wage rate	0	1	0	0	0	0	1	1	0	1	1	1	1	1
140	prod labor cost	0	12514	0	0	0	0	3146	7587	0	12622	1867	4531	563	1659
150	o'looking%	0	5	0	0	0	0	5	5	0	5	5	5	5	5
160	o'looking time	0	750	0	0	0	0	248	625	0	757	124	314	44	137
170	o'looking rate	0	1	0	0	0	0	1	1	0	1	1	1	1	1
180	o'looking cost	0	589	0	0	0	0	157	378	0	594	93	245	28	83
190	waiting%	0	2	0	0	0	0	2	2	0	2	2	2	2	2
200	waiting time	0	251	0	0	0	0	83	209	0	253	41	105	15	46
210	waiting rate	0	1	0	0	0	0	1	1	0	1	1	1	1	1
220	waiting cost	0	182	0	0	0	0	49	117	0	184	29	70	9	25
230	tot labor cost	0	13285	0	0	0	0	3351	8081	0	13400	1989	4846	599	1767
240	o'time rate	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250	o'time cost	0	734	0	0	0	0	245	612	0	766	128	319	24	72

page no. 1

calculation of section fixed salaries
report produced: 23 oct 1974
start date: jan 1975

row	description	10 section manager	20 section supervisor	30 clerical men	40 clerical women	50 tech assistant
10	dir fixed salaries					
20	salary staff list	12088	43092	0	0	3605
30	increases	4325	0	0	0	0
40	reductions	0	0	0	0	0
50	net incr_decrease	4325	0	0	0	0
60	sub total	16413	43092	0	0	3605
70	budget incr 6%	985	2586	0	0	216
80	salary	17398	45678	0	0	3821
90	overtime payment					
100	no of persons	6	20	0	0	1
110	av hrs p wk p prsn	2	7	0	0	4
120	tot avail hrs p wk	12	138	0	0	4
130	bgt rate p hr	2	1	0	0	1
140	o_t wkly cost	20	204	0	0	6
150	no of wks p.a.	48	48	48	48	48
160	o_t annumn cost	987	9885	0	0	-287
170	shift premium					
180	no of prsn shift	1	7	0	0	0
190	s_p rate p wk	9	8	0	0	0
200	s_p annumn cost ??	9	50	0	0	0
210	mgt salary	18394	55612	0	0	4108

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sales budget 1975
report produced: 23 jan 1975
start date: jan 1975

row	description	1	2	3	4	5	6	7	8	9	10	11	12	tot
1000	sales budget													
1001	so_sales 000outers													
1002	spu_price per unit													
1003	sr_sales revenue													
1100	choc eclairs													
1111	choc seepak so	16.20	20.30	26.10	30.10	29.10	25.50	27.80	25.90	20.70	20.50	22.40	25.00	289.0
1112	choc seepak spu	2035.08	2035.08	2035.08	2035.08	2035.08	2035.08	2035.08	2035.08	2035.08	2035.08	2035.08	2035.08	
1113	choc seepak sr	32968	41312	53116	61256	59221	51895	56575	52709	42126	41719	45586	50877	5895
1121	choc 4lbjar so	3.60	5.30	6.40	6.80	6.20	4.70	4.10	4.10	4.40	5.20	4.90	4.30	60.0
1122	choc 4lbjar spu	1517.43	1517.43	1517.43	1517.43	1517.43	1517.43	1517.43	1517.43	1517.43	1517.43	1517.43	1517.43	
1123	choc 4lbjar sr	5463	8042	9712	10319	9408	7132	6221	6221	6677	7891	7435	6525	91046
1131	choc 10lbexp so	0.20	0.10	0.10	0.10	0.10	0.20	0.10	0.20	0.10	0.20	0.10	0.10	1.60
1132	choc 10lbexp spu	8400.00	8400.00	8400.00	8400.00	8400.00	8400.00	8400.00	8400.00	8400.00	8400.00	8400.00	8400.00	
1133	choc 10lbexp sr	1680	840	840	840	840	1680	840	1680	840	1680	840	840	13440
1193	choc eclairs tsr	40111	50194	63667	72414	69469	60706	63637	60610	49643	51290	53861	58202	693844
1200	bc eclairs													
1211	bc seepak so	11.30	14.80	15.70	16.00	15.60	13.70	14.40	14.30	13.80	14.90	13.50	12.40	170.40
1212	bc seepak spu	2035.08	2035.08	2055.08	2035.08	2035.08	2035.08	2035.08	2035.08	2035.08	2035.08	2035.08	2035.08	
1213	bc seepak sr	22996	30119	31951	32561	31747	27881	29305	29102	28084	30323	27474	25235	346777
1221	bc 4lbjar so	4.80	5.90	6.30	6.60	6.00	5.20	4.40	4.90	4.30	6.00	5.30	5.20	65.50
1222	bc 4lbjar spu	1517.43	1517.43	1517.43	1517.43	1517.43	1517.43	1517.43	1517.43	1517.43	1517.43	1517.43	1517.43	
1223	bc 4lbjar sr	7284	8953	9560	10015	9105	7891	6677	7435	6525	9105	8042	8861	95592
1231	bc 10lbexp so	0.10	0.10	0.10	0.10	0.10	0.20	0.20	0.20	0.20	0.20	0.20	0.10	1.80
1232	bc 10lbexp spu	8250.00	8250.00	8250.00	8250.00	8250.00	8250.00	8250.00	8250.00	8250.00	8250.00	8250.00	8250.00	
1233	bc 10lbexp sr	825	825	825	825	825	1650	1650	1650	1650	1650	1650	825	14850
1293	bc eclairs tsr	31105	39897	42336	43401	41677	37421	37632	38187	36259	41077	37166	34861	461019
1993	eclairs tsr	71216	90091	106003	115816	111146	98128	101268	98797	85902	92367	91027	93203	1154863

page no. 1

material budget 1975
report produced: 23 jan 1975
start date: jan 1975

row	description	1	2	3	4	5	6	7	8	9	10	11	12	tod
2000	production budget													
2001	cstk_cl stock													
2004	ostk_op stock													
2005	po_prod 000outers													
2006	cp1_conv paramter1													
2007	cp2_conv paramter2													
2008	pt_prod tons													
2009	ph_prod hours													
2100	choc eclairs													
2111	choc seepak cstk	47.20	62.30	62.90	54.10	48.70	41.00	36.90	22.90	2[illegible].90	29.10	30.40	29.10	
2112	choc seepak so	16.20	20.30	26.10	30.10	29.10	25.50	27.80	25.90	20.70	20.50	22.40	25.00	289.60
2113	choc seepak reqd	63.40	82.60	89.00	84.20	77.80	66.50	64.70	48.80	46.60	49.60	52.80	54.10	780.10
2114	choc seepak ostk	28.00	47.20	62.30	62.90	54.10	48.70	41.00	36.90	22.90	25.90	29.10	30.40	
2115	choc seepak po	35.40	35.40	26.70	21.30	23.70	17.80	23.70	11.90	23.70	23.70	23.70	23.70	290.70
2116	choc seepak cp1	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51	
2117	choc seepak cp2	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	
2118	choc seepak pt	88.94	88.94	67.09	53.52	59.55	44.72	59.55	29.90	59.55	59.55	59.55	59.55	730.0
2119	choc seepak ph	1168.20	1168.20	881.10	702.90	782.10	587.40	782.16	392.70	782.10	782.10	782.10	782.10	95930
2121	choc 41bjar cstk	13.50	13.30	12.00	9.80	8.70	7.80	8.80	7.30	8.00	7.90	8.10	8.90	
2122	choc 41bjar so	3.60	5.30	6.40	6.80	6.20	4.70	4.10	4.10	4.40	5.20	4.90	4.30	600
2123	choc 41bjar reqd	17.10	18.60	18.40	16.60	14.90	12.50	12.90	11.40	12.40	13.10	13.00	13.20	1741
2124	choc 41bjar ostk	12.00	13.50	13.30	12.00	9.80	8.70	7.80	8.80	7.30	8.00	7.90	8.10	
2125	choc 41bjar po	5.10	5.10	5.10	4.60	5.10	3.80	5.10	2.60	5.10	5.10	5.10	5.10	560
2126	choc 41bjar cp1	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.79	
2127	choc 41bjar cp2	25.29	25.29	25.29	25.29	25.29	25.29	25.29	25.29	25.29	25.29	25.29	25.29	
2128	choc 41bjar pt	9.11	9.11	9.11	8.21	9.11	6.79	9.11	4.64	9.11	9.11	9.11	9.11	1010
2129	choc 41bjar ph	128.98	128.98	128.98	116.33	128.98	96.10	128.98	65.75	128.98	128.98	128.98	128.98	14390
2131	choc 101bexp cstk	0.50	0.50	0.50	0.50	0.50	0.40	0.40	0.30	0.30	0.40	0.50	0.50	
2132	choc 101bexp so	0.20	0.10	0.10	0.10	0.10	0.20	0.10	0.20	0.10	0.20	0.10	0.10	10
2133	choc 101bexp reqd	0.70	0.60	0.60	0.60	0.60	0.60	0.50	0.50	0.40	0.60	0.60	0.60	60
2134	choc 101bexp ostk	0.50	0.50	0.50	0.50	0.50	0.50	0.40	0.40	0.30	0.30	0.40	0.50	
2135	choc 101bexp po	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.30	0.20	0.10	10

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material budget 1975
report produced: 23 jan 1975
start date: jan 1975

row	description	1	2	3	4	5	6	7	8	9	10	11	12	totl
2136	choc 101bexp cp1	13,33	13,33	13,33	13,33	13,33	13,33	13,33	13,33	13,33	13,33	13,33	13,33	
2137	choc 101bexp cp2	147,06	147,06	147,06	147,06	147,06	147,06	147,06	147,06	147,06	147,06	147,06	147,06	
2138	choc 101bexp pt	2,67	1.33	1.33	1.33	1.33	1,33	1,33	1,33	1.33	4.00	2.67	1.33	213
2139	choc 101bexp ph	29	15	15	15	15	15	15	15	15	44	29	15	25
2198	choc eclairs pt	100.72	99,39	77,53	63,07	69,99	52,84	69,99	35,88	69,99	72,65	71,32	69,99	853.5
2199	choc eclairs ph	1326.59	1311.88	1024.78	833,94	925,78	698,21	925,78	473,16	925,78	955,20	940,49	925,78	11267.3
2200	bc eclairs													
2211	bc seepak cstk	34.70	40.90	40.80	37,30	35,60	32,30	31,80	24,40	24,50	23,50	23,90	25,40	
2212	bc seepak so	11,30	14,80	15,70	16,00	15,60	13,70	14,40	14,30	13,80	14,90	13,50	12,40	170,40
2213	bc seepak reqd	46,00	55,70	56,50	53,30	51,20	46,00	46,20	38,70	38,30	38,40	37,40	37,80	56,50
2214	bc seepak ostk	25	35	41	41	37	36	32	32	24	25	24	24	
2215	bc seepak po	21,00	21,00	15,60	12,50	13,90	10,40	13,90	6,90	13,90	13,90	13,90	13,90	170,80
2216	bc seepak cp1	2,23	2,23	2,23	2,23	2,23	2,23	2,23	2,23	2,23	2,23	2,23	2,23	
2217	bc seepak cp2	33,00	33,00	33,00	33,00	33,00	33,00	33,00	33,00	33,00	33,00	33,00	33,00	
2218	bc seepak pt	46.87	46.87	34,82	27,90	31,03	23,21	31,03	15,40	31,03	31,03	31,03	31,03	381,25
2219	bc seepak ph	693,00	693,00	514,80	412,50	458,70	343,20	458,70	227,70	458,70	458,70	458,70	458,70	5653,9
2221	bc 41bjar cstk	9,90	9,70	9,10	7,60	7,30	6,40	7,70	5,60	7,00	6,70	7,10	7,00	
2222	bc 41bjar so	4,80	5,90	6,30	6,60	6,00	5,20	4,40	4,90	4,30	6,00	5,30	5,80	65,50
2223	bc 41bjar reqd	14,70	15,60	15,40	14,20	13,30	11,60	12,10	10,50	11,30	12,70	12,40	12,80	156,60
2224	bc 41bjar ostk	9,00	9,90	9,70	9,10	7,60	7,30	6,40	7,70	5,60	7,00	6,70	7,10	
2225	bc 41bjar po	5,70	5,70	5,70	5,10	5,70	4,30	5,70	2,80	5,70	5,70	5,70	5,70	63,50
2226	bc 41bjar cp1	1,79	1,79	1,79	1,79	1,79	1,79	1,79	1,79	1,79	1,79	1,79	1,79	
2227	bc 41bjar cp2	25,29	25,29	25,29	25,29	25,29	25,29	25,29	25,29	25,29	25,29	25,29	25,29	
2228	bc 41bjar pt	10,18	10,18	10,18	9,11	10,18	7,68	10,18	5,00	10,18	10,18	10,18	10,18	117,38
2229	bc 41bjar ph	144,15	144,15	144,15	128,98	144,15	108,75	144,15	70,81	144,15	144,15	144,15	144,15	1665,91
2231	bc 101bexp cstk	0,30	0,30	0,30	0,30	0,30	0,30	0,30	0,30	0,30	0,30	0,30	0,30	
2232	bc 101bexp so	0,10	0,10	0,10	0,10	0,10	0,20	0,20	0,20	0,20	0,20	0,20	0,10	1,80

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material budget 1975
report produced: 23 jan 1975
start date: jan 1975

row	description	1	2	3	4	5	6	7	8	9	10	11	12	total
2233	bc 101bexp rcqd	0.40	0.40	0.40	0.40	0.40	0.50	0.50	0.50	0.50	0.50	0.50	0.40	5.10
2234	bc 101bexp ostk	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	
2235	bc 101bexp po	0.10	0.10	0.10	0.10	0.10	0.20	0.20	0.20	0.20	0.20	0.20	0.10	1.8
2236	bc 101bexp cp1	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	
2237	bc 101bexp cp2	147.06	147.06	147.06	147.06	147.06	147.06	147.06	147.06	147.06	147.06	147.06	147.06	
2238	bc 101bexp pt	1.33	1.33	1.33	1.33	1.33	2.67	2.67	2.67	2.67	2.67	2.67	1.33	24.0
2239	bc 101bexp ph	14.71	14.71	14.71	14.71	14.71	29.41	29.41	29.41	29.41	29.41	29.41	14.71	264.7
2298	bc eclairs pt	58.39	58.39	46.33	38.34	42.54	33.56	43.87	23.07	43.87	43.87	43.87	42.54	518.1
2299	bc eclairs ph	851.86	851.86	673.66	556.18	617.56	481.36	632.26	327.92	632.26	632.26	632.26	617.56	7507.0
2999	eclairs ph	2178.45	2163.74	1698.44	1390.12	1543.34	1179.57	1558.05	801.08	1558.05	1587.46	1572.75	1543.34	18774.5
3000	materials budget													
3002	cpu_cost per ton													
3003	mc_materials costs													
3009	material breakdown													
3100	choc eclairs													
3104	extrd tons ch ecl	100.72	99.39	77.53	63.07	69.99	52.84	69.99	35.88	69.99	72.65	71.32	69.99	853.1
3105	pkg waste ch ecl4%	4.03	3.98	3.10	2.52	2.80	2.11	2.80	1.44	2.80	2.91	2.85	2.80	34.1
3106	mkg loss ch ecl 5%	5.24	5.17	4.03	3.28	3.64	2.75	3.64	1.87	3.64	3.78	3.71	3.64	44.37
3107	enrbd tons ch ecl	109.98	108.53	84.66	68.87	76.43	57.70	76.43	39.18	76.43	79.34	77.88	76.43	931.85
3109	requisite units													
3111	chocolate 25%	27.50	27.13	21.16	17.22	19.11	14.43	19.11	9.79	19.11	19.83	19.47	19.11	232.96
3112	choc 25% cpu	670.472	670.472	670.472	670.472	670.472	670.472	670.472	670.472	670.472	670.472	670.472	670.472	
3113	choc 25% mc	18435	18191	14190	11543	12811	9672	12811	6567	12811	13299	13055	12811	156194
3121	caramel 75%	82.49	81.40	63.49	51.65	57.32	43.28	57.32	29.38	57.32	59.50	58.41	57.32	698.89
3122	caramel 75% cpu	326.621	326.621	326.621	326.621	326.621	326.621	326.621	326.621	326.621	326.621	326.621	326.621	
3123	caramel 75% mc	26942	26586	20738	16870	18722	14136	18722	9597	18722	19435	19079	18722	228271
3193	choc eclairs tmc	45378	44777	34929	28413	31533	23808	31533	16163	31533	32734	32133	31533	384465
3200	bc eclairs													

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material budget 1975
report produced: 23 jan 1975
start date: jan1975

row	description	1	2	3	4	5	6	7	8	9	10	11	12	total
3204	extrd tons bc ecl	58.39	58.39	46.33	38.34	42.54	33.56	43.87	23.07	43.87	43.87	43.87	42.54	518.64
3205	pkg waste bc ecl 4%	2.34	2.34	1.85	1.53	1.70	1.34	1.75	0.92	1.75	1.75	1.75	1.70	20.75
3206	mkg loss bc ecl 5%	3.04	3.04	2.41	1.99	2.21	1.75	2.28	1.20	2.28	2.28	2.28	2.21	26.3
3207	enrbd tons bc ecl	63.76	63.76	50.60	41.87	46.45	36.65	47.91	25.19	47.91	47.91	47.91	46.45	566.3
3209	requisite units													
3221	caramel 64.6%	41.19	41.19	32.68	27.05	30.01	23.67	30.95	16.27	30.95	30.95	30.95	30.01	365.5
3222	caramel 64.6%cpu	371.817	371.817	371.817	371.817	371.817	371.817	371.817	371.817	371.817	371.817	371.817	371.817	
3223	caramel 64.6%mc	15314	15314	12153	10057	11158	8802	11507	6051	11507	11507	11507	11158	1366
3231	middle jam 8.21%	5.23	5.23	4.15	3.44	3.81	3.01	3.93	2.07	3.93	3.93	3.93	3.81	46.D
3232	mdle jam 8.21%cpu	297.219	297.219	297.219	297.219	297.219	297.219	297.219	297.219	297.219	297.219	297.219	297.219	
3233	mdle jam 8.21%mc	1556	1556	1235	1022	1134	894	1169	615	1169	1169	1169	1134	13[illegible]
3241	nougat 23.76%	15.15	15.15	12.02	9.95	11.04	8.71	11.38	5.99	11.38	11.38	11.38	11.04	1347
3242	nougat 23.76%cpu	371	371	371	371	371	371	371	371	371	371	371	371	
3243	nougat 23.76%mc	5624	5624	4463	3693	4097	3232	4226	2222	4226	4226	4226	4097	491
3293	bc eclairs tmc	22494	22494	17850	14772	16388	12929	16902	8887	16902	16902	16902	16388	199[illegible]
3993	eclairs tmc	67872	67271	52779	43185	47921	36737	48434	25051	48434	49636	49035	47921	584[illegible]
4000	rend													

page no. 1

direct wages budget 1975
report produced: 23 jan 1975
start date: jan 1975

row	description	1	2	3	4	5	6	7	8	9	10	11	12	total
10	dir wages budget													
20	calc prod wker hrs													
30	male day employed	7	7	7	7	7	10	10	10	10	10	10	10	
40	fem day employed	7	7	7	7	7	7	7	7	7	7	7	7	
50	male ngt employed	14	14	7	5	5	7	5	7	5	6	6	5	
60	totl employed	28	28	21	19	19	24	22	24	22	23	23	22	
70	av wkly hrs	40.9	40.8	41.8	41.5	41.7	40.0	41.6	40.7	41.3	40.6	40.3	41.6	
80	no of wks	4	4	4	4	4	3	4	2	4	4	4	4	45
90	prod wker hrs	4581	4570	3511	2839	3169	2880	3661	1954	3634	3735	3708	3681	41902
100	prod hours	4575	4573	3513	2839	3168	2882	3658	1954	3634	3733	3707	3666	41902
110	non prod hours	6	-3	-2	-0	1	-2	3	-0	0	2	1	-5	-0
120	prod percnt	99.87	100.07	100.05	100.01	99.96	100.67	99.92	100.02	99.99	99.94	99.98	100.14	
130	waitg percnt	0.04	-0.02	-0.02	-0.00	0.01	-0.02	0.03	-0.01	0.00	0.02	0.01	-0.05	
140	olkg percnt	0.02	-0.01	-0.01	-0.00	0.01	-0.01	0.01	-0.00	0.00	0.01	0.00	-0.02	
150	anlyse prod hr req													
160	norml wkly hrs	40	40	40	40	40	40	40	40	40	40	40	40	
1501	otime wk hr m5d st	6.90	6.90	6.90	6.90	6.90	6.90	6.90	6.90	6.90	6.90	6.90	6.90	
1502	av employ m5d st	6	6	6	6	6	6	6	6	6	6	6	6	
1503	pd atten hr m5d sb	1126	1126	1126	1013	1126	844	1126	563	1126	1126	1126	1135	12550
1504	prod hours m5d sb	1124	1126	1126	1013	1125	845	1125	563	1125	1125	1125	1127	12561
1505	ol'g hours m5d sb	0	-0	-0	-0	0	-0	0	-0	0	0	0	-0	-0
1506	waitg hours m5d sb	0	-0	-0	-0	0	-0	0	-0	0	0	0	-1	-0
1507	prod wrate m5d sb	1.9900	1.9900	1.9900	1.9900	1.9900	1.9900	1.9900	1.9900	1.9900	1.9900	1.9900	1.9900	
1508	prod wages m5d sb	2237	2242	2241	2016	2239	1681	2238	1120	2240	2239	2240	2213	24676
1509	olkg wgerate m5	1.0348	1.0348	1.0348	1.0348	1.0348	1.0348	1.0348	1.0348	1.0348	1.0348	1.0348	1.0348	
1510	olkg wages m5d sb	0	-0	-0	-0	0	-0	0	-0	0	0	0	-0	-0
1511	waitg wgerate m5	0.9676	0.9676	0.9676	0.9676	0.9676	0.9676	0.9676	0.9676	0.9676	0.9676	0.9676	0.9676	
1512	waitg wages m5d sb	0	-0	-0	-0	0	-0	0	-0	0	0	0	-1	-0
1513	otime prem per hr	0.2862	0.2862	0.2862	0.2862	0.2862	0.2862	0.2862	0.2862	0.2862	0.2862	0.2862	0.2862	
1514	otime hrs m5d sb	166	166	166	140	166	124	166	83	166	166	166	166	1846
1515	otime prem m5d sb	47	47	47	43	47	36	47	24	47	47	47	47	528

CHAPTER 8

DEVELOPING STRATEGIC LEVEL BUDGET MODELS

8.1. INTRODUCTION

We have observed in the previous chapter that computerisation of budget preparation at operational levels will not help much to set equitable budgets. It will not greatly improve the quality of information. It will help to do better what is already done fairly well. Perhaps it might help to reduce cost of data processing, but we have often seen increase in costs by computerisation projects.

Computerisation, however, make possible the use of so-called "what if" game. This is used principally in profit budgeting and requires a simulation model of the budget and its key variables. At the budget meeting, management can obtain quickly the answers to a number of alternatives by asking "what if the volume of Product A is 67% of that projected?" or "what if the cost of Product B is 10 per cent higher than projected?" and so forth. This allows management to consider many more alternatives than would be possible without the simulation model.

Profit budgeting/planning is carried out at higher levels of aggregation i.e. at corporate level. We have developed computer budget models to produce profit and loss, cash flow statements and balance sheet for the Confectionery group as a whole. Another suite of models are designed and developed to enable to carry out "what if" games. These programs allow selective changes to be made to budget assumptions, variables and parameters relating to sales, production, stocks, prices and expenditures etc. and work out the new cash, profit and financial position and produce them quickly.

This chapter gives an account of the work in this connection and begins with the methodology and approach in systems design. It then deals with various aspects of the models: objectives, type and structure, logic, programming, and the data collection phase of the study. The language used in computer programming, variables and parameters, the type of "what if" queries answered by the models and the mode of operation are covered under the section 'programming the models.'

8.2. METHODOLOGY AND APPROACH

We have taken the following steps in launching our work:

1. Define the objectives,
2. Broad specification of the model: type, plan horizon, and breadth and depth of models,
3. Working out the framework of necessary financial models using the basic principles of double-entry book keeping,
4. Flow charting the logic of the models,
5. Deciding the use of a particular general purpose computer language,
6. Programming the financial models,
7. Testing with dummy data,
8. Collecting data,
9. Testing and running with live data, and
10. Presenting and demonstrating the system to senior staff of Finance Department.

This is only a general indication of the sequential steps we have taken and it needs hardly be emphasised that the process we have undergone is iterative.

8.3. OBJECTIVES OF THE MODELS

The strategic level budget models have as their objectives to:

1. Produce broad guidelines for estiblishment of group budgets,
2. Facilitate the revision and rolling on quarterly or other periodic basis,
3. Assist in setting targets of profits, sales and production,
4. Test and check profitability and liquidity of alternatives,
5. Help develop contingency plans for meeting changes in areas of major uncertainty,
6. Show the effects on profits, cash and financial position of different budget assumptions, premises and policies - provide answers to "what if" queries, and
7. Ensure compatibility of plans of sales, production, stocks and personnel with group financial resources.

8.4. TYPE AND STRUCTURE OF MODELS

We have definite notions, after the survey of the literature on corporate models which is covered in Chapter 6, that the models are going to be deterministic simulation models. They are simulations of the Confectionery groups budgets and their key variables.

There are three aspects to the models: profitability, cash flows and financial position. The models, therefore, cover practically all activities and operations of the group which impinge on those three aspects, though in a somewhat general manner and for a certain period of time which might be short of the full period to reflect all the implications and effects.

We have given our thoughts to the level of aggregation at which the models are to be directed and worked upon. The models have to be operational at a rather high level for profit budgeting and planning purposes. But we are also aware that the profitability among various products of the group are different. This means that our models have to deal with major product groupings up to the net contribution stage. In the accounting practice of the Confectionery group, the following items are handled separately by major product groups: sales income, variable material costs, variable conversion costs and direct marketing expenses.

We then considered the basic level of material explosions or receipe structures to be incorporated in the models. This is important because various raw materials, i.e. cocoa, sugar, milk, butter, nuts, etc. going into the variable material costs are subjected to different rates of changes in prices and supplies. We have resolved this and the previous problem by building in complete flexibility in our models. Our models are designed to handle different number of planning periods, product groupings and raw materials/ingredients from run to run without necessitating any changes made to them.

We have also considered the classification or breakdown of overheads. This is also essential once we recognised that the various items in over-

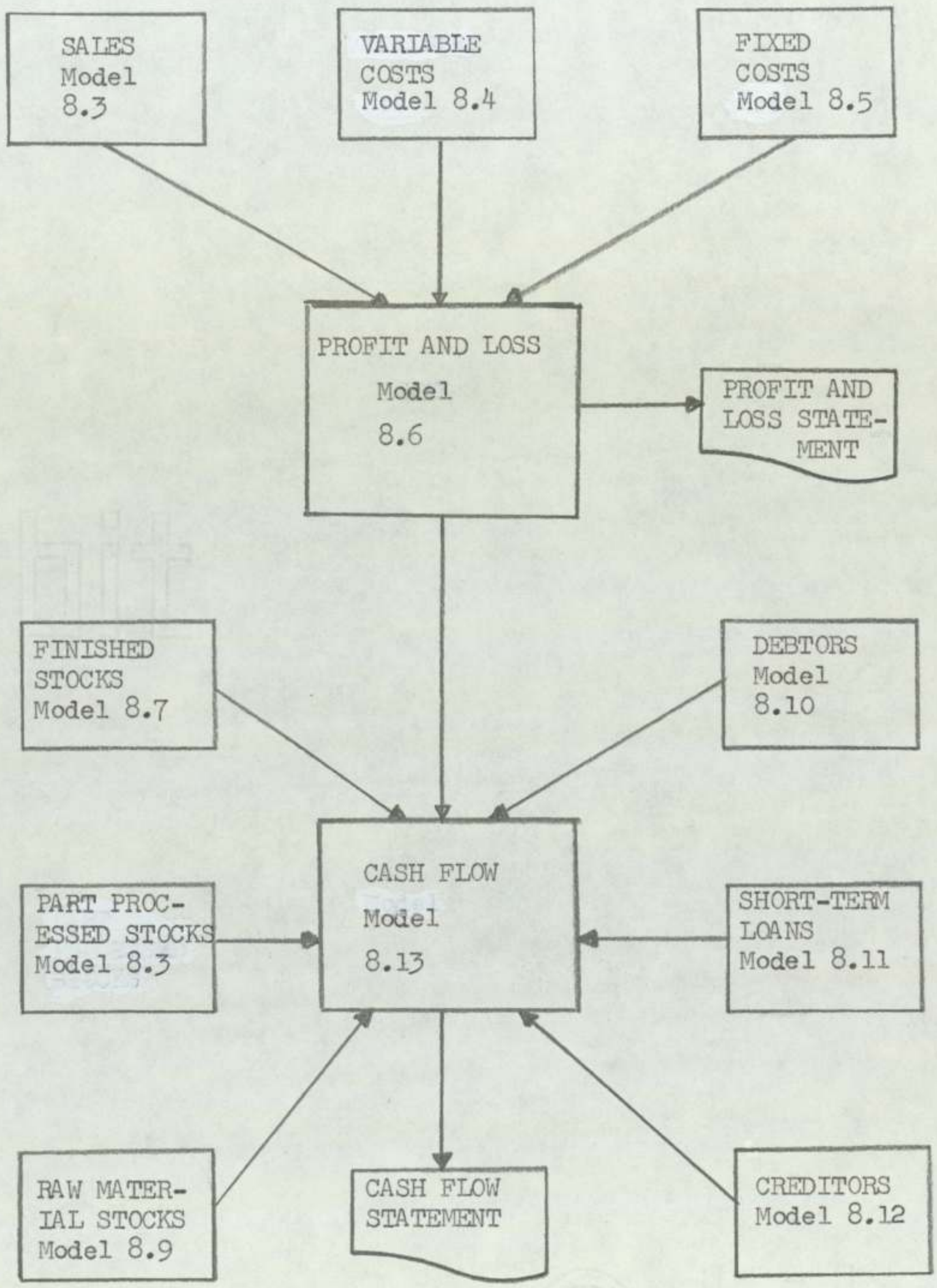

FIGURE 8.1. STRUCTURE OF PROFIT AND CASH FLOW MODELS

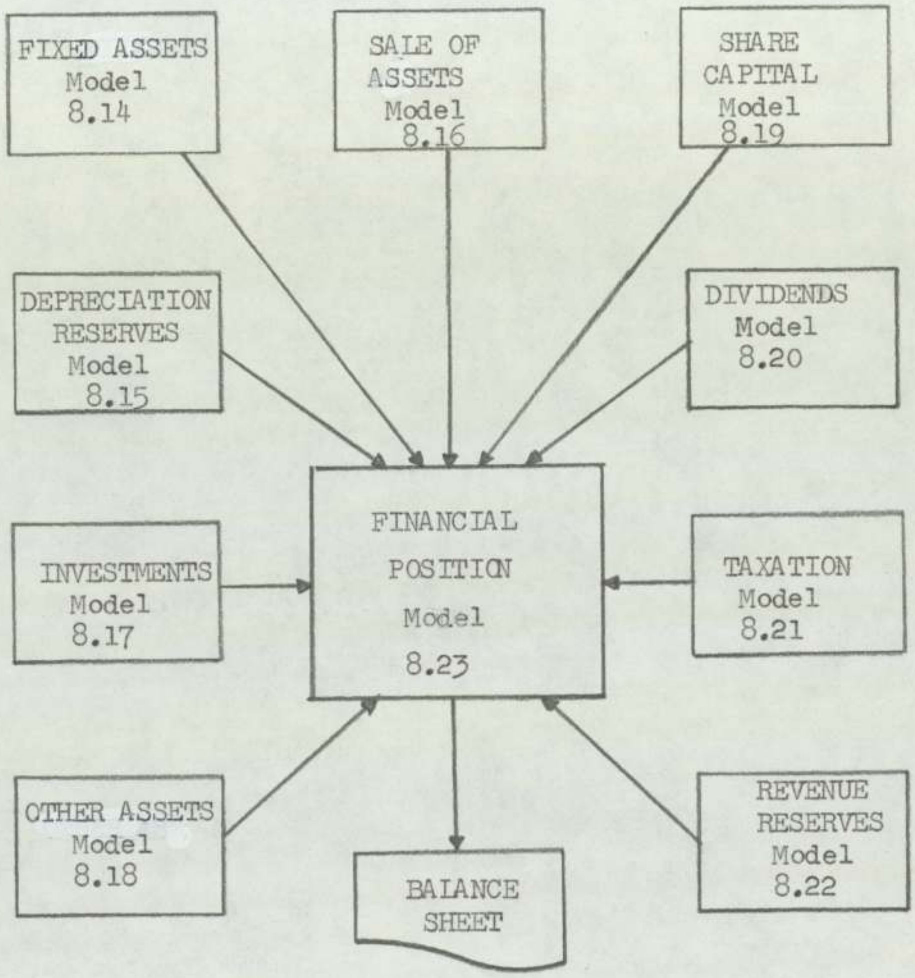

FIGURE 8.2. STRUCTURE OF FINANCIAL POSITION MODELS

heads and fixed costs are different in vulnerability to inflation, uncertainty and timings in disbursements. But there is always the danger in getting far too much into the details. A compromise has to be made in view of the fact that we are modelling at the corporate level. The factory overheads are broken down into: salary and wages, rent, rates and taxes, heat, light and power, depreciation, management charges (inter-company), and sundries. The office and selling and distribution overheads, being smaller in amounts to those of factory and therefore less significant, are classified only into salary and wages, and others to keep the financial models simple.

The framework of the models is built on modules. We have adopted a modular approach in systems design. There are some number of individual models, which together make up the corporate suite to produce profit and loss statement, cash flow statement and balance sheet. The structure of the models appear in FIGURES 8.1 and 8.2.

8.5. MODEL LOGIC

The logic underlying the models is basically the principles of double-entry book-keeping and generally accepted accounting conventions, hypotheses and practices, which are in vogue at Cadburys. We think, at this point, the simplest way to present the logic behind our models is to show them in flow charts.

The logic in our models is shown in the flow charts following. We

We have adopted the PROSPER[1] format in flowcharting. These flowcharts read from left to right and the operations therein are denoted by conventional mathematical signs (+ - x ÷). Each rectangle in the flow charts represents an item of data or information, which is either read into the model or derived from a previous operation. Information or data fed into the model is shown by rectangles with continously lined boundaries ( ) whereas those derived from prior calculations and already held in the models are represented by rectangles bounded by broken lines ( ).

8.6. PROGRAMMING THE MODELS

8.6.1. Language Used

We attach priority to a general purpose interactive language for reasons stated in Chapter 7. We have used BASIC in programming our operational level budget models. But the budget officer expresses a preference to APL as there are company plans to use this on in-house computers.

APL/CMS (A Programming Language/Control Monitoring System) is based on the concepts first developed by Kenneth Iverson in 1958. The implementation took some years and appeared as a practising language in the states in 1968. It is a conversational/interactive language, relatively new in U.K. and claimed to be very powerful. It is offered on IBM's (VM/370 system) virtual machines of system 370. We use APL to program our higher-level budget models. There are altogether 56 programs in the suit. In the course of our work, we found APL highly powerful often

1. PROSPER (PROfit Simulation, Planning and Evaluation of Risk) is an ICL package consisting a range of subroutines for performing cash flow forecasting, financial analysis and risks simulation in building financial models.

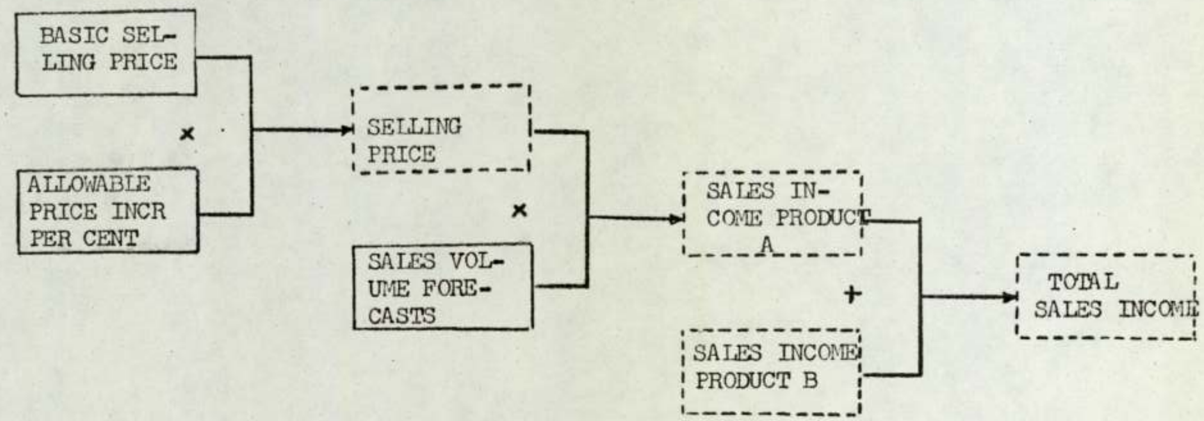

FIGURE 8.3 SALES MODEL

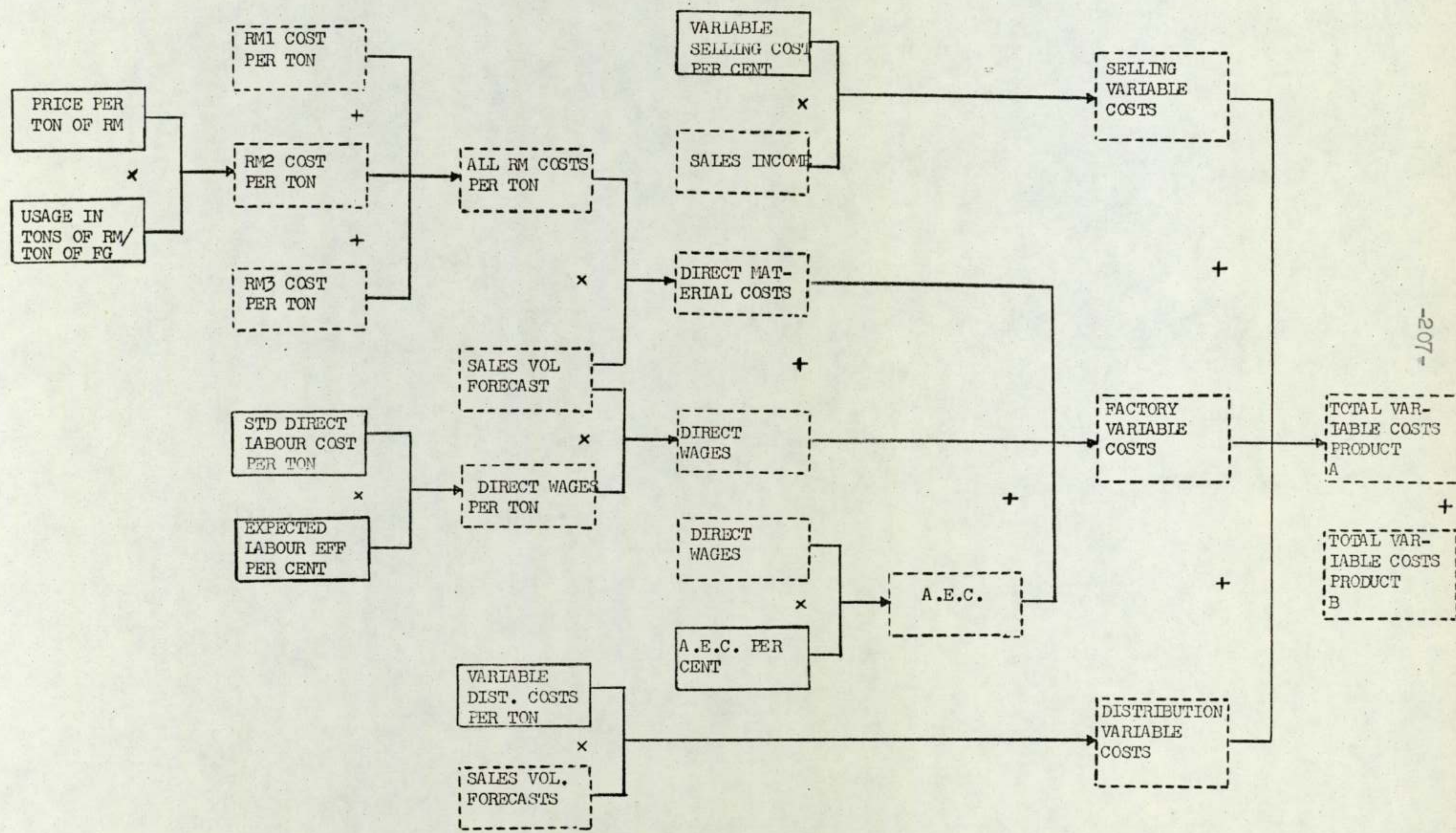

FIGURE 8.4 VARIABLE COSTS MODEL

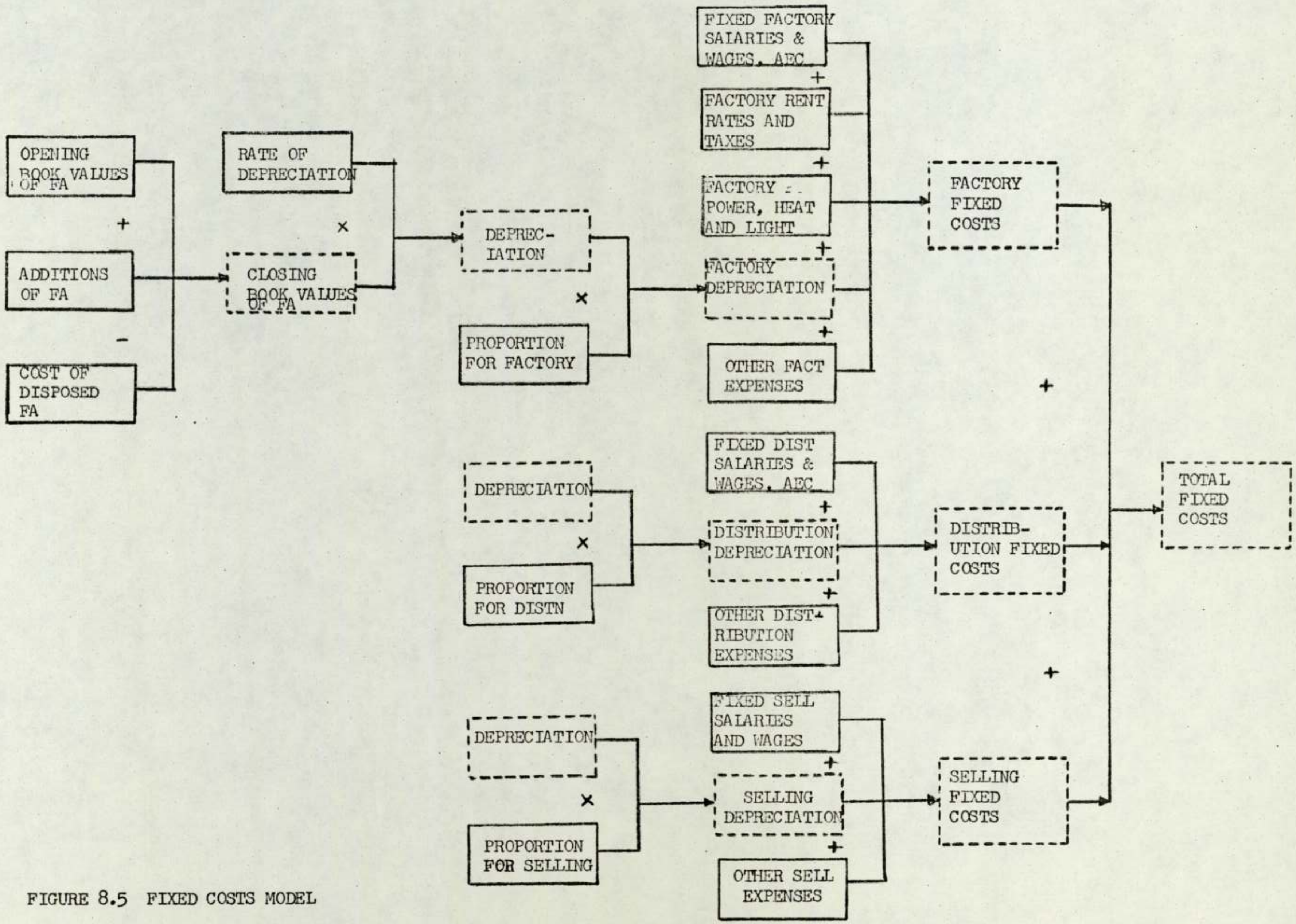

FIGURE 8.5 FIXED COSTS MODEL

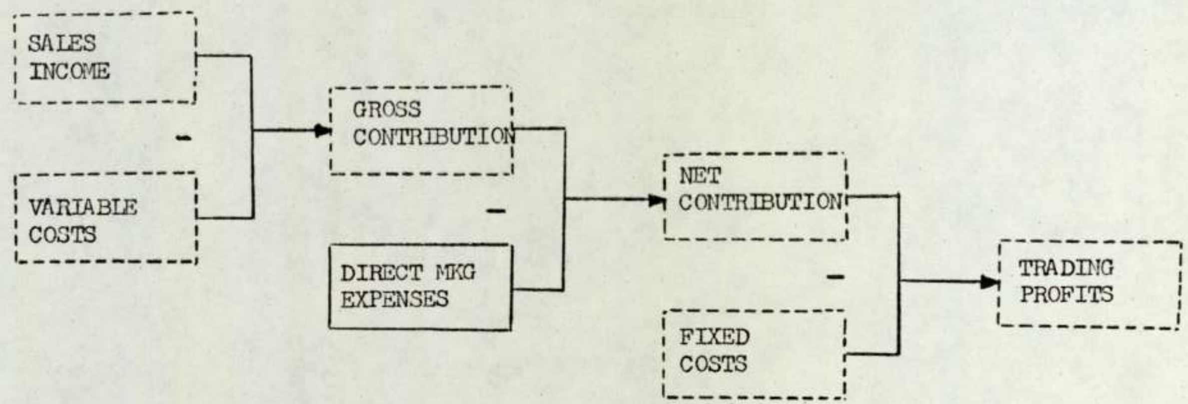

FIGURE 8.6. PROFIT AND LOSS MODEL

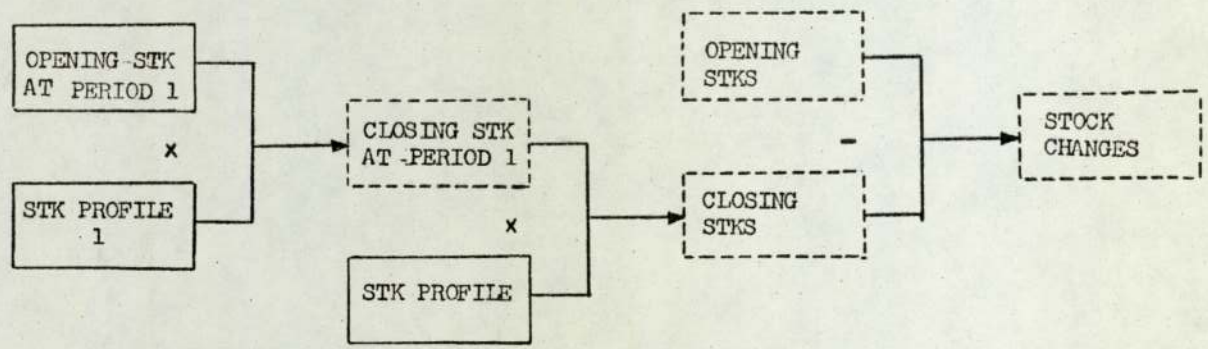

FIGURE 8.7/8.9 STOCKS MODELS

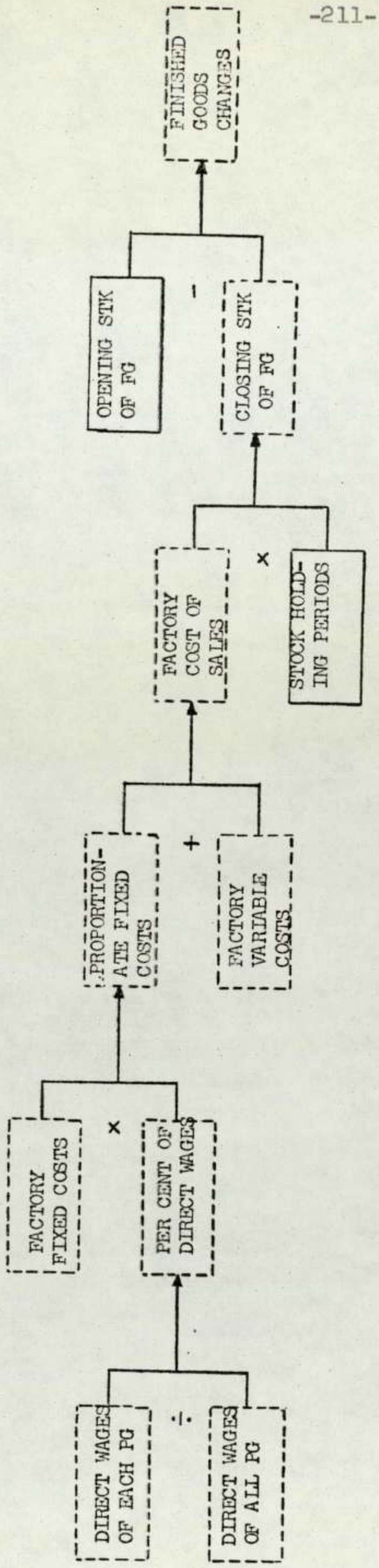

FIGURE 8.7. FINISHED STOCKS MODEL

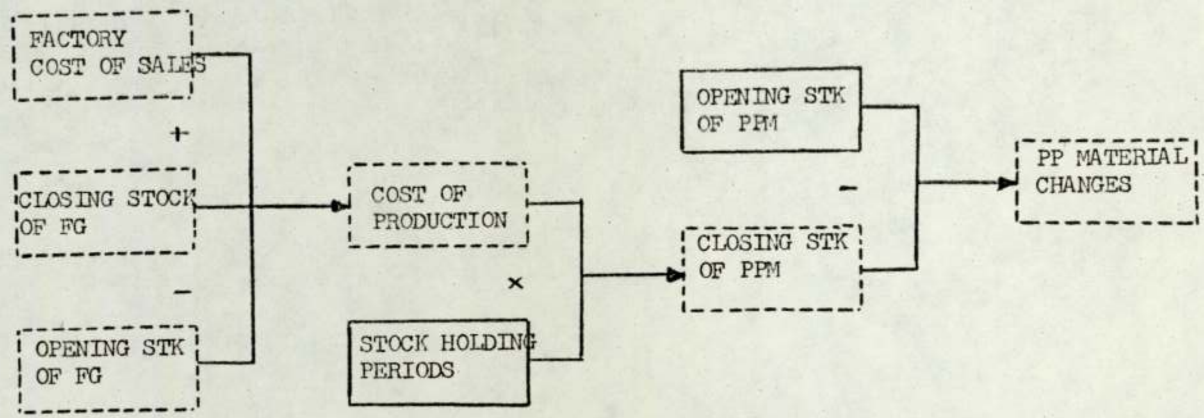

FIGURE 8.8 PART PROCESSED STOCKS MODEL

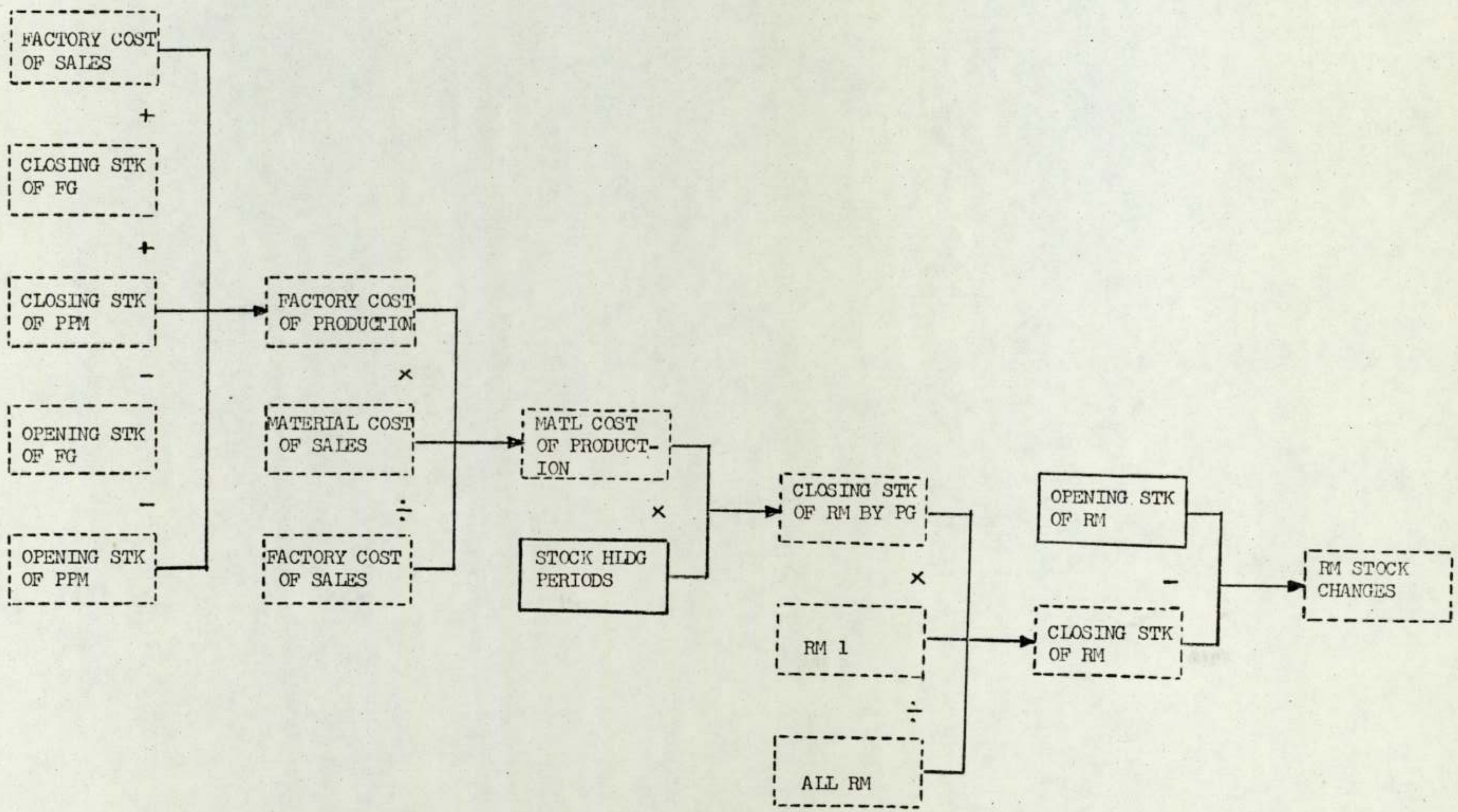

FIGURE 8.9 RAW MATERIAL STOCKS MODEL

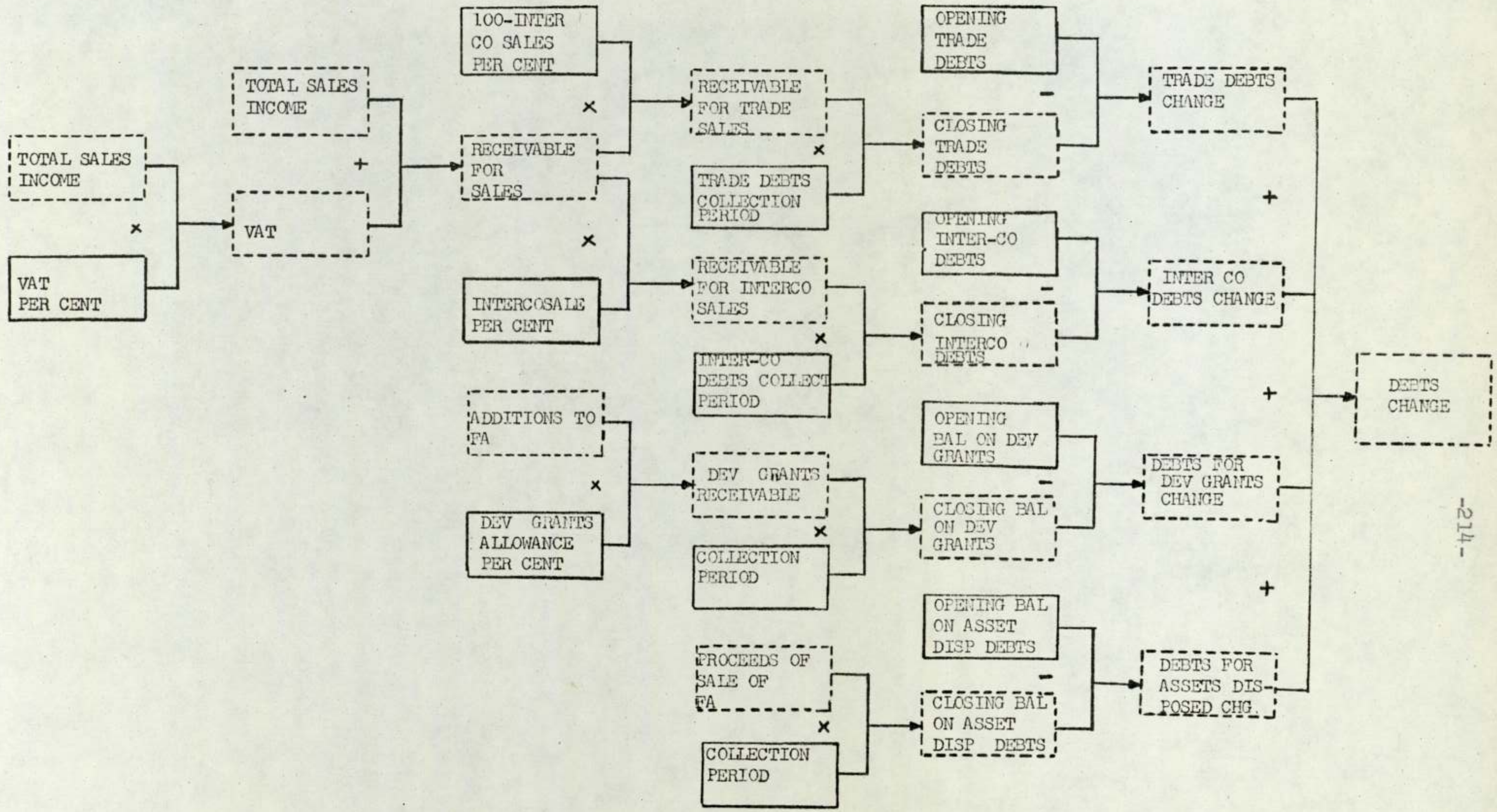

FIGURE 8.10 DEBTORS MODEL

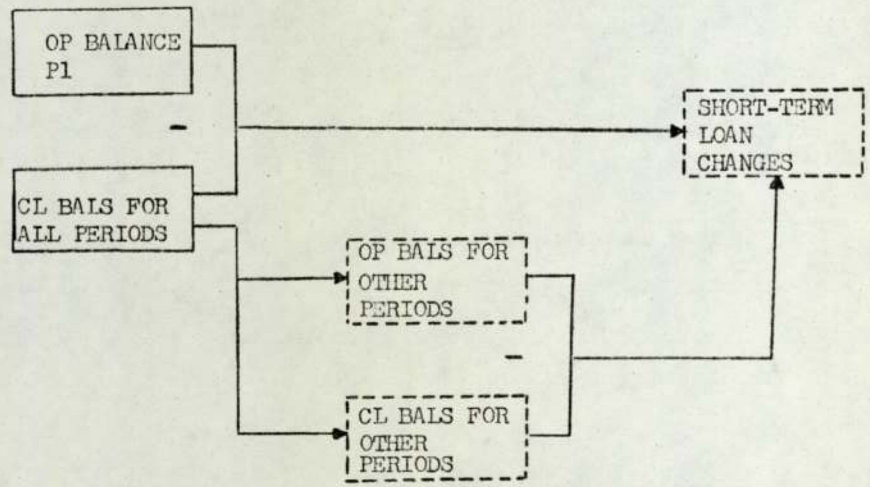

Figure 8.11 SHORT-TERM LOANS MODEL

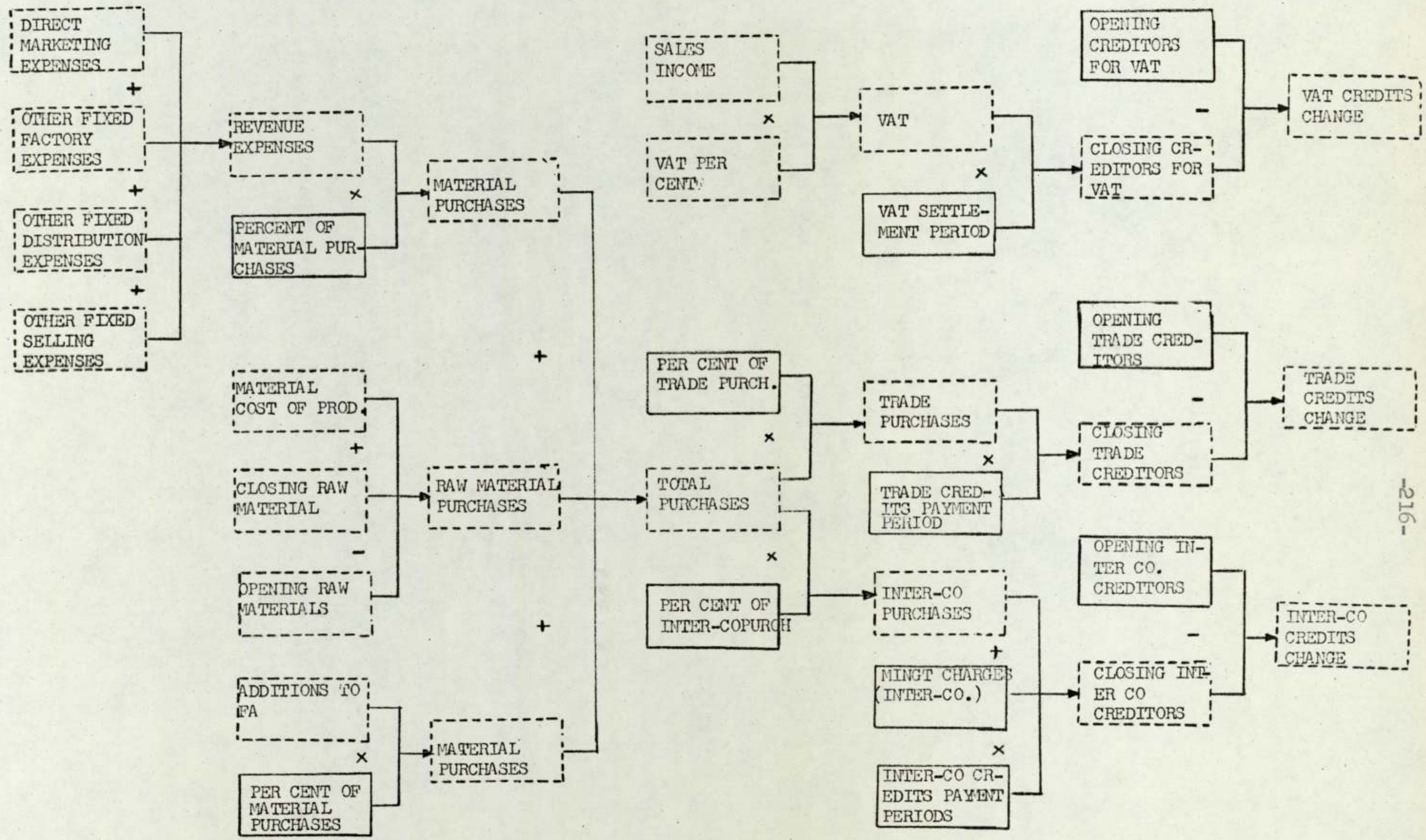

FIGURE 8.12/1 CREDITORS MODEL

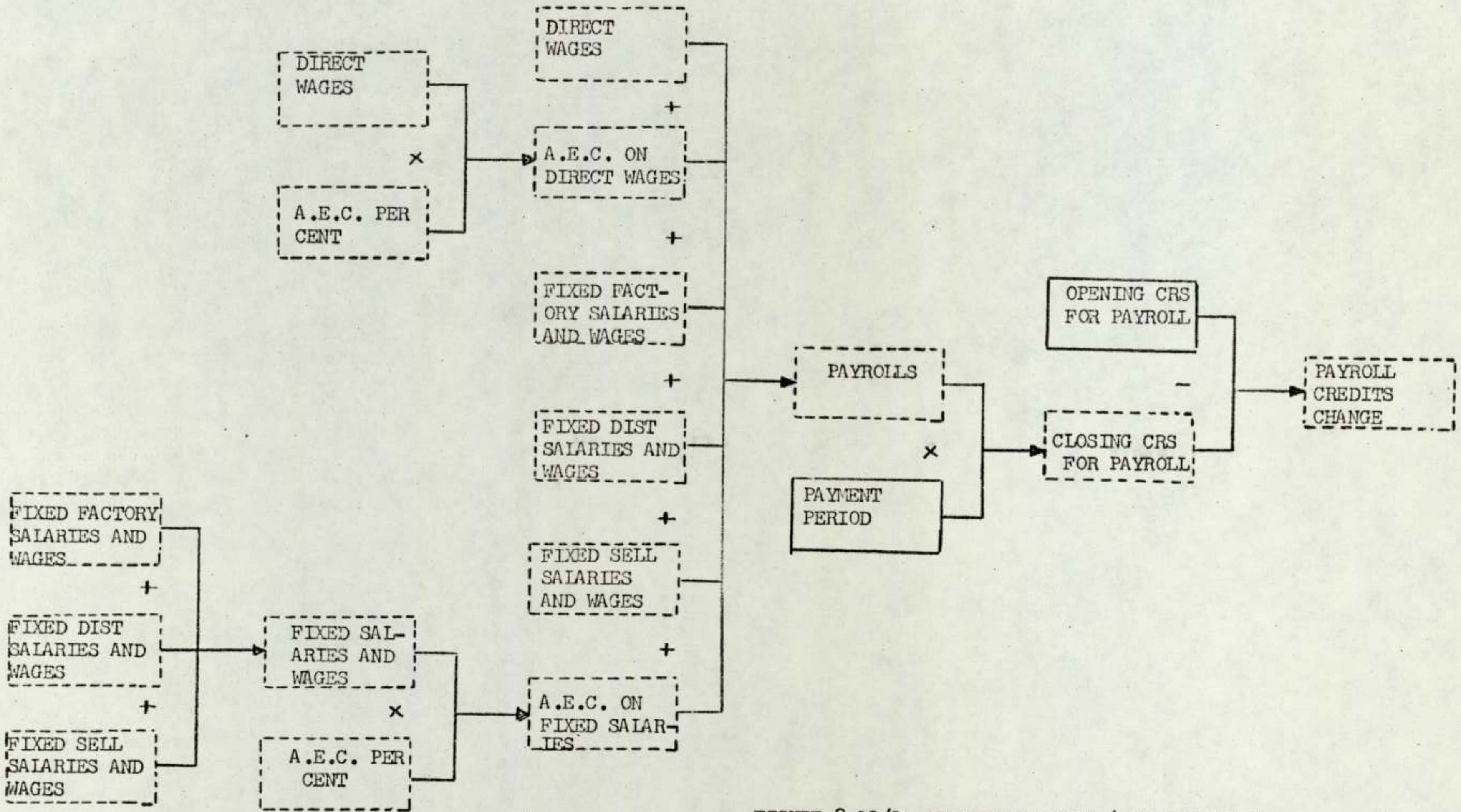

FIGURE 8.12/2 CREDITORS MODEL (CONTINUATION)

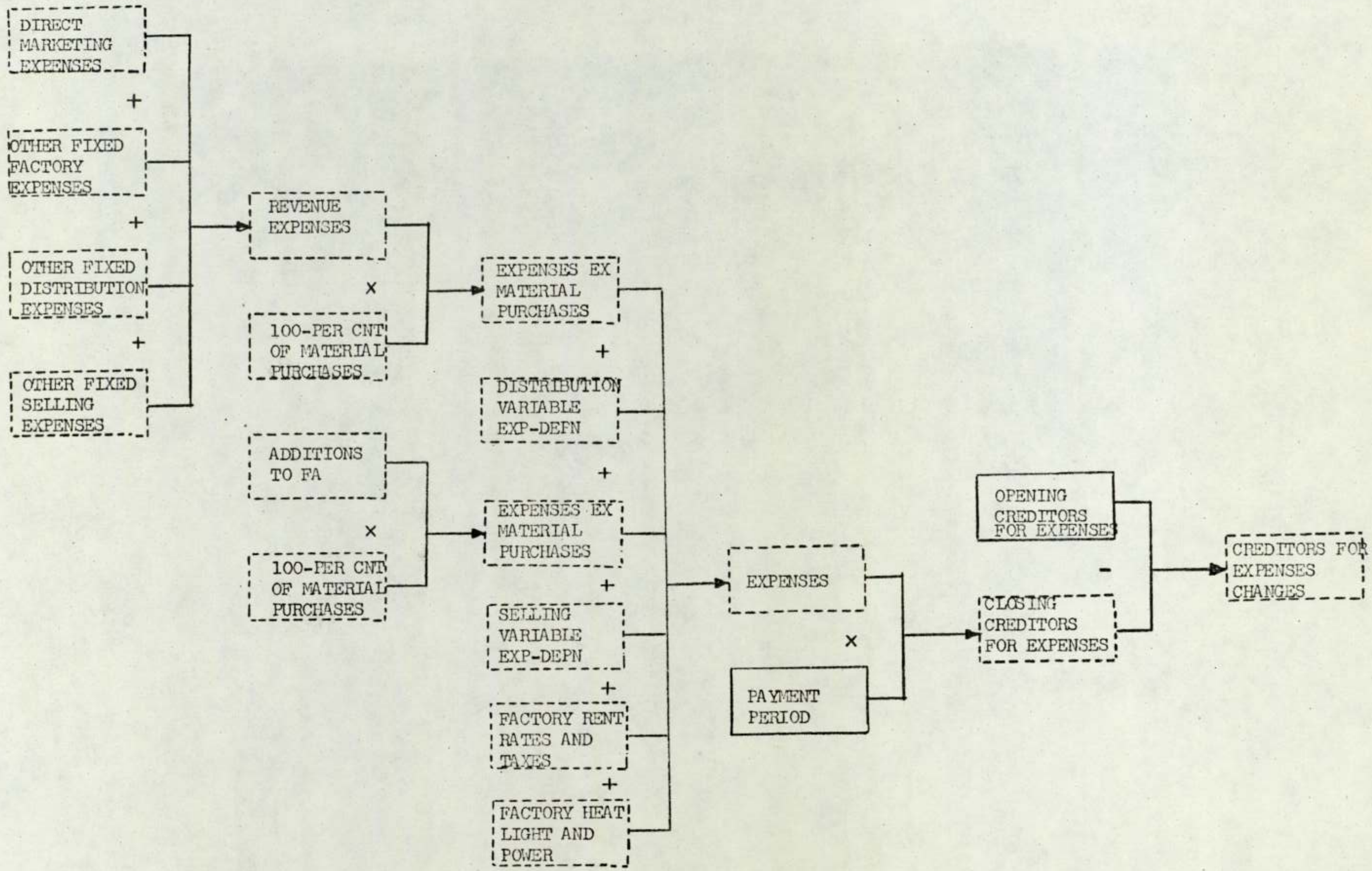

FIGURE 8.12/3 CREDITORS MODEL (CONTINUATION)

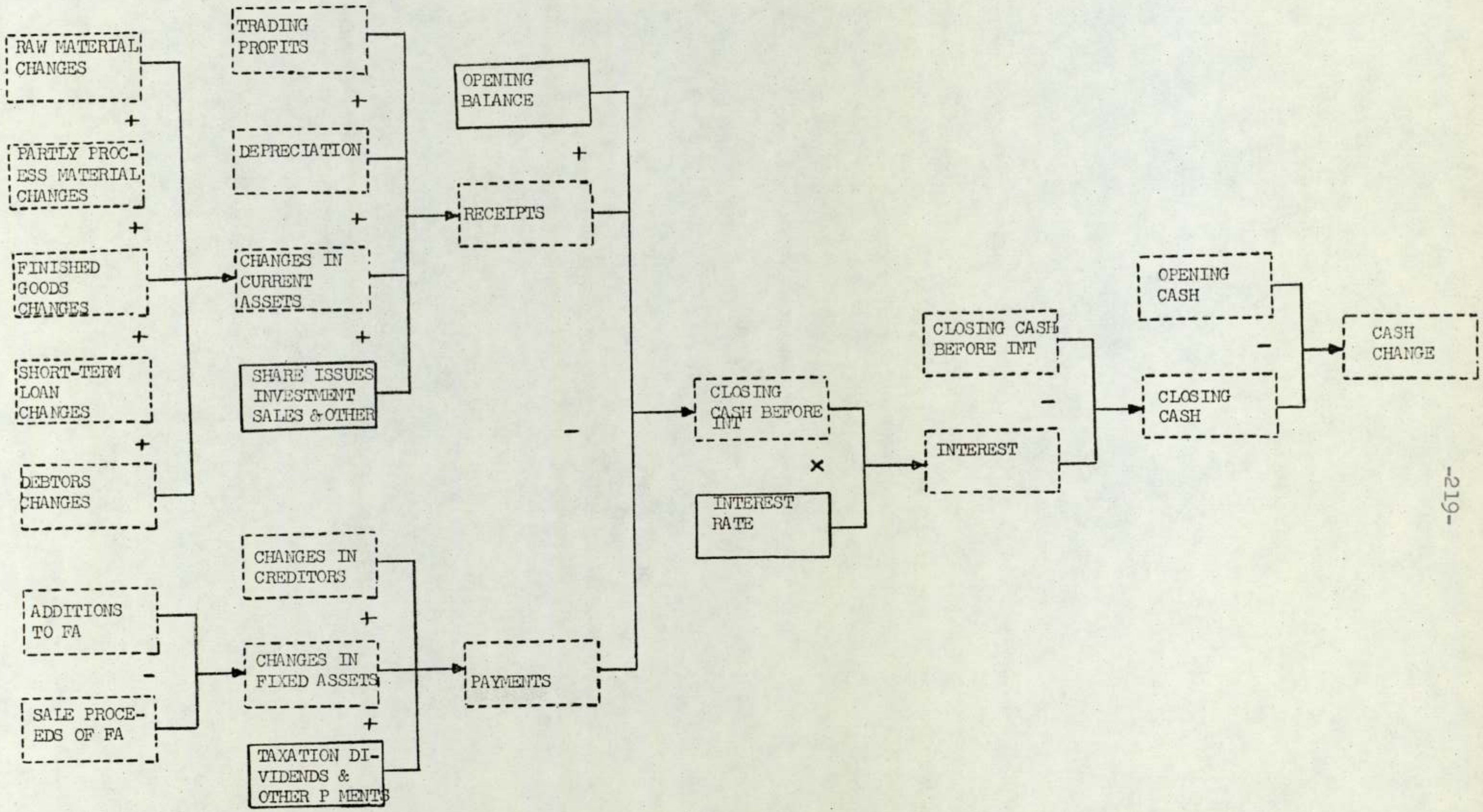

FIGURE 8.13 CASH FLOW MODEL

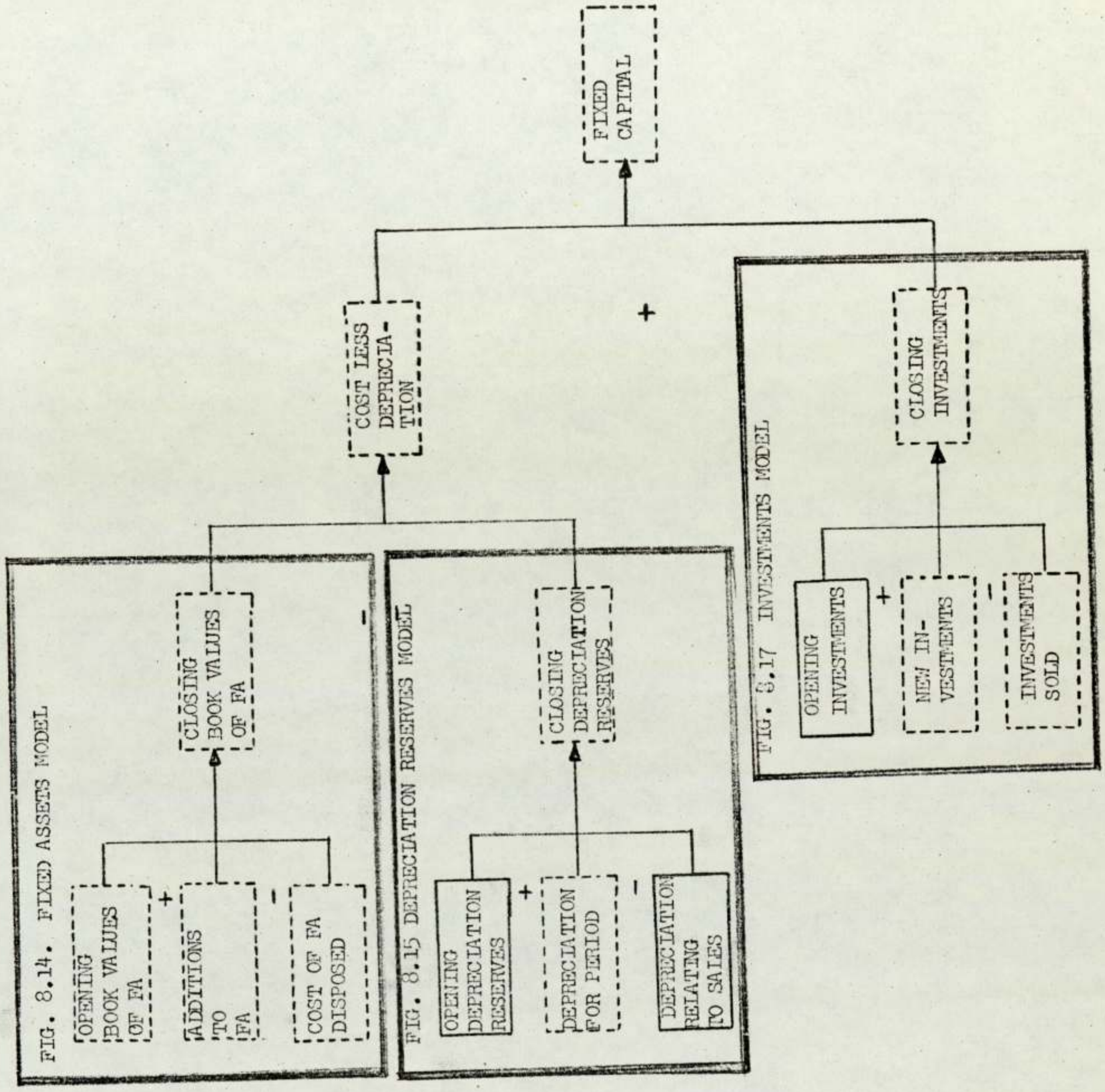

FIG. 8.14. FIXED ASSETS MODEL

FIG. 8.15 DEPRECIATION RESERVES MODEL

FIG. 8.17 INVESTMENTS MODEL

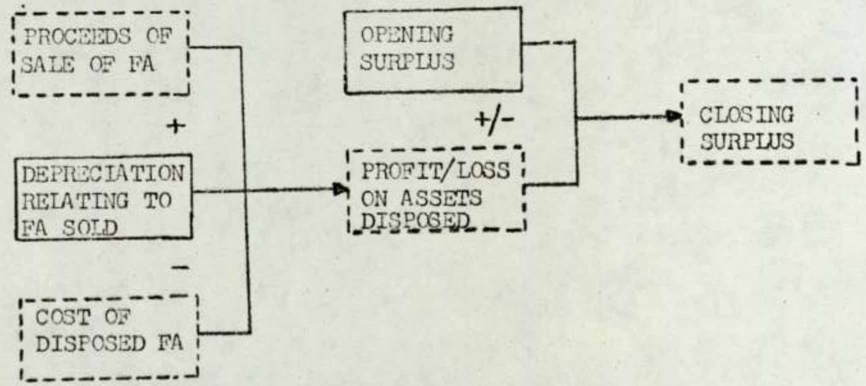

Figure 8.16. SALE OF ASSETS MODEL

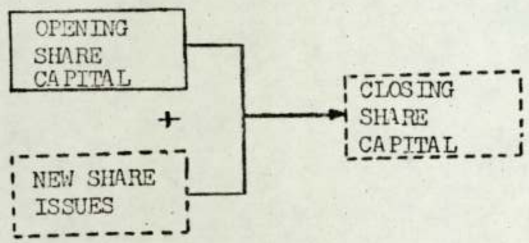

Figure 8.19. SHARE CAPITAL MODEL

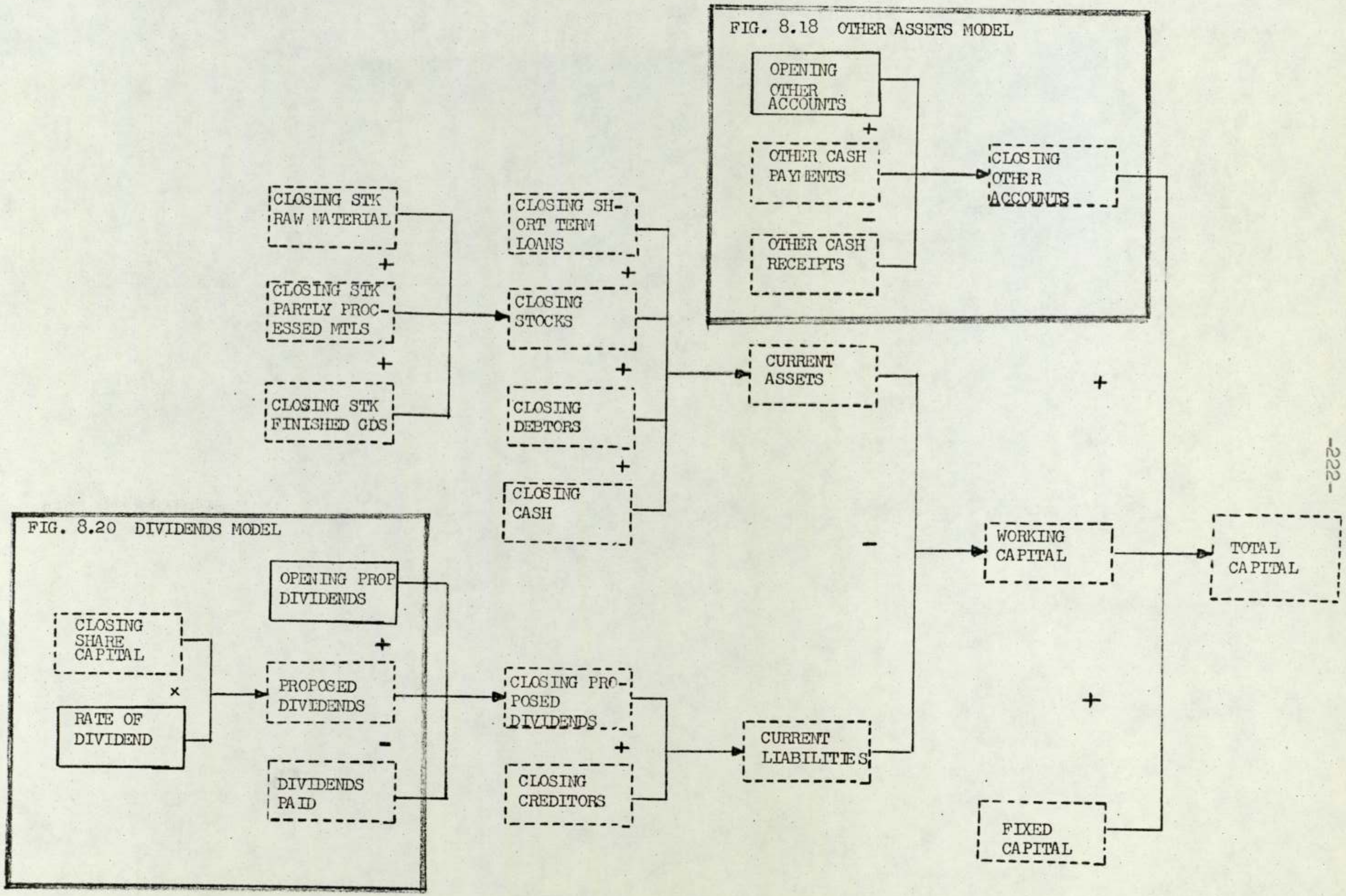

FIG. 8.18 OTHER ASSETS MODEL

FIG. 8.20 DIVIDENDS MODEL

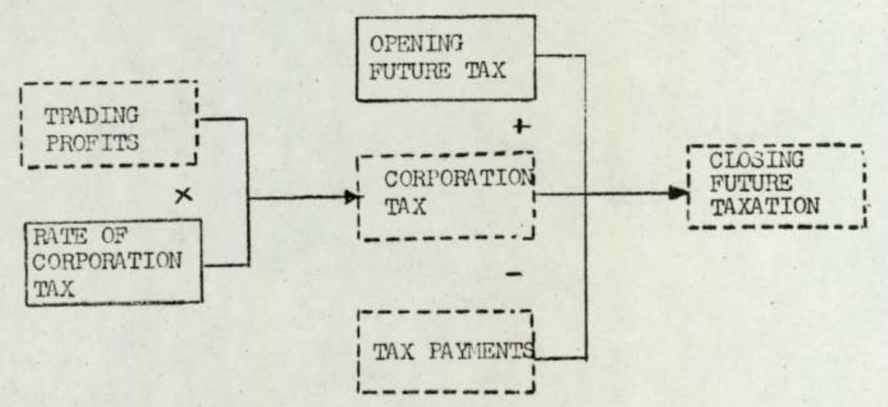

Figure 8.21. TAXATION MODEL

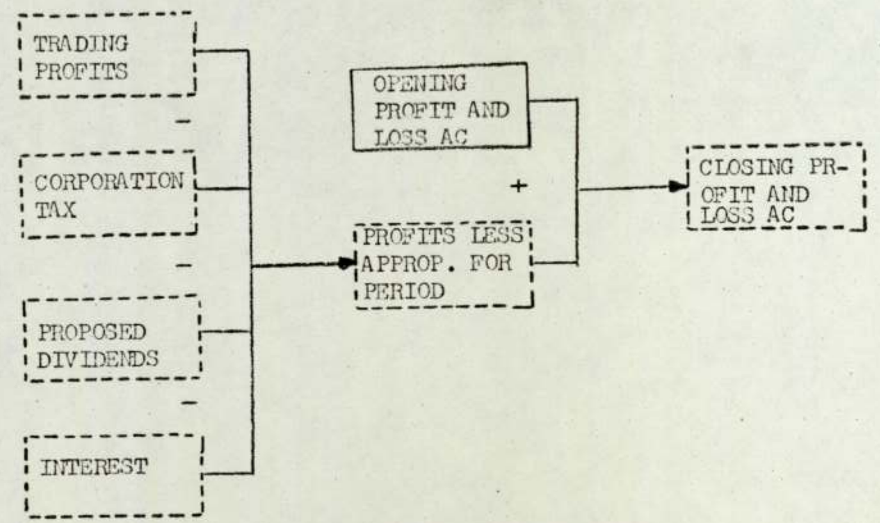

Figure 8.22. REVENUE RESERVES MODEL

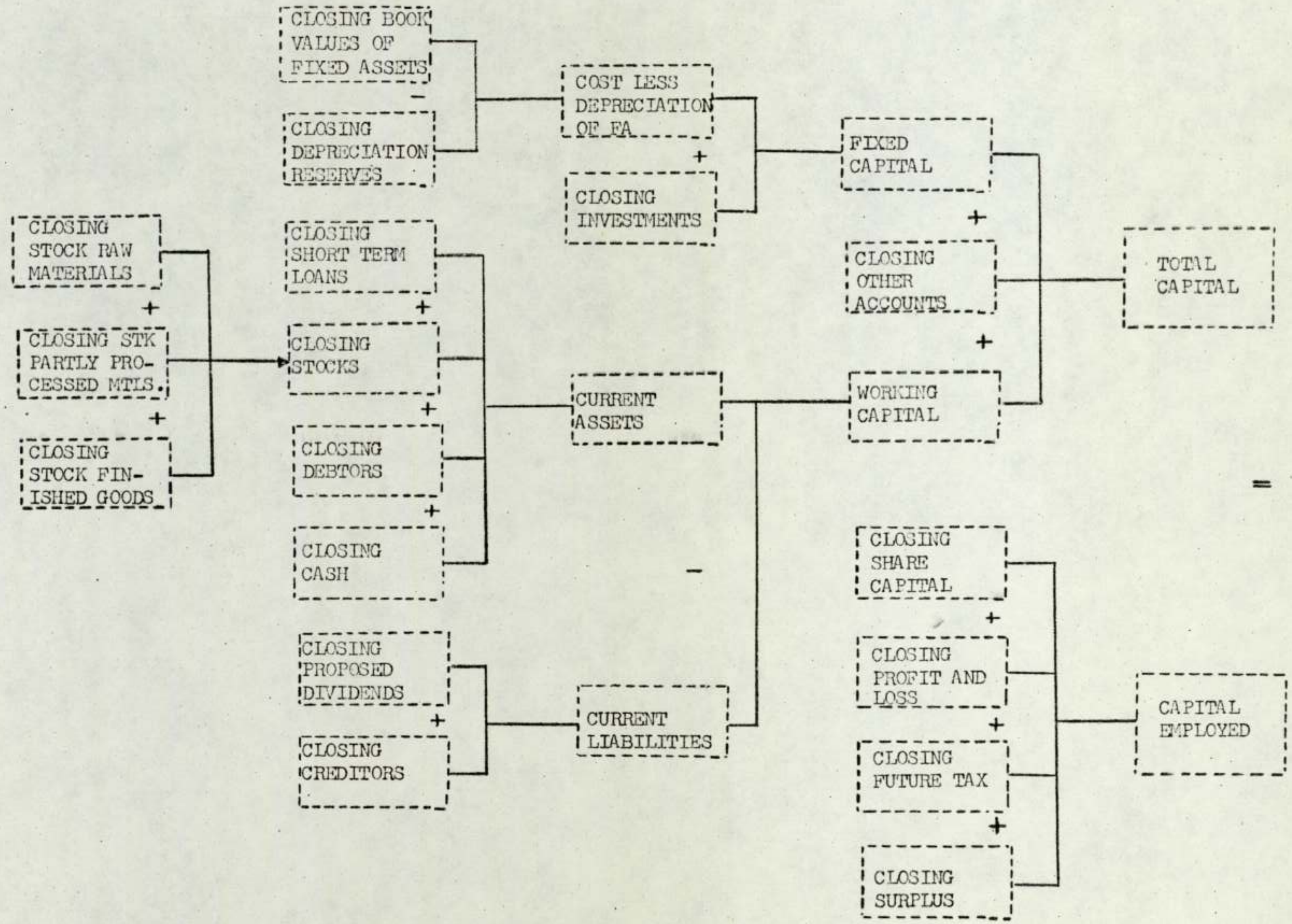

Figure 8.23 FINANCIAL POSITION MODEL

absolving the need to do loops in many cases because of its ability to handle vectors and matrices. The mathematical operators bear conventional signs (+ - x ÷) and there are some special functions represented by signs and symbols which in APL are termed primitive operators. This language, apart from being symbolic making it difficult for others to follow through the programs, is easy in our experiences to learn and use. The diagnostic messages are quite specific for the location of errors. There are no such requirements as "Dimension Statements" which often confuse a beginner. We would say it is at a level higher than other high level languages and lie somewhere between modelling systems and other high level languages.

8.6.2. Variables and Parameters

It is inevitable that we have to provide a certain amount of information and/or data, somehow or other, to run the models. There are two choices in this connection. The information or data can either be built in the models as constants or incorporated therein as variables.

The common practice is to build in parameters (i.e. measures which remain fairly unchanged) as constants in the models. This is done either directly by inserting the parameter values in the programs or indirectly through the use of parameter names with values assigned to them. It is obvious that constants take the same values from run to run and models need amendments if any changes to the values are desired and necessary.

Variables, on the other hand, are built in with associated names. The values to the variables are created before a run. This allows models to be run with different sets of data.

The information/data requirements in various models together with their parameter/variable names incorporated in the programs are as follows:

SN	Description/type	Variable/ Parameter name	Design for operation
A	SALES MODEL		
1	Basic selling prices per ton	P1	Read in
2	Allowable price increase per cent	I1	" "
3	Sales volume forecasts in tons	Q	" "
B	VARIABLE COSTS MODEL		
1	Price per ton of each ingredient	P2	" "
2	Usage in tons of each ingredient per ton of each product	Q2	" "
3	Standard direct labour costs per ton of each product	LC2	" "
4	Associated employee costs as a % of wages and salaries	AEC	Built in
5	Variable distribution costs per ton of each product	D2	Read in
6	Variable selling costs as a % of sales incomes	S2	" "
C	FIXED COSTS MODEL		
1	Fixed factory salaries and wages of each period	W3	Read in
2	Factory rent, rates and taxes of each period	R3	" "
3	Factory power, heat and light of each period	H3	" "

4	Original costs of each category of fixed assets at beginning	OC	Read in
5	Additions to each category of fixed assets in each period	A3	" "
6	Original costs relating to disposed assets	CD3	" "
7	Sale proceeds of disposed assets	D3	
8	Depreciation rates of fixed assets	DR3	Built in
9	Management charges of each period	MNGTCHG	Read in
10	Other fixed factory costs	OF3	" "
11	Fixed distribution salaries and wages of each period	W4	" "
12	Other fixed distribution expenses	OF4	" "
13	Fixed selling salaries and wages	W5	" "
14	Other fixed selling expenses	OF5	" "

D <u>PROFIT MODEL</u>

1	Direct marketing expenses	DMKGEXP	" "

E <u>FINISHED STOCKS MODEL</u>

1	Pattern of finished stock holdings during the budget period	FGPFLE FGPFLE1	Built in " "
2	Stock balance at the beginning of first period	OPFG	Read in

F <u>PART PROCESSED STOCKS MODEL</u>

1	Pattern of part processed stock holdings during the budget period	PPMPFLE PPMPFLE1	Built in " "
2	Stock balance at the beginning of first period	OPPPM	Read in

G	RAW MATERIAL STORES MODEL		
1	Pattern of raw material stores holdings during the budget period	RMPFLE RMPFLE1	Built in " "
2	Store balance at the beginning of first period	OPRM	Read in
H	SHORT TERM LOANS MODEL		
1	Balances at period ends during the budget period	CI10 CLSTLOANS	Read in " "
I	DEBTORS MODEL		
1	Debtor's balances at the beginning of first period	OPDEBTS	Read in
2	V.A.T. per cent	V11	Built in
3	Trade debts collection period in weeks	CTI1	Built in
4	Inter-company debts collection period in weeks	CT11	Built in
5	Development grants allowance % of capital expenditure	G11	Built in
J	CREDITORS MODEL		
1	Creditors' balances at the beginning	OPCREDITS	Read in
2	Per cent of material purchases in revenue expenses.	PM12	Built in
3	Percent of material purchases in capital expenditures	PM12A	" "
4	Trade credits settlement period	CS12	" "
5	Percent of inter-company transactions in credits	P12	" "

6	Inter-company credits settlement period	IS12	Built in
7	Accrued expenses disbursement period	DD12	" "
K	<u>CASH FLOW MODEL</u>		
1	Cash balance at beginning	OPCASH	Read in
2	Rate of interest	RI	Built in
3	Payments for taxation, dividends and others of each period	TDC	Read in
4	Receipts on share issues, sale of investments and others of each period	SIR	" "
L	<u>FIXED ASSETS MODEL</u>		
M	<u>DEPRECIATION RESERVES MODEL</u>		
1	Depreciation reserves at beginning	OPDEPN	Read in
2	Depreciation reserves relating to disposed assets	DEPNS	" "
N	<u>INVESTMENT MODEL</u>		
1	Investment at cost at beginning	OPINV	Read in
O	<u>OTHER ASSETS MODEL</u>		
1	Balance on others at beginning	OPOAC	" "
P	<u>SALE OF FIXED ASSETS MODEL</u>		
1	Balance of profits/loss at beginning	OPSRPLS	" "
Q	<u>SHARE CAPITAL MODEL</u>		
1	Share capital at beginning	OPSHCAP	" "

R	REVENUE RESERVES MODEL		
1	Balance at beginning	OPPL	Read in
S	TAXATION MODEL		
1	Rate of corporation tax	CPNR	Built in
2	Tax provisions at beginning	OPFTAX	Read in
T	DIVIDENDS MODEL		
1	Rate of dividends	DIVR	Built in
2	Proposed dividends at beginning	OPPDIV	Read in
U	FINANCIAL POSITION MODEL		

8.6.3. Selective changes to variables and parameters

Programming the models to produce profit and loss, cash flow statements and balance sheet is completed after coding 19 computer programs (functions in 'APL' usage). The strong point in computerised budgeting is the ability to respond repidly to "what if" queries. Very often, only one or a few of the data elements relating to one or a few of the variables and parameters,are to be changed and 37 programs have been written to fulfil such requirements. We have designed our system to enable us to ascertain the effects on sales incomes, costs, profits, cash balances, working capital and the overall state of affairs of the following changes:

(i) sales volume forecasts,

(ii) selling price forecasts,

(iii) value added tax rates,

(iv) purchase price forecasts of cocoa, sugar, milk, other ingredients and packing materials,

(v) changes in receipes by shortages in supplies of any of the materials in (4),

(vi) wage and salary structures,

(vii) basis of associated employee costs,

(viii) labour efficiency/productivity,

(ix) short time working, labour and staff redundancies,

(x) charges for power, rent, rates and insurance,

(xi) marketing expenses due to changes in channels and advertising media,

(xii) interest rates and overdraft facilities,

(xiii) amounts and timings of capital programmes,

(xiv) debts collection periods,

(xv) periods of settling suppliers' accounts,

(xvi) disbursing periods of wages and A.E.C.,

(xvii) payment periods of other expenses,

(xviii) stock levels of cocoa, other edibles, packing materials, crumb, other part processed materials, standard and seasonal lines of finished stocks,

(xix) rates of corporation taxes, and

(xx) dividend rates.

8.6.4. Mode of Operation

Our models are operated on conversational mode. All that a user needs to initiate a run is to type in FORECAST (for profit and loss and/or cash flow statements), AMENDFORECAST (for changes in any of the variables and changeable parameters and then to produce amended profit and loss and/ or cash flow statements) and FORECAST BALSHT (for balance sheet). The user is, thereafter, prompted by the programs to provide the values of respective variables. Facilities are built in to pass over variables and parameters which are not to be subjected to amendments. There are also options to suppress the printing of reports, in which case, users could simply examine

FORECAST

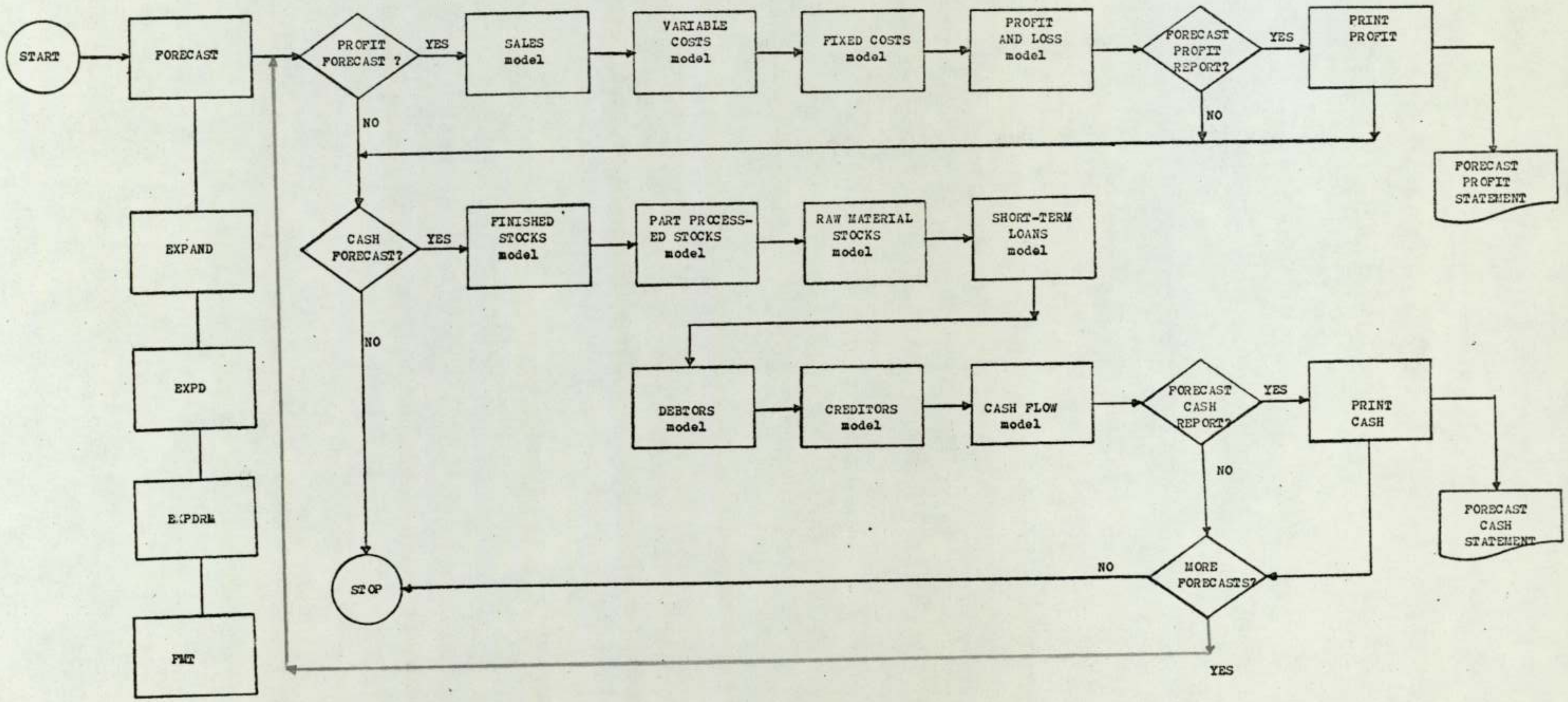

FIGURE 8.24 OPERATING PROFIT AND CASH FLOW MODELS

AMENDFORECASTS

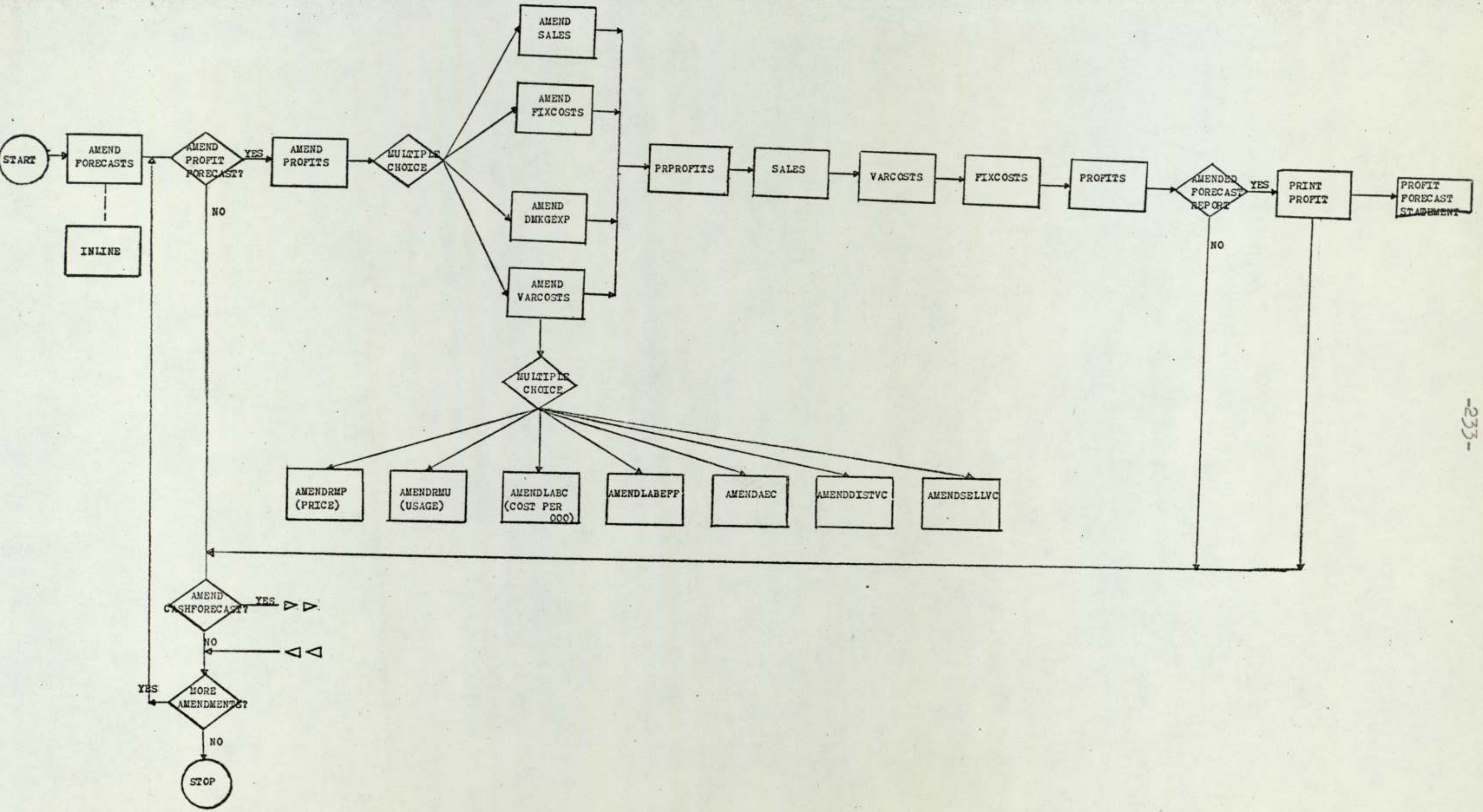

FIGURE 8.25/1 OPERATING 'WHAT IF' MODELS

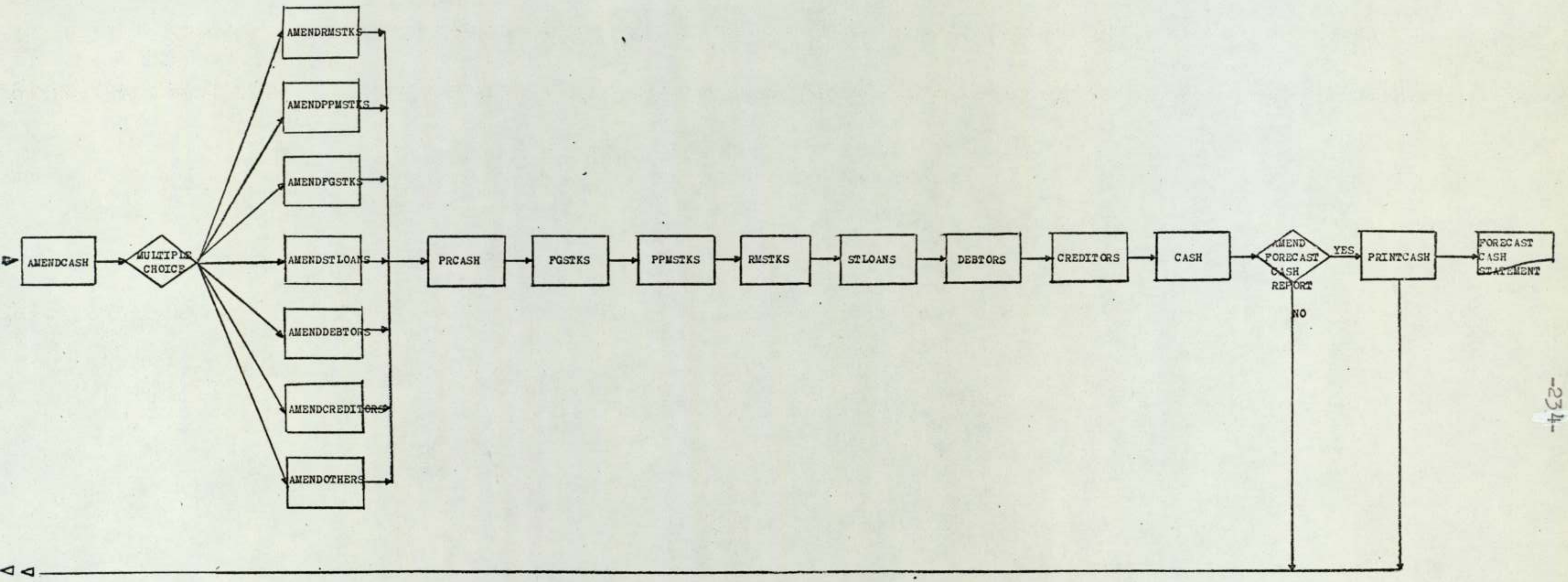

FIGURE 8.25/2 OPERATING 'WHAT IF' MODELS

FORECASTBALSHT

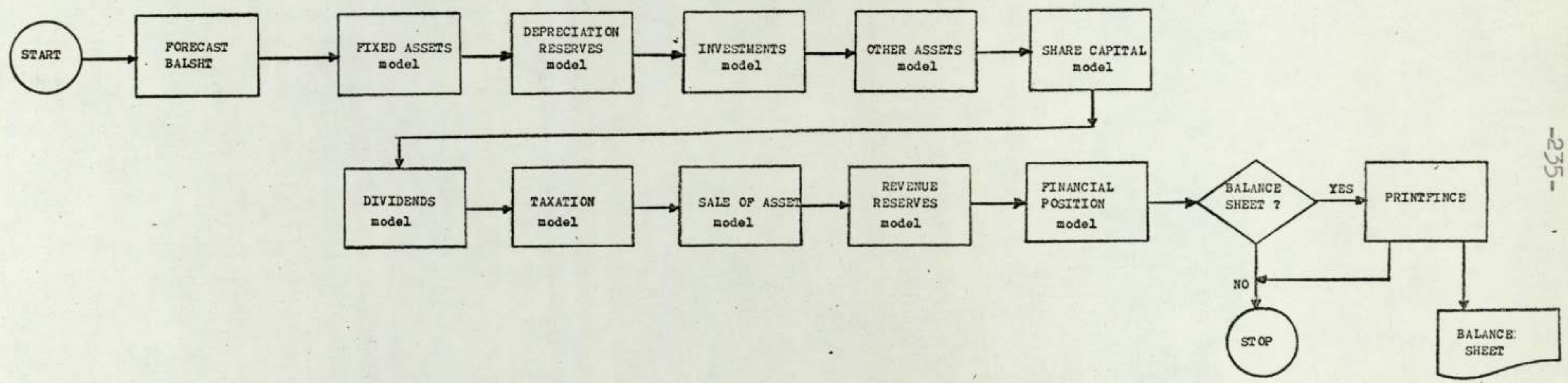

FIGURE 8.26 OPERATING BALANCE SHEET MODELS

a particular result or results by entering appropriate outcome variable names. The order in which the programs are processed is shown by the flow charts in Figures 8.24/8.26. Program listings could be found in Appendix 5 of the thesis.

8.7. DATA COLLECTION

Our models are built to handle different number of product groups, ingredients and varying lengths of planning horizons. This leaves the dimension of data formats flexible to suit particular circumstances. In the data collection phase, after considering availability, ease of collection, economy, compatibility with existing system, and objectives and functions of the models, we decided for a structure of 43 product groups with 33 ingredients stretching over 13 four-weekly periods. This should provide us a happy medium, high enough level of aggregation to do profit planning at corporate/group level and at the same time sufficiently detailed to avoid undesirable consequences of averaging too far. The product groupings and receipe structures also fit in with the outputs from PRINCE runs.

The data collection phase took over two months which is more than we have anticipated. The problems we encounter and overcome are discussed here to convey an idea of their nature, type, and to enable to take lessons from computerisation of financial planning and budgeting functions.

We observe first of all that there are no uniform groupings of products. Two computer packages, STRATPLAN and PRINCE are in use at Confectionery Finance Department. The product groupings for these two computer software packages are different and the outputs/results from one could not directly be fed into the other. Besides no one package provides all data requirements of a model encompassing the entire group. It necessitates restructuring either one or the other of the outputs to be used in our models.

The second point we wish to make is that there are more than one source of data with no agreement between/among them. The records of fixed assets, maintained and kept at "Equipment Control", show values different from those in "Group Board Returns." We also observe some differences between the balances and requisite breakdowns shown by the "General Ledger" and "Group Board Returns" on debtors and creditors. We understand that some transactions and items bear many aspects which might be emphasised and highlighted variously for different purposes. But we could hardly justify for those cited above, which to outsiders like us, attempting to portray an integrated picture, demand some thoughts and consideration perhaps unnecessarily.

We stated earlier that various types of expenses which make up the factory administration, and selling overheads are vulnerable to inflation and other changes at different degrees. We have, therefore, broken down the factory fixed costs into salary and wages, rent, rates and insurance, heat, light and power, depreciation, management charges and others. The overhead expenses have been prepared in some details by cost centres. But it necessitates us to analyse them all over to compile the breakdown of overheads by type of expense categories to enable us to ascertain the effects of inflation and others, as they are not readily available.

In this connection, we feel it pertinent to bring out a limitation of one of the accounting conventions, which is none other than that the amounts of fixed costs are different when accounted on "absorption" and "accrual" bases. This makes our models difficult to achieve both the likely cash balances and net profits (in conventional sense), at least periodically, with a single set of fixed overheads. One has to be satisfied with the knowledge that contributions, at best, would be close to the correct amounts when runs are made with fixed costs accounted on "accrual" basis. We need separate runs of the models with respective sets of fixed overheads to obtain forecasts of likely profits as well as probable cash balances by periods.

We also wish to point out that unavailability and/or incompleteness of data forces us to amend the models in some cases and use subjective estimates in others. As could be observed from the flow charts depicting the logic behind stock models, we intend to determine the stock balances by relating them to stock holding periods - finished stocks to number of weeks' sales, part processed materials to length of production cycle in weeks and raw material stocks to number of weeks' production. The informat-ion concerning respective stock holding periods is not practically available by product groups and type of materials. We have, therefore, amended the stock models, making them to project stock balances following the previous year's patterns. This, in our opinion, should produce reasonable results as the pattern of forecast sales for the budget period follow very closely to those of the previous year and if there are no material changes in production policy, which we considered highly unlikely from our observations.

We have used subjective estimates for the percentage composition of material purchases in revenue and capital expenditures and also for the per cent of inter-company transactions in credits. This has produced respectable results and the values can be changed, if necessary. We observe in this connection, that the use of subjective data or information is often necessary and at times preferable to the historical data especially because we are dealing with planning rather than scorekeeping. But data collection is a formidable task and users should be prepared to face and cope with the type of problems we have encountered.

8.8. SUMMARY

In this chapter, an account of the work of developing computer budget models at the corporate level was given. We went through a series of steps in designing the system: defining objectives, determining type and structure of models, specifying model logic, programming, testing and debugging the models, collecting data, running the programs with live data and presenting the system to a group of senior finance personnel.

There are altogether 56 computer programs to process the data and produce the reports in the first instance and also to allow "what if" exercises to be undertaken and produce the reports accordingly. The entire system is composed of a set of modules. The programs basically utilised accounting hypotheses, conventions and practices in use at Cadbury Schweppes Ltd. as the logic underlying them. We used a general purpose computer language - APL - in programming the models, which were run in conversational mode. The data collection phase took more than the time we expected and it proved to be a formidable task with all the subsequent changes to the models to suit available data.

The system produces profit and loss statement, cash flow statement and financial position statements by periods for the Confectionery group as a whole. They are shown on pp. 241-248 at the end of this chapter.

The models, therefore, cover practically all the activities and operations which give rise to financial effects to the group. The Confectionery group of Cadbury Schweppes could pick up the system, perhaps with some changes, to use it for financial planning and budgeting purposes.

The system was demonstrated to a group of senior finance personnel and the follow up of its uses in interviews with the latter indicated that the system would fulfill its objectives and serves as a planning media. The first hand experiences and observations in designing and running the system provided us with ideas of the requirements, problems and implications of computerised planning and budgeting systems which are discussed in the next chapter.

CADBURY SCHWEPPES LIMITED-CONFECTIONERY GROUP
FORECAST PROFIT STATEMENT AT 18/05/76
FOR FIRST 6 PERIODS

POUNDS IN 000

	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD
SALES INCOME	15,536	16,409	13,344	11,769	11,891	11,046
FACTORY VAR COSTS	8,785	9,325	7,661	6,816	6,885	6,450
DISTRIBN VAR COSTS	390	493	277	185	187	172
SELLING VAR COSTS	425	451	360	314	319	291
TOTAL VAR COSTS	9,600	10,270	8,298	7,315	7,391	6,913
GROSS CONTRIBUTION	5,936	6,139	5,046	4,454	4,500	4,133
DIRECT MKTG EXPENSES	659	1,025	695	736	616	429
NET CONTRIBUTION	5,277	5,114	4,351	3,717	3,884	3,704
FACTORY FIXED COSTS	1,797	1,815	1,834	1,854	1,873	1,892
DISTRIBN FIXED COSTS	387	391	395	400	404	408
SELLING FIXED COSTS	1,004	1,014	1,024	1,035	1,045	1,056
TOTAL FIXED COSTS	3,188	3,221	3,253	3,288	3,321	3,356
TRDG PROFITS BF INT	2,089	1,893	1,098	429	563	348

CADBURY SCHWEPPES LIMITED-CONFECTIONERY GROUP
FORECAST PROFIT STATEMENT AT 18/05/76
FOR LATER 7 PERIODS

POUNDS IN 000

	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD
SALES INCOME	10,822	9,041	10,553	18,973	19,172	13,893	10,330
FACTORY VAR COSTS	6,331	5,254	6,219	11,038	11,137	8,074	5,984
DISTRIBN VAR COSTS	168	141	158	456	458	235	159
SELLING VAR COSTS	284	238	275	529	535	372	271
TOTAL VAR COSTS	6,783	5,633	6,651	12,023	12,131	8,681	6,413
GROSS CONTRIBUTION	4,040	3,408	3,902	6,950	7,041	5,211	3,917
DIRECT MKTG EXPENSES	427	437	710	762	705	778	329
NET CONTRIBUTION	3,612	2,971	3,191	6,188	6,335	4,433	3,587
FACTORY FIXED COSTS	1,911	1,931	1,950	1,970	1,990	2,010	2,029
DISTRIBN FIXED COSTS	412	416	420	424	429	433	437
SELLING FIXED COSTS	1,066	1,077	1,088	1,099	1,110	1,121	1,132
TOTAL FIXED COSTS	3,388	3,423	3,458	3,493	3,529	3,563	3,598
TRDG PROFITS BF INT	224	(452)	(267)	2,694	2,807	870	(10)

CADBURY SCHWEPPES LIMITED - CONFECTIONERY GROUP
FORECAST CASH STATEMENT AT 18/05/76
FOR THE FIRST 6 PERIODS

POUNDS IN 000

	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD
OPENING BALANCE	(2,390)	(11,085)	(9,236)	(11,792)	(12,504)	(12,917)
TRADING PROFITS	2,089	1,893	1,098	429	563	348
DEPRECIATION	187	190	193	195	198	201
OTHER RECEIPTS	(20)	(20)	0	(20)	(10)	(11)
DECR/(INCR) IN RAW MATLS	(3,885)	181	(901)	485	899	52
DECR/(INCR) IN P P MATLS	(1,874)	1,001	511	(500)	(360)	(1,553)
DECR/(INCR) IN FND GOODS	(1,731)	587	(876)	(163)	(1,777)	392
DECR/(INCR) IN ST LOANS	0	0	0	0	0	0
DECR/(INCR) IN DEBTORS	(4,474)	(3,348)	2,802	3,342	648	854
INCR/(DECR) IN CREDITORS	4,018	2,011	(4,324)	(3,847)	163	902
NET DECR/(INCR) IN ASSETS	(412)	(568)	(559)	(528)	(628)	(526)
OTHER PAYMENTS	(2,500)	0	(400)	0	0	0
INTEREST CHARGES	(94)	(78)	(100)	(106)	(109)	(105)
CLOSING BALANCE	(11,085)	(9,236)	(11,792)	(12,504)	(12,917)	(12,363)

CADBURY SCHWEPPES LIMITED - CONFECTIONERY GROUP
FORECAST CASH STATEMENT AT 18/05/76
FOR THE LATER 7 PERIODS

POUNDS IN 000

	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD
OPENING BALANCE	(12,363)	(17,357)	(17,445)	(16,964)	(16,667)	(16,758)	(8,526)
TRADING PROFITS	224	(452)	(267)	2,694	2,807	870	(10)
DEPRECIATION	203	205	208	210	213	214	216
OTHER RECEIPTS	21	10	20	0	50	40	12
DECR/(INCR) IN RAW MATLS	1,570	143	215	271	491	122	626
DECR/(INCR) IN P P MATLS	(1,309)	(814)	(305)	1,432	1,258	1,203	1,312
DECR/(INCR) IN FND GOODS	1,218	(1,018)	(795)	4,032	2,266	(1,137)	(999)
DECR/(INCR) IN ST LOANS	0	0	0	0	0	0	0
DECR/(INCR) IN DEBTORS	765	2,076	(801)	(9,763)	(4,752)	5,617	6,759
INCR/(DECR) IN CREDITORS	(4,544)	420	2,845	2,066	(1,771)	1,807	(2,089)
NET DECR/(INCR) IN ASSETS	(508)	(523)	(508)	(518)	(523)	(438)	(467)
OTHER PAYMENTS	(2,500)	0	0	0	0	0	0
INTEREST CHARGES	(134)	(134)	(130)	(128)	(129)	(66)	(25)
CLOSING BALANCE	(17,357)	(17,445)	(16,964)	(16,667)	(16,758)	(8,526)	(3,190)

CADBURY SCHWEPPES LIMITED - CONFECTIONERY GROUP
FORECAST FINANCIAL POSITION AT 18/05/76
AS AT THE ENDS OF THE FIRST 6 PERIODS

POUNDS IN 000

	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD
FIXED CAPITAL						
FIXED ASSETS						
COST AT BEGINNING	26,789	27,133	27,633	28,124	28,584	29,144
ADDITIONS	419	575	566	535	635	534
	27,208	27,708	28,199	28,659	29,219	29,678
DISPOSALS	75	75	75	75	75	85
COST TO DATE	27,133	27,633	28,124	28,584	29,144	29,593
DEPN AT BEGINNING	12,673	12,800	12,931	13,064	13,199	13,337
DEPN FOR PERIOD	187	190	193	195	198	201
	12,860	12,991	13,124	13,259	13,397	13,538
DEPN RELATING TO SALES	60	60	60	60	60	68
DEPN TO DATE	12,800	12,931	13,064	13,199	13,337	13,470
COST LESS DEPN TO DATE	14,333	14,702	15,060	15,385	15,807	16,123
INVESTMENTS						
AT BEGINNING	120	140	160	160	180	190
ADDITIONS						
	120	140	160	160	180	190
DISPOSALS	(20)	(20)	0	(20)	(10)	(11)
INVESTMENTS TO DATE	140	160	160	180	190	201
FIXED CAPITAL	14,473	14,862	15,220	15,565	15,997	16,324

WORKING CAPITAL						
CURRENT ASSETS						
STOCKS-RAW MATERIALS	14,573	14,392	15,292	14,807	13,908	13,856
-PART PROCESSED	7,672	6,671	6,160	6,661	7,021	8,574
-FINISHED GOODS	17,806	17,219	18,095	18,257	20,035	19,642
	40,051	38,282	39,548	39,725	40,963	42,072
DEBTORS-TRADE	20,859	23,939	21,139	17,900	17,211	16,318
-INTER-COMPANY	1,418	1,463	1,401	1,315	1,329	1,368
-DEV GRANTS	175	398	456	440	468	468
-ASSETS DISPOSAL	9	11	11	11	11	12
	22,462	25,810	23,008	19,666	19,018	18,165
SHORT TERM LOANS	7,000	7,000	7,000	7,000	7,000	7,000
CASH BALANCE	(11,085)	(9,236)	(11,792)	(12,504)	(12,917)	(12,363)
CURRENT ASSETS	58,428	61,856	57,764	53,887	54,065	54,874
CURRENT LIABILITIES						
CREDITORS-TRADE	15,932	17,463	12,605	11,991	11,079	11,423
-EXPENSE	2,819	3,369	2,778	2,672	2,640	2,390
-PAYROLL	1,397	1,449	1,287	1,214	1,225	1,209
-INTER-COMPANY	2,900	1,466	1,685	1,312	1,457	1,398
-VAT ACCOUNT	1,243	2,556	3,623	941	1,893	2,776
	24,291	26,302	21,978	18,131	18,294	19,197
PROPOSED DIVIDENDS						
AT BEGINNING	2,900	400	400	0	0	0
FOR PERIOD	0	0	0	0	0	0
	2,900	400	400	0	0	0
AMOUNTS PAID OUT	2,500	0	400	0	0	0
BALANCE TO DATE	400	400	0	0	0	0
CURRENT LIABILITIES	24,691	26,702	21,978	18,131	18,294	19,197
WORKING CAPITAL	33,737	35,154	35,786	35,756	35,770	35,677
OTHER ACCOUNTS						
AT BEGINNING	101	101	101	101	101	101
FOR PERIOD	0	0	0	0	0	0
	101	101	101	101	101	101
TOTAL CAPITAL EMPLOYED	48,310	50,117	51,107	51,422	51,868	52,102

REPRESENTED BY;						
SHARE CAPITAL	30,675	30,675	30,675	30,675	30,675	30,675
PROFIT AND LOSS BALANCE						
AT BEGINNING	751	2,746	4,561	5,559	5,882	6,336
TRADING PROFITS FOR PERD	2,089	1,893	1,098	429	563	348
	2,840	4,639	5,659	5,988	6,445	6,683
INTEREST CHARGES	94	78	100	106	109	105
PROPOSED DIVIDENDS	0	0	0	0	0	0
CORPORATION TAX PROVISIO	0	0	0	0	0	0
	94	78	100	106	109	105
BALANCE TO DATE	2,746	4,561	5,559	5,882	6,336	6,579
SURPLUS ON ASSET DISPOSAL						
AT BEGINNING	0	(8)	(16)	(24)	(32)	(40)
SALE PROCEEDS	7	7	7	7	7	8
ORIGINAL COST	75	75	75	75	75	85
LESS:ACCUMULATED DEPRECN	60	60	60	60	60	68
COST LESS DEPRECIATION	15	15	15	15	15	17
PROCEEDS LESS NET COST	(8)	(8)	(8)	(8)	(8)	(9)
BALANCE TO DATE	(8)	(16)	(24)	(32)	(40)	(49)
FUTURE TAXATION						
AT BEGINNING	14,897	14,897	14,897	14,897	14,897	14,897
PROVISION FOR PERIOD	0	0	0	0	0	0
	14,897	14,897	14,897	14,897	14,897	14,897
AMOUNTS PAID OUT	0	0	0	0	0	0
	14,897	14,897	14,897	14,897	14,897	14,897
CAPITAL EMPLOYED	48,310	50,117	51,107	51,422	51,868	52,102

CADBURY SCHWEPPES LIMITED - CONFECTIONERY GROUP
FORECAST FINANCIAL POSITION AT 18/05/76
AS AT THE ENDS OF THE LATER 7 PERIODS

POUNDS IN 000	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD
FIXED CAPITAL							
FIXED ASSETS							
COST AT BEGINNING	29,593	30,033	30,488	30,928	31,378	31,833	32,203
ADDITIONS	515	530	515	525	530	445	476
	30,108	30,563	31,003	31,453	31,908	32,278	32,679
DISPOSALS	75	75	75	75	75	75	90
COST TO DATE	30,033	30,488	30,928	31,378	31,833	32,203	32,589
DEPN AT BEGINNING	13,470	13,613	13,759	13,906	14,057	14,209	14,364
DEPN FOR PERIOD	203	205	208	210	213	214	216
	13,673	13,819	13,966	14,117	14,269	14,424	14,580
DEPN RELATING TO SALES	60	60	60	60	60	60	72
DEPN TO DATE	13,613	13,759	13,906	14,057	14,209	14,364	14,508
COST LESS DEPN TO DATE	16,420	16,729	17,022	17,321	17,624	17,839	18,081
INVESTMENTS							
AT BEGINNING	201	180	170	150	150	100	60
ADDITIONS							
	201	180	170	150	150	100	60
DISPOSALS	21	10	20	0	50	40	12
INVESTMENTS TO DATE	180	170	150	150	100	60	48
FIXED CAPITAL	16,600	16,899	17,172	17,471	17,724	17,899	18,129

WORKING CAPITAL							
CURRENT ASSETS							
STOCKS-RAW MATERIALS	12,286	12,144	11,928	11,657	11,166	11,045	10,419
-PART PROCESSED	9,883	10,697	11,002	9,571	8,313	7,110	5,798
-FINISHED GOODS	18,424	19,442	20,236	16,205	13,939	15,076	16,075
	40,593	42,283	43,167	37,433	33,419	33,231	32,292
DEBTORS-TRADE	15,544	13,730	14,240	23,974	28,737	23,070	16,544
-INTER-COMPANY	1,425	1,166	1,456	1,487	1,470	1,552	1,338
-DEV GRANTS	420	418	418	416	422	390	368
-ASSETS DISPOSAL	11	11	11	11	11	11	13
	17,400	15,324	16,125	25,888	30,639	25,023	18,263
SHORT TERM LOANS	7,000	7,000	7,000	7,000	7,000	7,000	7,000
CASH BALANCE	(17,357)	(17,445)	(16,964)	(16,667)	(16,758)	(8,526)	(3,190)
CURRENT ASSETS	47,636	47,161	49,328	53,653	54,300	56,728	54,365
CURRENT LIABILITIES							
CREDITORS-TRADE	9,276	8,720	10,292	9,929	10,340	11,636	9,887
-EXPENSE	2,378	2,335	2,634	3,251	3,225	2,869	2,327
-PAYROLL	1,212	1,169	1,243	1,683	1,697	1,377	1,265
-INTER-COMPANY	921	1,259	1,314	1,169	1,416	1,493	979
-VAT ACCOUNT	866	1,589	2,433	3,951	1,534	2,645	3,472
	14,652	15,072	17,916	19,983	18,212	20,019	17,930
PROPOSED DIVIDENDS							
AT BEGINNING	0	(2,500)	(2,500)	(2,500)	(2,500)	(2,500)	(2,500)
FOR PERIOD	0	0	0	0	0	0	3,681
	0	(2,500)	(2,500)	(2,500)	(2,500)	(2,500)	1,181
AMOUNTS PAID OUT	2,500	0	0	0	0	0	0
BALANCE TO DATE	(2,500)	(2,500)	(2,500)	(2,500)	(2,500)	(2,500)	1,181
CURRENT LIABILITIES	12,152	12,572	15,416	17,483	15,712	17,519	19,111
WORKING CAPITAL	35,484	34,590	33,912	36,170	38,588	39,209	35,255
OTHER ACCOUNTS							
AT BEGINNING	101	101	101	101	101	101	101
FOR PERIOD	0	0	0	0	0	0	0
	101	101	101	101	101	101	101
TOTAL CAPITAL EMPLOYED	52,184	51,590	51,184	53,743	56,413	57,209	53,485

REPRESENTED BY;							
SHARE CAPITAL	30,675	30,675	30,675	30,675	30,675	30,675	30,675
PROFIT AND LOSS BALANCE							
AT BEGINNING	6,579	6,669	6,083	5,685	8,252	10,930	11,734
TRADING PROFITS FOR PERD	224	(452)	(267)	2,694	2,807	870	(10)
	6,803	6,217	5,816	8,380	11,059	11,800	11,724
INTEREST CHARGES	134	134	130	128	129	66	25
PROPOSED DIVIDENDS	0	0	0	0	0	0	3,681
CORPORATION TAX PROVISIO	0	0	0	0	0	0	6,388
	134	134	130	128	129	66	(10,094)
BALANCE TO DATE	6,669	6,083	5,685	8,252	10,930	11,734	1,630
SURPLUS ON ASSET DISPOSAL							
AT BEGINNING	(49)	(57)	(65)	(73)	(81)	(89)	(97)
SALE PROCEEDS	7	7	7	7	7	7	9
ORIGINAL COST	75	75	75	75	75	75	90
LESS:ACCUMULATED DEPRECN	60	60	60	60	60	60	72
COST LESS DEPRECIATION	15	15	15	15	15	15	18
PROCEEDS LESS NET COST	(8)	(8)	(8)	(8)	(8)	(8)	(9)
BALANCE TO DATE	(57)	(65)	(73)	(81)	(89)	(97)	(106)
FUTURE TAXATION							
AT BEGINNING	14,897	14,897	14,897	14,897	14,897	14,897	14,897
PROVISION FOR PERIOD	0	0	0	0	0	0	6,388
	14,897	14,897	14,897	14,897	14,897	14,897	21,285
AMOUNTS PAID OUT	0	0	0	0	0	0	0
	14,897	14,897	14,897	14,897	14,897	14,897	21,285
CAPITAL EMPLOYED	52,184	51,590	51,184	53,743	56,413	57,209	53,485

CHAPTER 9

CONCLUSIONS

9.1. INTRODUCTION

This final chapter sets out the requirements, problems and implications of developing computer budget models under the headings of approach, environment, operating the models, costs and uses of budget models. The requirements, problems and implications relating to developing and operating the models are discussed under hardware, software and personnel. The thesis concludes with a full summary.

9.2. APPROACH

The approach adopted in developing the corporate level budgeting models have been stated on p.199of Chapter 8. The work proceeded well, but the approach taken is akin more to the technical computerisation phase. The approach to the entire problem appears to consist of six basic steps,[1] although others[2] break the process into ten (or even more!) steps. The six basic steps are:

> "First, there is the feasibility study, in which the uses of the model and the general approach are defined. Secondly, one determines

1. George W. Gershefski, Corporate Models - The State of the Art, Management Science, Vol. 16, No.6, February, 1970, p. B-310.

2. John S. Hammond III, Do's & don'ts of computer models for planning, Harvard Business Review, Vol. No. March-April, 1974, pp. 112-113.

the basic structure of the model and develops the necessary equations. Third comes computer coding, testing and debugging. Fourth, is accuracy testing. Fifth, management review, and sixth a continual process of extension and revision."[3]

The work done and accounted for in the previous chapter precludes the early and later steps i.e. feasibility study and implementation which is presumably included under management review of the six steps mentioned above. A professional assignment, however, would definitely undergo all six steps which are all equally important in developing budget models.

9.3. ENVIRONMENT

9.3.1. Management Policy and Attitude

Management support of computer budget models scarcely needs any more emphasis. A computer project or for that matter any project would hardly ever get off the ground without management support. Besides, we can find much being written about this need.[4,5,6] It is, however, to be pointed out that management interest, involvement or even enthusiasm are very important in projects of this kind. The development of budgeting and planning models involves questions of principles, philosophy and conventions too important to be left entirely with model builders. Model builders, after all, because of their concern (necessarily!) for details are at middle management levels

3. George W. Gershefski, op. cit., p. B-310.

4. D. E. Brown, Stages in the cycle of a corporate planning model, in A.N. Schriber (Ed.), Corporate Simulation Models, University of Washington, pp. 92-116.

5. J. H. Goldie, Simulation and Irration, in A. N. Schrieber (Ed.), Corporate Simulation Models, University of Washington, 1970, pp. 614-

6. Peter H. Grinyer, Corporate Financial Simulation Models for Top Management, Omega, Vol. 1, No. 4, 1973.

and cannot be assumed to possess top level views, ideas and considerations. Management need to show interest and get involved in model development which requires continuous improvements by interaction with and feedback from managers. There is also a lot to be said for model builders to excite management attention and gain involvement and acceptance. Achieving fairly rapid pay-offs from the investment in model building is one of them. Grinyer and Batt,[7] in a study of three firms, reported management understanding of the model logic and familiarity of report formats as factors affecting level of success. These relate directly to model logic and design and are dealt with under 'program requirements'.

9.3.2. Behavioural Considerations in Budgeting

We have seen in Chapter 4 and in the study of the existing budget system in Chapter 7 the indispensability of the involvement of staff and their participation in establishing budgets. The staff and the employees are committed to the budgets and will put their maximum efforts to achieve them when these personnel are given a hand to in setting the budgets and see them as equitable. It is important that the levels of standards in the budgets are at the same time reasonably high and also to be accepted by the personnel so that the goals in the budgets become the levels of aspiration of the employees. It, however, needs and takes time to give effect to these human considerations. The basic data and information (standards) are neither available for some time nor could simply be generated by computer models. It has been noted in the conclusions on operational level budget

7. P. H. Grinyer and C. D. Batt, Some Tentative Findings on Corporate Financial Simulation Models, Operational Research Quarterly, Vol. 25. No. 1, March, 1974, pp.

models that computers will not be a great help in setting up 'equitable' budgets.

This is the environment within which budget models must live and operate. It does not mean that computer-aids are neither devisable nor feasible for budgeting. The human considerations and the need for personnel involvement pose obstacles to attempts at automatic generation of basic data and drastic shortening of the budget time cycle. The budget models in top down applications, with their means of evaluating alternatives and 'what if' facilities have a lot to offer to management in planning the activities and operations of a firm.

9.3.3. Availability of Data

Data availability has often been a problem in many of the applications. Boulden, in a study of 55 computerised corporate planning system installations, finds that such is the case and says "many firms have been restricted in the degree to which they can apply computerized corporate planning because the historical data has not been adequate to permit developing meaningful relationships between variables."[8] Our experience supports this finding.

The development of the strategic level budgeting system was completed in August 1975. Most of the work since then has been concerned with assembling the basic input data. At the beginning, it was left with the staff of the company to get the data. But the necessary data was not forthcoming and by the end of 1975, we set out to collect the data. The data collection, vetting and validation lasted until February 1976 working full time.

8. James B. Boulden, Computerized Corporate Planning, Long Range Planning, Vol. 3, No. 4, June 1971, p.7.

There altogether 70 data items of various dimensions in the corporate level budget models. The dimensions of respective items depend on the level of aggregation, at which the models are to be operational. It was stated in the previous chapter that the corporate level budget models were to be operational for 43 product groups, broken down into 33 ingredients, covering a planning horizon of 13 four-weekly budget periods. The design of details or break down of other items like fixed assets, finished stocks, part-processed materials, raw materials, debtors and creditors also made their impacts on the dimensions of the data items. Fixed assets were classified into 5 categories, necessitated by the different depreciation rates. For reasons of similar nature, finished stocks, part-processed materials, raw materials, debtors and creditors were classified into 2,2,3, 4 and 5 categories respectively. The dimensions of the 70 data items, therefore, are of various sizes: 43 x 33, 43 x 13, 33 x 1, 2 x 13, 3 x 13, 4 x 13, 5 x 13, 5 x 1, etc. The total number of data elements included in the above 70 data items amount to 3410. It is estimated that some 400 man-hours were spent to collect them.

The type of data available and subsequent runs with them, moreover, brought about a number of changes to model logic and consequently to computer programs in our experience. Changes were necessary also to accommodate large masses of data within the allowed storage areas (work spaces) of the computers. These types of changes are necessary, perhaps, because test runs were made with dummy data which were not massive enough to use large stores. We are aware of the practice of testing with historical data, which in our case, would demand efforts out of all proportions to anticipated advantages. It was necessary to keep on working to the middle of April 1976 to obtain respectable results. The data availability is, therefore, sometimes a real problem but should not be an obstruction altogether and Beer's words are highly relevant: "there is the old excuse (it is nothing more) about there being an inadequate data base. I have never been able to understand this claim, and have never yet found it justified. The business is being run; it is run on some data or other, however inadequate. To put those data into a model cannot conceivably make anything worse than it already is."[9]

The problem of data accessability and availability, we believe, would be minimised by embedding the models in the company's procedures for budgeting and planning especially when they are well-defined and quantified. This means that the computer models should be part and parcel of the firm's budgeting system, governed by the same principles and philosophy, covering the same planning horizon and following and forming an integral part of the procedures. The computer models should fit in with the overall time schedules and use the same structure and format of data as that of the planning and budgeting system. The models and the working papers or forms to be produced by the system should be designed in such a manner that the latter will directly become or usable as inputs to the models.

9.4. OPERATING THE MODELS

9.4.1. D. P. Hardware

We have seen in Chapter 5 the tremendous developments in dp hardware on all fronts. These developments have reduced the cost and increased the speed of processing and size of stores. Developments in systems software

9. Stafford Beer, Computer Simulation in Europe, Long Range Planning, Vol. 3, No. 4, June 1971, p.9.

made even more dramatic impact in that small and medium sized firms can now have access to latest hardware via tele-processing and time-sharing systems.

All the budget models were developed and run on I.B.M. system 360 and 370 computers which are offered to users on time-shared basis. Data security on time-shared systems is no longer a major problem and is satisfactory when the safeguards and measures like the user number and passwords built in the system by manufacturers and bureaux are reinforced by the use of codes in various data items. A major problem which could be encountered is the high load factor resulting in poor response time. This is particularly noticeable at peak hours of the day. Data storage requirements are large in low level applications under bottom up approaches and users often find the storage facilities inadequate, necessitating additional file handling and file management techniques. The time-shared systems was found to be adequate and reasonably satisfactory in developing and running the corporate level budget models and the company's I.B.M. 145 and 165 computers were not used.

The physical equipment required to use the time-shared system is a terminal (with an APL golf ball when using APL) and a data telephone or telephone coupler connecting the terminal to the computers. We use a basic terminal with neither card nor paper-tape attachments. But it is reckoned that terminal systems with the card or paper tape reader and punch in addition to the basic keyboard typewriter and the associated electronic controls would allow a reduction in connect time when applications involve massive data inputs as users decend down the level of aggregation.

9.4.2. Software

This section discusses the requirements and problems relating to the applications programs rather than the utility and operating software. It is to be noted that the use of the word 'software' in the present contexts is restricted.

9.4.2. (i) Program Requirements

Models cannot be considered successful unless they are used by managers. Models should extend a manager's ability to think about and analyse his operation, if they are ever to be used by a manager. This puts special requirements on design and a few suggestions, gained from experience and literature surveys,[10] are given below.

(a) Simple. We observe that one of the reasons why optimisation models are not in wide use is because managers find difficult to understand them. Simplicity promotes ease of understanding. Important phenomena should be put in the model and unimportant ones left out. Strong pressure often builds up to put more and more detail into a model. This should be resisted, until the users demonstrate they are ready to assimilate it.

(b) Robust. It is meant here that a user should find it difficult to make the model give bad answers. This can be done by a structure that constrains answers to a meaningful range of values.

(c) Ease to control. A user should be able to make the model behave the way he wants it to. We feel that majority of managers will seize models eagerly whenever apparent objective accuracy is attainable. It is desirable that managers should be left in control where this is not the case. After-all, the future is seldom like the past and a high degree of subjective judgement and skill should be allowed to play their parts in the models. Thus the goal of parameterization is to represent the operation as the manager sees it.

(d) Adaptive. The model should be capable of being updated as new

10. John D. C. Little, Models and Managers: The Concept of a Decision Calculus, Management Science, Vol.16, No.8, April 1970. p. B-470.

information becomes available. This is especially true of the parameters but to some extent of structure as well.

(e) Complete on important issues. Completeness is in conflict with simplicity. Structures must be found to handle many phenomena without bogging down. An important aid to completeness is the incorporation of subjective judgements. Human beings have a way of making better decisions than their data seem to warrant. We have often seen their ability to process a variety of assorted inputs and come up with aggregate judgements about them.

The use of subjective inputs may personalise the models to an individual or a group with apparent fragility and less trust by others than an empirical model. But the model with subjective estimates may be a good deal tougher because it is more complete and conforms more realistically to the world - or at least the world as the manager sees it.

(f) Easy to communicate. The manager should be able to change inputs easily and obtain outputs quickly. The use of on-line, conversational I/O and time-shared computing, is a great help in this connection.

Every effort should be made to express input requests in usual operational terms. The internal parameterisation of the model can be anything, but the requests for data should be in his language. The programs should be prepared to compel the computer to infer from inputs that are easier for the user to work with. Again it needs hardly any stress that familiar report formats facilitate ease of understanding which is one of the factors of successful applications.

9.4.2. (ii) Applications and Theory

It appears that it will be some time before applications and practices catch up advances in theory. Management still needs time to familiarise and appreciate the wide horizons opened up by theory. 'Self-correcting' mechanisms and 'decision' routines could have been built in the corporate level budget models, had necessary parameters been stated and available. The minimum and maximum levels in respect of cash, stocks, debtors, creditors and many others, if known, could have been built in the models along with courses of actions to be pursued in each case.

9.4.2. (iii) Continual Follow-up and updates

Ease of updating is unquestionably a desirable attribute of models and has been emphasised variably under flexibility and adaptability. But the need for continual follow up and updating the models demands efforts which users should be aware of and be prepared to accept. We find that there is always room for improvements to be made to the models. There are many alternatives in carrying out certain operations with different appeals to different users. Improvements could be effected in many ways, ranging from fundamental logic to minor matters like report descriptions. Such improvements have been incorporated in the corporate level models all throughout the period since they were completed to the time of demonstration and presentation to the senior finance staff. The amendments seem endless. There will be, doubtless, further changes, improvements and updates as the performance of the models are evaluated against results fed back over time. The model building is a continuing process and users must be prepared to update and amend the models as necessary.

The modular approach in design, structure and programming proves useful under such continual amendments. Despite this, it is a great task to keep track of updated versions of relative models. Besides, the number of runs for all the amendments and updates was also found to use up a considerable amount of resources.

9.4.3. Personnel Determinants and Requirements

The ideal is for the managers to design and build the models. But the managers have more important matters to attend to and they have neither the time nor the professional and technical expertise to develop the models. It requires a working knowledge in all the associated disciplines of management accounting, management science, data processing, systems science and computer technology. It does not necessarily follow that models developed by others will not be appropriate for planning and decision making. An analogy may, perhaps, be drawn in that the best motor cars (or all the motor cars) are not designed and built by any motorist. The design and development of computer models are left with the staff personnel.

The type of applications determines the group of model building personnel. Finance departments are ultimately held responsible for budgeting and financial planning functions. Besides, descriptive or simulation models, which finance personnel should be able to build without much problems and difficulties, appeal better than the optimising models to management. In 1968, in the United States, descriptive models accounted for 95% of all corporate models. There is also evidence that banks in U.S.A. are switching from linear programming to descriptive, simulation models.[11] It has been found that the active sponsorship normally came from the planning and finance department. Boulden even goes further to say: "Operational research groups have generally been an obstacle to the installation since they are oriented to more sophisticated techniques ..."[12] These developments clearly

11. C. D. Batt and T. R. Fowkes, Management science models in bank planning, Computer Weekly, No. 244, 24 June, 1971.

12. James B. Boulden, op. cit., p.4.

pointed out the suitability of finance personnel to undertake the model building tasks.

There is also another factor which favours the sponsorship of finance personnel in building budget models. The developments in software have brought a new breed of general purpose computer languages known as 'conversational' or 'interactive'. These languages learnt lessons and benefited from the experiences of precedent languages. They are not only simple, powerful and machine independent but also encouraging to beginners to learn and use them. This is due to the powerful diagnostics built in them. We are of the opinion that conversational languages would enable non-professional dp men like accountants to make in-roads to the model building field.

We use 'BASIC' and 'APL' in writing computer instructions to process the budget models. These languages enable us to carry out, without too much difficulties, what was being set out to do. The experience with 'APL' suggests that it will be a matter of days at the terminal, re-inforced by a study of the manual, for a person of reasonable intelligence and diligence, to come to use APL. We think finance personnel with orientation and training in maths, are suited to build and run computer budget models.

9.5. COSTS OF BUDGET MODELS

The costs and time spent on models are influenced by several factors like:

(1) scale and type of model,

(2) complexity of the company,

(3) amount of detail to be considered,

(4) availability of data,

(5) degree of documentation of existing planning and budgeting procedures,

(6) amount of statistical analysis required, and

(7) availability of trained personnel to work on the model.

It takes us about 1,200 man-hours to develop the system of strategic level budget models reported in the previous chapter. This is exclusive of the studies and observations of the company but inclusive of the learning period for 'APL'.

The following distribution of times to various phases, reported by Gershefski,[13] could be typical though we spent more on phase II in our experiences. The 10% allocation to 'implementation', in our opinion, would be the minimal which in many cases could easily be exceeded.

I	Definition of general approach	25%
II	Collection and analysis of historic data	25%
III	Development of computer programs	40%
IV	Implementation	10%

The times spent to develop corporate models ranges from 0.5 man-years to 23 man-years (Gershefski)[14] and 0.25 man-years to 2 man-years

13. George W. Gershefski, op. cit., p. B-311

14. Ibid, p. B-310.

(Grinyer and Batt).[15] The money expended is given in the latter source to range from £1,500 to £15,000. The strategic level budget models referred to in the previous chapter is estimated, in view of the 1,200 man-hours spent in developing them, to cost about £5,000.

9.6. USE OF MODELS

Budget models are designed for use by managers. The time has not, however, come for senior managers to sit at terminals asking 'what if' questions to the computers and explore a range of possible alternatives. Boulden finds in a survey of 55 of his clients that the final decision maker, in virtually all cases, choose to test alternatives via his planning staff rather than involve directly on a terminal himself.[16]

The use of models involves an analysis-education-decision process built around man-model-machine interaction. This simply means that at first the input data to the models is prepared and the manager reflects about the problem at hand. He spends a certain amount of effort digging out numbers and forming subjective estimates of several quantities. The models are then run and a process starts of comparing the results with intuition and of finding out what it is about inputs that makes the outputs come out as they do. The whole process updates a manager's intuition. The models serve the function of interrelating a number of factors and the

15. P. H. Grinyer and C. D. Batt, op. cit., p.152.
16. James B.Boulden, op. cit. p. 5.

implications of the interrelations become more apparent to the manager with repeated use of the model. The benefits of models could be realised through use. It also appears that a perfect system could seldom be expected at the very beginning. Systems of computer aids to budgeting need improvements as their performances in use and interaction with user managers are fed back over time. The system of corporate level budget models was demonstrated to the senior finance staff and the subsequent interviews with them suggest that they would achieve their objectives (stated on p.200 of Chapter 8). The objectives of the models, briefly stated, is to provide a medium and to assist in planning and budgeting the activities and operations of the company.

9.7. MAIN SUMMARY

This thesis began with a survey of planning systems, concepts, requirements and implications to give a broad perspective to budgeting systems. It then examined the budgeting function in systems contexts of a firm and its environment. Systems models of the various elements and overall finance function are developed in this process, looking at the objectives, functions, interrelations and inter-dependencies among such elements. A systems model of the financial planning and budgeting sub-system is then designed showing the interfaces with all other systems and their parts. It is observed that budgeting is not exclusively a finance function and to achieve the objectives, it should be the concern and working tool of every organisation units. A review is then made of the developments in inputs, processing and outputs of financial planning and budgeting systems encompassing philosophical, behavioural and technical aspects. An entire chapter is devoted to examine the developments in hardware (mainframes and peripherals) and software of computers as an important material inputs to budgeting systems. It is observed that, although some developments stress the significance of human factors in budget preparation, electronic computers leave no exceptions and make their impacts on budgeting systems by offering vast opportunities and potentials to be harnessed from them. The state of computer applications to budgeting and financial planning is, therefore, looked at by examining the type of models, model logic, type of computer models, languages used, modes of operation and benefits from such applications. It is found that applications fell short of expectations despite the prevalence of relevant concepts and adequate technology.

The experimental work involved the development of computer budget models in a leading U.K. confectionery manufacturer with a view, at the beginning, to determine their practicality. The objectives are then defined also to include a search for and specification of the requirements, problems and implications of using computers in budgeting and financial planning. Computer budget models are developed for operational (budget centre/shop floor) and strategic (group/corporate) levels after studying the existing budget system. These models are developed on I.B.M. computers using a time-sharing system. It is observed that computerisation of budget preparation has much to commend, despite some factors operating against achieving dramatic advantages discussed on p.13 of Chapter 1 in relation to operational level budget models, largely because of the immense volume of data processed and handled at operational levels and of the assistance to planning, enumerated on p.14 of Chapter 1 with respect to strategic level budget models, the activities and operations of the company.

The thesis concludes with this chapter specifying the requirements, problems and implications which were observed and experienced while carrying out the literature surveys and experimental work of the study. The work is an in-depth study and as such is related to one firm. The findings and conclusions are drawn from first-hand experiences and are, therefore, expected to explain partly the state of applications and also to contribute towards increasing the use of computers in budgeting and financial planning.

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APPENDIX 1

APPENDIX 1

OPERATIONS IN PREPARING BUDGETS

The following are the operations, shown against responsible personnel, involved in preparing the budgets.

No.	Operations	Responsible Personnel
A	<u>BRAND STRATEGY, SALES AND ADVERTISING BUDGET</u>	
1	Preliminary indication of 19-values to Market Managers	Financial Planning
2	Issue list of packings to be included in budget	Market Services
3	Prepare preliminary estimate of sales marketing expenditure and profit	Marketing Market Services Finance
4	Board considers and agrees 3 above	Board
5	Agreed sales estimates broken down into Product Groups and packings	Marketing Market Services
6	Provide indications of volume and likely areas of manufacture to Factory Accountants	Financial Planning
7	Factory Accountants discuss significant changes to product costs due to:	Factory Accountants

(a) Volume

(b) Waste

(c) Labour efficiencies

8	Preliminary estimates issued of: (a) Increase in labour rates (b) Increase in overhead	Budget Officer
9	Factory Accountants inspect preliminary factory costs ex. PRINCE and adjust manually for any change due to 7 and 8 above. Prepare manually estimates required at revised weights. Pass cost to Financial Planners	Factory Accountants Budget Officer
10	Prepare estimate of changes in variable selling and distribution rates	Group Department Accountant
11	Prepare brand strategies in accordance with agreed targets	Marketing Financial Planning
12	Brand strategies presented to Marketing Group	Marketing
13	Board considers and approves Brand Strategies	Board
14	Analyse Brand Strategy sales into packings by period	Market Services
B	<u>PRODUCTION BUDGETS - PLANNING</u>	
1	Obtain requirements from other groups	Factory Planning
2	Prepare production plans, summarising sales, stocks and production in outers by period for Bournville and Somerdale	Factory Planning

3	Input production plans into PRINCE	Factory Accountants
4	Run PRINCE to produce gross requirements reports	Budget Officer
5	Prepare production plans for milk factories	Factory Planning
6	Adjust PRINCE structures as necessary to reflect the correct weighting between production cost centres	Factory Accountants
7	Input revised structures in PRINCE	Factory Accountants
C	<u>MATERIALS BUDGET</u>	
1	Agree and schedule waste percentage to be approved for each process	Factory Managers Industrial Engineers Factory Accountants
2	Enter standard prices for all purchased material, edible and packaging on standard price cards	Buyers
3	Input on to standard price cards, details of units of measure for materials included in PRINCE structures and thus calculate PRINCE prices for purchased items.	Factory Accountants
4	Calculate prices for packing materials manufactured within the group and input on to standard price cards	Factory Accountants (Printing/Card Box Areas)
5	Prepare punch cards for revised prices	Budget Officer
6	Check receipe structures on PRINCE, adjusting as necessary for waste levels as in C/1	Factory Accountants

D	VARIABLE COST BUDGETS	
1	Prepare schedule of standard minutes and average performance levels for the year to date	Industrial Engineer
2	Agree standard minutes and efficiencies for budget period with production management	Factory Managers
3	Calculate agreed standard minutes for each product	Factory Accountants
4	Input revised standard minutes into PRINCE	Factory Accountants
5	Prepare mannings budget for each cost centre from production plans for variable direct labour	Factory Managers
6	Receive PRINCE gross requirements report showing number of standard hours required, reconcile this with the mannings budgets for cost centres	Factory Managers Factory Accountants Industrial Engineer
7	Complete budget forms showing budgeted labour cost rates including waiting time overlooking and other payments	Factory Accountants
8	Complete budget form setting budgeted rates to be applied for calculation of associated employee costs	Factory Accountants
9	Prepare budgets for other variable costs (i.e. non-labour)	Accountants
10	Prepare variable indirect labour mannings budget	Factory Managers Distribution Manager

11	Evaluate variable indirect mannings budget including associated employee costs	Factory Accountants Distribution Accountants
12	Evaluate variable direct manning budget including associated employee costs	Factory Accountants
13	Complete and summarise variable conversion budgets by cost centres	Factory Accountants
14	Budget holders consider and approve variable conversion budgets	Factory Managers
15	Compute variable conversion cost hourly rates and input into PRINCE, or variable cost recovery rates as appropriate	Accountants
16	Summarise variable labour personnel figures and supply to Factory Services	Factory Accountants

E <u>FIXED OVERHEAD BUDGETS-FACTORIES AND GROUP DEPARTMENTS</u>

1	Prepare and issue schedule setting out actual expenses to date for each cost centre by departmental expense code	Accountants
2	Prepare salary budget forms including overtime and shift payments. Calculate salary budget	Managers Accountants
3	Prepare indirect labour staffing requirements for fixed overhead factory cost centres	Factory Managers
4	Evaluate indirect labour staffing requirements including shift and overtime premiums	Factory Accountants

5	Prepare budgets for indirect materials and other direct cost	Managers Accountants
6	Prepare a budget for repairs and maintenance material and trades labour hours as follows:-	
	(a) Schedule of major revenue projects	
	(b) Calculate divisional and central trades requirements	Managers Divisional Engineers
	(c) Prepare a budget of stores issues and outside purchases	
	(d) Summarise divisional requirements for trades labour	Accountants
	(e) Summarise own divisional trades labour requirements and reconcile with E/3	Factory Accountants Divisional Engineers
7	Budget requirements in hours of cleaners and factory records	Managers
8	Update allocation factors for electricity, refrigeration, steam and accommodation	Factory Managers Engineers
9	Calculate budgets for electricity, steam and other services required from factory services	Factory Managers
10	For Factory Services Division	Factory Managers
	(a) Calculate budget for electricity, steam and other services	Factory Accountants
	(b) Reconcile staffings with requirements for trades, factory records and	

	cleaners and calculate costs	
	(c) Budget trunk haulage costs from factory stockrooms	
11	Summarise Factory Services divisional budget for departmental management approval prior to allocation	Factory Accountants
12	Summarise all fixed personnel figures and supply to Factory Services	Factory Accountants
13	Allocate and apportion direct costs using agreed factors	Factory Accountants
14	Complete and summarise fixed overhead budgets by cost centre	Accountants
15	Budget holders consider and approve fixed budgets	Managers
16	Calculate fixed conversion cost recovery rates and input to PRINCE	Accountants
F	FIXED OVERHEAD-SPECIFIC ITEMS-GROUP OVERHEADS DEPARTMENTS	
1	Analyse sales budget to depots in standard equivalent outers	Distribution Manager
2	Analyse deliveries to detached van points	Distribution Manager
3	Budget trunk haulage and delivery costs	Distribution Accountant
4	Calculate and agree service charge with other groups	Group Department Accountants
G	BUDGET CONSOLIDATION	
1	Board considers and approves factory budgets - fixed and variable	Board
2	Board considers and approves other budgets	Boards
3	Run PRINCE to calculate factory costs and	Budget Officer

	gross requirements	
4	Create STRATPLAN data files scheduled with models	Financial Planning
5	Check PRINCE output and reconcile with total factory budgets	Finance
6	Enter factory costs details and run STRATPLAN	Financial Planning
7	Board considers and approves total budget	Board
8	Prepare G forms and submit to Marble Arch	Finance
9	Copy, collate and circulate STRATPLAN STRATPLAN outputs	Financial Planning
10	Prepare, copy, collate and circulate Budget Manuals including performance indices	Accountants
11	Prepare cash flow by period	Finance
12	Approve G forms and submit to Marble Arch	Finance

APPENDIX 2

APPENDIX 2

BUDGET WORKING PAPERS

The examination of the working papers for computerisation of budget preparation at operational level was confined to the budget forms used for 'eclairs' section. Since the factory is organised as 'cost' and 'budget' centres, rather than 'profit' centres, the forms related to expenditure budgets.

The following relates to preparation of production budgets.

BP1 Allocation of Finished Production By Line to Cost Centres

BP1 is prepared at a higher level but is an input to the preparation of budgets for the cost centre.

BP4 Summary of Finished Production Requirements and Stocks by Period

BP4 is passed to Divisional Factory Accountants from Divisional Factory Planners. It shows the opening stocks and production in 000 outers for each product over the 13 four weekly accounting periods. It is essentially a reconciliation of production to sales as adjusted by stock changes. The calculations on BP4 is based on accounting hypothesis of: $\text{Sales}_i + \text{Closing Stocks}_i - \text{Opening Stocks}_i = \text{Production}_i$ where subscript i denotes type of product.

BP5 Analysis of Production and Calculation of Budget Production Hours by Periods

BP5 is prepared at Divisional Factory Accountants' office. It shows the production in tons and hours for 13 periods for subsequent determination of material and labour requirements. It is prepared from BP4 by applying the appropriate factors to convert production in 000 outers to tons and hours. There are two multiplicative calculations for each product and an additive calculation for each cost centre.

BP7 Calculation of Outputs Required from Manufacturing Processes

BP7 is prepared at Divisional Factory Accountant's office. It used the production in tons shown byBP5 as an input. Output in tons is grossed up to cover for packing waste and making loss at specified percentages. The resulting enrobed tons are exploded into requisite units which again are further exploded into middle breakdowns according to the percentage compositions. These materials explosions are made for all products over 13 periods.

BP6 Allocation of Production by Type of Centre to Base and Middle Making Processes in Tons

BP6 is prepared at Divisional Factory Accountants' office. It is a further explosion of middles arrived at in BP7 into bases and pre-made ingredients by composite percentages. This is carried out for 13 periods. The multiplicative and divisive calculations involved in preparing BP6 and BP7 approximate 6,500 for Confectionery and Dark Chocolate Division alone and nearly approach 7,000 with additions. It takes about two weeks to prepare BP6 and BP7.

The following forms relate to preparation of direct wages budget.

BL2 Calculation and Analysis of Production Worker Hours by Periods

This form is completed by cost centre superintendents and shows for

13 periods (a) number of production workers - full time, part time (b) average weekly hours worked per person (c) working weeks (d) total available hours - full time, part time = (a) x (b) x (c) (e) total hours worked by production hours = total available hours full time + part time (f) absent % (g) absent hours=(e) x (f) ÷ 100 (h) estimated hours paid to production workers = (e) - (g). (i) budget production hours at % efficiency (j) non-productive time = (h) - (i), analysed to: waiting time and overlooking. The information (i) is picked from BP5. This is the hours equivalent of production which is matched to paid hours to arrive at non-productive hours.

W1 Analysis of Production Labour Requirements by Pay Rates

W1 shows estimated paid hours into productive, overlooking and waiting hours by each grade of workers. Totals for all grades of workers in this form are reconciled and agreed with corresponding times in BL2 and BP5.

W2 Calculation of Productive Labour Cost

W2 calculates productive wages by inserting relevant rates and recapitulating the hours in W1.

W3 Calculation of Cost of Overlooking

W3 calculates cost of overlooking by inserting rates and recapitulating the hours in W1.

W4 Calculation of Cost of Waiting

W4 calculates cost of waiting by insertion of relevant rates as in W2 and W3.

W41 Calculation of Overtime Premiums

W42 Calculation of Shift Premiums

All entries in these forms except appropriate hourly rates, relevant times and resulting weekly costs and annual costs are repetitions of those in W1.

P20 Calculation of Overlooking R te of Pay per Hour Pieceworkers

Details and calculations on P20 are (a) sex (b) age (c) grade (d) days/nights (e) current time rate £/hour (f) bonus at 50 BSI (g) total current rate = (e) + (f) (h) budget increase% (i) budget total rate = (g) + (g) x (h) ÷ 100).

P21 Calculation of Hourly Rates of Pay for Pieceworkers

Details and calculations on P21 (a) sex (b) age (c) grade (d) days/nights (e) time rates £/hour (f) performance level (g) bonus per hour (h) threshold (i) total current rate = (e) + (g) (j) budget increase % (k) budget total rate = (i) + ((i) x (j) ÷ 100)

Forms W1 to W4, P20 and P21 are all completed in Divisional Factory Accountants' office. These forms and BL2 are possible, practicable and preferable to be combined. As such, they have been linked and combined in our program to produce direct wages budget.

The following relates to preparation of indirect wages budget.

BL5 Request for Non-Productive Labour from Service Departments

BL5 shows (a) average number of people per week (b) average hours per person per week (c) number of weeks (d) rate per hour (e) budget annual costs = (a) x (b) x (c) x (d). Working hours i.e. (a) x (b) x (c) is related to productive labour hours and a percentage is computed and also shown on BL5.

W20 Calculation of Wages for Hourly Paid Non-Production Operatives

W20 shows the following particulars and calculations (a) departmental expense code (b) grade and sex-number on full time, number on part-time (c) normal hours per week - full time, part time (d) total hours per week = (b) x (c) for full time and part time (e) average overtime per operative per week - full time, part time (f) total overtime hours per week = (b) x (e) (g) total available hours = (d) + (f) (h) absence % (i) absent hours = ((h) x (g) ÷ 100) (j) total paid attendence hours per week (k) rate per hour (l) cost per week = (j) x (k) (m) weeks in a year (n) cost per annum = (l) x (m)

W41 Calculation of Overtime Premiums

W42 Calculation of Shift Premiums

Entries in these forms except for inserting appropriate rates and calculations of costs are the same as in W20. Forms (BL5, W20, W41 and W42) used in setting indirect wages budget are related to one another and are combined in our computer program.

The following forms are used in preparing direct fixed salaries budget.

S1 Salaried Staff

S1 shows budget centre code, description and details, number employed, salaries per period and salaries for the year. It is used to arrive at budgeted salaries for a budget centre by summarising the information on S2 S3 and S4. It starts with present salaries (S2), to which is added/subtracted net increase/decrease (S3 and S4). Budget increase% and thresholds are added to the sub-totals to arrive at budgeted salaries.

S2 List of Present Salaried Staff

S2 presents the list with the following particulars: names, job description, male/female, full time/part time, part time hours, present salary per period and per annum. Totals in S2 are carried to S1.

S3 Amendment to Staff List

S3 shows expense code, names, reasons and specifications of sex, full time/part time, part time hours, present salary per annum under add and delete headings. Totals in S3 are carried to S1.

S4 Planned Increases and Reductions in Salaried Staff

S4 shows job-description, start date, periods in budget year, sex, full time/part time, part time hours, salary for one period and the year with reasons for increase and reductions in each case. Totals in this list are carried to S1.

S10 Budget Detail Sheet-Overtime Payment

S10 calculates overtime payments to salaried staff and shows (a) category of staff (b) number of people (c) average hours per person per week (d) total average hours per week = (b) x (c) (e) budget rates per hour (f) weekly cost = (d) x (e) (g) costs per annum = (f) x number of weeks in the year.

S11 Budget Detail Sheet - Shift Premium

S11 calculates shift premium to salaried staff and shows (a) category of staff (b) number of people (c) type of shift (d) shift premium rate per week (e) weekly cost = (b) x (d) (f) cost per annum = (e) x number of weeks in the year. The total premiums for shift work and overtime are compared with projected costs for current year and reasons for variations are asked to ensure control over the budget.

The forms S1 to S4 used in preparing budget salaries involved few calculations apart from additions and subtractions. This demands heavy data input in computer models. S10 and S11 involve some calculations and are combined in our program.

Forms relating to preparation of associated employee costs are:

A2 Associated Employee Costs - Wages

A3 Associated Employee Costs - Salaries

A2 and A3 are the same in format and show (a) grade or category descriptions (b) budgeted wages/salaries (c) average number (d) average weekly earnings = (b) ÷ ((c) x number of weeks) (e) ERC and company pension % (f) ERC and company pension = (b) x (e) ÷ 100 (g) sick pay % (h) sick pay = (b) x (g) ÷ 100 (i) holiday pay % (j) gift % (k) holiday pay and gift % = (i) + (j) (l) holiday pay and gifts = (b) x (k) ÷ 100 (m) total AEC = (f) + (h) + (l). Columns (b), (c), (f), (h), (l) and (m) are then totalled for all grades/categories.

APPENDIX 3

STRATPLAN MODEL LISTINGS

```
testmod1    10:21    10/23/74  wednesday  uk2

1 material breakdown(1,,=)
10 total tons(1,,,,2)=data(10)
20 1:overweight 1.6%=data(10)*1.6/100
30 packing waste 4.0 %=1(1)+data(10)*4/100
40 2:enrobed tons(1,-,=)=sum(total tons,packing waste 4.0%)
50 requisite units(1,,=,2)
60 strawberry 9.44%=1(2)*9.44/100
70 orange 9.51 %=1(2)*9.51/100
80 coffee 9.51 %=1(2)*9.51/100
90 caramel 8.44 %=1(2)*8.44/100
100 coker nut 7.67 %=1(2)*7.67/100
110 nut crunch 7.59%=1(2)*7.59/100
120 nougat ls 6.28%=1(2)*6.28/100
130 nut whirl 7.89%=1(2)*7.89/100
140 turk delight 9.29 =1(2)*9.29/100
150 hazel cream 6.04 %=1(2)*6.04/100
160 hazl in tofe 9.05%=1(2)*9.05/100
170 fudge 9.29%=1(2)*9.29/100
180 enrobed  tons(1,-,=)=sum(strawberry 9.44%,fudge 9.29%)
190 unit breakdowns(1,,=,2)
200 strawberry(1,,-)
210 waste 7.5 %=strawberry 9.44%*7.5/100
220 enrobed tons 1=strawberry 9.44%*107.5/100
230 chocolate 1 31.15%=enrobed tons 1*31.15/100
240 middle 1 68.85%=enrobed tons 1*68.85/100
250 base cream 94.83%=middle 1 68.85%*94.83/100
260 egg whip 4.74%=middle 1 68.85 %*4.74/100
270 end
```

```
testmod4     10:33   10/23/74  wednesday  uk2

10 i0p choc eclairs(,,,2,2)=data(10)
11 choc ecl 29.80=data(10)*29.80
20 b41 choc ecl jars(,,,2,2)=data(20)
21 ch ecl jars 23.29=data(20)*23.29
30 i01b export plybag(,,,2,2)=data(30)
31 expo pbag 49.03=data(30)*49.03
40 i0p b_current(,,,2,2)=data(40)
41 b_current 29.80=data(40)*29.8
50 b41 b_c jars(,,,2,2)=data(50)
51 b_c jars 23.29=data(50)*23.29
60 b101 b_c polybag(,,,2,2)=data(60)
61 b_c polybag 49.03=data(60)*49.03
70 choc eclairs(,,,2,2)=data(70)
71 choc ecl 16.58ton=data(70)*16.58
80 choc eclair p_mix(,,,2,2)=data(80)
81 ch ecl p_m 16.58t=data(80)*16.58
90 b_c eclairs(,,,2,2)=data(90)
91 b_c ecl 16.13&pton=data(90)*16.13
100 end
```

```
testmod3     10:29    10/23/74   wednesday   uk2

10 1:av no operators=data(10)
20 2:normal wkly hrs=data(20)
30 3:o'time wkly hrs=data(30)
40 4:tot norml wkly hrs(1,-,,1)=1(1)*1(2)
50 5:tot o'time wkly hr=1(1)*1(3)
60 6:tot avail wkly hrs(1,-)=1(4)+1(5)
70 7:no of wks p.a=data(40)
80 8:annual avail hrs(1,-)=1(6)*1(7)
90 9:absent hrs=data(50)
100 10:tot pd atten hrs(1,-)=1(8)-1(9)
110 11:productive%(1,-)=data(60)
120 12:prod time=1(11)*1(10)/100
130 13:prod wage rate=data(70)
140 14:prod labor cost(1,-,=)=1(12)*1(13)
150 15:o'looking%(1,,,2)=data(80)
160 16:o'looking time=1(15)*1(10)/100
170 17:o'looking rate=data(90)
180 18:o'looking cost(1,-,=)=1(16)*1(17)
190 19:waiting %(1,,,2)=data(100)
200 20:waiting time=1(19)*1(10)/100
210 21:waiting rate=data(110)
220 22:waiting cost(1,-,-)=1(20)*1(21)
230 tot labor cost(1,,=)=1(14)+1(18)+1(22)
240 23:o'time rate=.2503
250 o'time cost=1(23)*1(5)*1(7)
260 end
```

```
testmoc3     10:31    10/23/74   wednesday   uk2

10 m 6 d
20 m 5 d
30 m 4 d
40 m 3 d
50 f 6 d
60 f 5 d
70 f 4 d
80 f 3 d
90 m 6 n
100 m 5 n
110 m 4 n
120 m 3 n
130 f 4 eve
140 f 3 eve
150 end
```

```
testmod2    10:24   10/23/74  wednesday  uk2

1 prod labour req
10 male 6 day=data(10)
20 male 5 day=data(20)
30 male 4 day=data(30)
40 dale 3 day=data(40)
50 fem 6 day=data(50)
60 fem 5 day=data(60)
70 fem 4 day=data(70)
80 fem 3 day=data(80)
90 male 6 night=data(90)
100 male 5 night=data(100)
110 male 4 night=data(110)
120 male 3 night=data(120)
130 fem 4 eve=data(130)
140 fem 3 eve=data(140)
150 end
```

```
testmoc2    10:26   10/23/74  wednesday  uk2

10 av no operators
20 normal wkly hrs
30 o'time wkly hrs
40 tot norml wkly hrs=av no operators*normal wkly hrs
50 tot o'time wkly hr=av no operators*o'time wkly hrs
60 tot avail wkly hrs=tot norml wkly hrs+tot o'time wkly hr
70 no of wks p.a
80 annual avail hrs=tot avail wkly hrs*no of wks p.a
90 absent hrs
100 tot pd atten hrs=annual avail hrs-absent hrs
110 productive%
120 prod time=productive%*tot pd atten hrs/100
130 prod wage rate
140 prod labor cost=prod time*prod wage rate
150 o'looking%
160 o'looking time=o'looking%*tot pd atten hrs/100
170 o'looking rate
180 o'looking cost=o'looking time*o'looking rate
190 waiting%
200 waiting%*tot pd atten hrs/100
210 waiting rate
220 waiting cost=waiting time*waiting rate
230 o'time rate
240 o'time cost=o'time rate*tot o'time wkly hr*no of wks p.a
250 end
```

```
testmod6    10:18    10/23/74   wednesday   uk2

10 dir fixed salaries(,,=)
20 salary staff list(,,-)=data(10)
30 increases=data(20)
40 reductions=data(30)
50 net incr_decrease(,-,-)=increases-reductions
60 sub total=salary staff list+net incr_decrease
70 budget incr 6%=6*sub total/100
80 salary(,-,-)=sub total+budget incr 6%
90 overtime payment(,,-)
100 no of persons=data(40)
110 av hrs p wk p prsn(,,-)=data(50)
120 tot avail hrs p wk=no of persons*av hrs p wk p prsn
130 bgt rate p hr=data(60)
140 o_t wkly cost(,-)=tot avail hrs p wk*bgt rate p hr
150 no of wks p.a.=48.4
160 o_t annumn cost(,-,-)=48.4*o_t wkly cost
170 shift premium(,,-)
180 no of prsn shift=data(70)
190 s_p rate p wk=data(80)
200 s_p annumn cost(,-,-)=s_p rate p wk*no of prsn shift
210 mgt salary(,,-)=salary+o_t annumn cost+s_p annumn cost
220 end
```

```
testmoc6    10:20    10/23/74   wednesday   uk2

10 section manager
20 section supervisor
30 clerical men
40 clerical women
50 tech assistant
60 end
```

APPENDIX 4

BASIC MODEL LISTINGS

```
improvel    13:46   04/23/75  wednesday  uk2

100 remark    ***sales budget***
110 rem p£ = product type
120 rem pl = selling price
130 rem q(p)= sales quantity in each budget period
140 rem r(p) = sales revenue in each budget period
150 dim q(13),r(13),y(4)
160 open 10,'datal',input
170 print   ,'eclairs sales budget for 1975'
180 print   ,   ,'in 000 outers and values in £'
190 print
200 print 'particulars','period 1','period 2','period 3','period 4'
210 let r1,r2,r3,r4=0
220 let n=0
230 get 10: p£,pl
240 for p=1 to 13
250 get 10: q(p)
260 let r(p) = pl*q(p)
270 next p
280 print
290 print p£,'at';'£';pl;'per 000 outers'
300 print 'sales 000 outers',q(1),q(2),q(3),q(4)
310 print 'sales values (£)',r(1),r(2),r(3),r(4)
320 let r1=r1+r(1)
330 let r2=r2+r(2)
340 let r3=r3+r(3)
350 let r4=r4+r(4)
360 let n=n+1
370 if n<3 then 440
380 print
390 print 'totl sales(£)',r1,r2,r3,r4
400 let r1,r2,r3,r4=0
410 let n=0
420 goto 440
430 print
440 if p£='bc 10 lb export' then 460
450 goto 230
460 print
470 print
480 close 10
490 open 10,'datal',input
500 print 'particulars','quarter 1','quarter 2','quarter 3','quarter 4'
510 let r1,r2,r3,r4=0
520 let n=0
530 get 10: p£,pl
540 for p= 1 to 13
550 get 10: q(p)
560 let r(p)=pl*q(p)
570 next p
580 let y(1)=r(1)+r(2)+r(3)+r(4)
590 let y(2)=r(5)+r(6)+r(7)
600 let y(3)=r(8)+r(9)+r(10)
610 let y(4)=r(11)+r(12)+r(13)
620 print
630 print p£,'at';pl;'prices per 000 outers'
640 print
650 print 'sales 000 outers',q(1)+q(2)+q(3)+q(4),q(5)+q(6)+q(7),
660 print q(8)+q(9)+q(10),q(11)+q(12)+q(13)
670 print 'sales values (£)',r(1)+r(2)+r(3)+r(4),r(5)+r(6)+r(7),
```

```
680 print r(8)+r(9)+r(10),r(11)+r(12)+r(13)
690 let r1=r1+y(1)
700 let r2=r2+y(2)
710 let r3=r3+y(3)
720 let r4=r4+y(4)
730 let n=n+1
740 if n<3 then 810
750 print
760 print 'totl sales(£)',r1,r2,r3,r4
770 let r1,r2,r3,r4=0
780 let n=0
790 goto 810
800 print
810 if p£='bc 10 lt export' then 830
820 goto 530
830 close 10
840 end
```

```
improve2    13:55    04/23/75  wednesday   uk2

100 rem   ***production budget***
110 rem o(p) = opening stocks
120 rem c(p) = closing stocks
130 rem t(p) = production in tons
140 rem f1 = factor to convert outers to tons
150 rem f2 = factor to convert outers to production hours
160 rem h(p) = production in hours
170 rem u(p) = production in 000 outers
180 dim o(14),c(13),t(13),q(13),h(13),u(13)
190 dim a(4),b(4)
200 open 11,'data2',input
210 print   ,'eclairs production budget for 1975'
220 print 'in 000 outers, tons, and production hours'
230  print
240 print 'particulars','period 1','period 2','period 3','period 4'
250 let q1,q2,q3,q4=0
260 let r1,r2,r3,r4=0
280 let n=0
290 get 11:p£,f1,f2,o(1)
300 for p=1 to 13
310 get 11:c(p),q(p)
320 let o(p+1)=c(p)
330 let u(p)=c(p)+q(p)-o(p)
340 let t(p)=u(p)*f1
350 let h(p)=u(p)*f2
360 next p
370 print
380 print
390 print
400 print p£
410 print 'closing stocks',c(1),c(2),c(3),c(4)
420 print 'sales 000 outers',q(1),q(2),q(3),q(4)
430 print          ,'----------','----------','----------','----------'
440 print 'total required',c(1)+q(1),c(2)+q(2),c(3)+q(3),c(4)+q(4)
450 print
460 print 'opening stocks',o(1),o(2),o(3),o(4)
470 print          ,'----------','----------','----------','----------'
480 print 'prod 000 outers',u(1),u(2),u(3),u(4)
490 print
500 print 'prod tons',t(1),t(2),t(3),t(4)
510 print 'prod hours',h(1),h(2),h(3),h(4)
520 let q1=q1+t(1)
530 let q2=q2+t(2)
540 let q3=q3+t(3)
550 let q4=q4+t(4)
560 let r1=r1+h(1)
570 let r2=r2+h(2)
580 let r3=r3+h(3)
590 let r4=r4+h(4)
600 let n=n+1
610 if n<3 then 690
620 print
630 print 'sub totl prod tons',q1,q2,q3,q4
640 print 'sub totl prod hours',r1,r2,r3,r4
650 let q1,q2,q3,q4=0
660 let r1,r2,r3,r4=0
670 let n=0
68
```

```
700 goto 290
710 close 11
720 print
730 print
740 print 'particulars','quarter 1','quarter 2','quarter 3','quarter 4'
750 open 11,'data2',input
760 let q1,q2,q3,q4=0
770 let r1,r2,r3,r4=0
780 let n=0
790 get 11: p£,f1,f2,o(1)
800 for p=1 to 13
810 get 11: c(p),q(p)
820 let o(p+1)=c(p)
830 let u(p)=c(p)+q(p)-o(p)
840 let t(p)=u(p)*f1
850 let h(p)=u(p)*f2
860 next p
870 let a(1)=t(1)+t(2)+t(3)+t(4)
880 let a(2)=t(5)+t(6)+t(7)
890 let a(3)=t(8)+t(9)+y(10)
900 let a(4)=t(11)+t(12)+t(13)
910 let b(1)=h(1)+h(2)+h(3)+h(4)
920 let b(2)=h(5)+h(6)+h(7)
930 let b(3)=h(8)+h(9)+h(10)
940 let b(4)=h(11)+h(12)+h(13)
950 print
960 print 'closing stocks',c(4),c(7),c(10),c(13)
970 print 'sales 000 outers',q(1)+q(2)+q(3)+q(4),q(5)+q(6)+q(7),q(8)+q(9)+q(10),
980 print q(11)+q(12)+q(13)
990 print          ,'----------','----------','----------','----------'
1000 print 'total required',c(4)+q(1)+q(2)+q(3)+q(4),c(7)+q(5)+q(6)+q(7),c(10)+q(8)+q(9)+q(10),
1010 print c(13)+q(11)+q(12)+q(13)
1020 print
1030 print 'opening stocks',o(1),o(5),o(8),o(11)
1040 print          ,'----------','----------','----------','----------'
1050 print 'prod 000 outers',u(1)+u(2)+u(3)+u(4),u(5)+u(6)+u(7),u(8)+u(9)+u(10),u(11)+u(12)+u(13)
1060 print
1070 print 'prod tons',t(1)+t(2)+t(3)+t(4),t(5)+t(6)+t(7),t(8)+t(9)+t(10),t(11)+t(12)+t(13)
1080 print 'prod hours',h(1)+h(2)+h(3)+h(4),h(5)+h(6)+h(7),h(8)+h(9)+h(10),h(11)+h(12)+h(13)
1090 let q1=q1+a(1)
1100 let q2=q2+a(2)
1110 let q3=q3+a(3)
1120 let q4=q4+a(4)
1130 let r1=r1+b(1)
1140 let r2=r2+b(2)
1150 let r3=r3+b(3)
1160 let r4=r4+b(4)
1170 let n=n+1
1180 if n<3 then 1250
1190 print
1200 print 'sub totl prod tons',q1,q2,q3,q4
1210 print 'sub totl prod hours',r1,r2,r3,r4
1220 let q1,q2,q3,q4=0
1230 let r1,r2,r3,r4=0
1240 let n=0
1250 if p£='lc eclairs' then 750
1260 close 11
1270 end
```

```
file data2
ready

10 open 11,'data2',output
20 print 'type in product name,factor to convert 000outers to tons'
30 print 'factor to convert to production hours, opening stock at p1'
40 print 'closing stocks for 13 periods'
50 dim c(13),q(13)
60 input p£,f1,f2,o(1),c(1),c(2),c(3),c(4),c(5),c(6),c(7),c(8),c(9),c(10),c(11),c(12),c(13)
70 print 'type in sales for 13 periods'
80 input q(1),q(2),q(3),q(4),q(5),q(6),q(7),q(8),q(9),q(10),q(11),q(12),q(13)
90 put 11:p£,f1,f2,o(1),c(1),c(2),c(3),c(4),c(5),c(6),c(7),c(8),c(9),c(10),c(11),c(12),c(13)
100 put 11:q(1),q(2),q(3),q(4),q(5),q(6),q(7),q(8),q(9),q(10),q(11),q(12),q(13)
110 if p£<>'bc 10 lb export' then 20
120 close 11
130 end

save
file name- data2
```

```
RUN

DATA2      16:07   01/17/75  FRIDAY      UK2

TYPE IN PRODUCT NAME, FACTOR TO CONVERT 000 OUTERS TO TONS.
FACTOR TO CONVERT TO PRODUCTION HOURS,OPENING STOCK AT P1
CLOSING STOCKS FOR 13 PERIODS
? CHOCOLATE SEEPAK,2.51,33.0,28.00,47.2,62.3,62.9,54.1,48.7,41.0,36.9.
TYPE IN SALES FOR 13 PERIODS
? 16.2,20.3,26.1,30.1,29.1,25.5,27.8,25.9,20.7,20.5,22.4,25.0,19.8
TYPE IN PRODUCT NAME, FACTOR TO CONVERT 000 OUTERS TO TONS.
FACTOR TO CONVERT TO PRODUCTION HOURS,OPENING STOCK AT P1
CLOSING STOCKS FOR 13 PERIODS
? CHOCOLATE 4 LB JAR,1.79,25.29,12.00,13.5,13.3,12.0,9.8,8.7,7.8,8.8.7
TYPE IN SALES FOR 13 PERIODS
? 3.6,5.3,6.4,6.8,6.2,4.7,4.1,4.1,4.4,5.2,4.9,4.3,3.3
TYPE IN PRODUCT NAME, FACTOR TO CONVERT 000 OUTERS TO TONS.
FACTOR TO CONVERT TO PRODUCTION HOURS,OPENING STOCK AT P1
CLOSING STOCKS FOR 13 PERIODS
? CHOCOLATE 10 LB EXPORT,13.33,147.06,0.50,0.5,0.5,0.5,0.5,0.5,0.4,0.4
TYPE IN SALES FOR 13 PERIODS
? 0.2,0.1,0.1,0.1,0.1,0.2,0.1,0.2,0.1,0.2,0.1,0.1,0.1
TYPE IN PRODUCT NAME, FACTOR TO CONVERT 000 OUTERS TO TONS.
FACTOR TO CONVERT TO PRODUCTION HOURS,OPENING STOCK AT P1
CLOSING STOCKS FOR 13 PERIODS
? BC SEEPAK,2.23,33.0,25.0,34.7,40.9,40.8,37.3,35.6,32.3,31.8,24.4,24.
TYPE IN SALES FOR 13 PERIODS
? 11.3,14.8,15.7,16.0,15.6,13.7,14.4,14.3,13.8,14.9,13.5,12.4,10.5
TYPE IN PRODUCT NAME, FACTOR TO CONVERT 000 OUTERS TO TONS.
FACTOR TO CONVERT TO PRODUCTION HOURS,OPENING STOCK AT P1
CLOSING STOCKS FOR 13 PERIODS
? BC 4 LB JAR,1.79,25.29,9.00,9.9,9.7,9.1,7.6,7.3,6.4,7.7,5.6,7.0,6.7.
TYPE IN SALES FOR 13 PERIODS
? 4.8,5.9,6.4_3,6.6,5.2,4.4,4.9,4.3,6.0,5.3,5.8,4.4

LINE    35:   1 ITEM(S) MISSING, RETYPE LINE
? 4.8,5.9,6.3,6.6,6.0,5.2,4.4,4.9,4.3,6.0,5.3,5.8,4.4
TYPE IN PRODUCT NAME, FACTOR TO CONVERT 000 OUTERS TO TONS.
FACTOR TO CONVERT TO PRODUCTION HOURS,OPENING STOCK AT P1
CLOSING STOCKS FOR 13 PERIODS
? BC 10 LB EXPORT,13.33,147.06,0.30,0.3,0.3,0.3,0.3,0.3,0.3,0.3,0.3,0.
TYPE IN SALES FOR 13 PERIODS
? 0.1,0.1,0.1,0.1,0.1,0.2,0.2,0.2,0.2,0.2,0.2,0.1,0.2

PROCESSING     1 UNITS
```

```
improve3    14:09   04/23/75  wednesday  uk2

100 remark  ***material cost budget***
110 rem f3 = packing waste percent      f4 = making loss percent      f5 = percentage composition of requisite unit
120 rem   w = packing waste            l = making loss
130 rem g$ = product sub-group      m$ = type of material (requisite unit)
140 rem c1 = unit cost of material m$      c2 = total cost of material m$
150 rem r(p) = enrobbed tons for each budget period
160 rem   **material breakdown**
170 dim t(13),r(13),w(13),l(13)
180 open 12,'data3',input
190 get12:g$,f3,f4
200 get 12:t(1),t(2),t(3),t(4),t(5),t(6),t(7),t(8),t(9),t(10),t(11),t(12),t(13)
210 for p=1 to 13
220 let w(p)=t(p)*f3
230 let l(p)=(t(p)+w(p))*f4
240 let r(p)=t(p)+w(p)+l(p)
250 next p
260 print
270 print
280 print
290 print                 ,'material breakdown'
300 print g$,'product sub_group'
310 print 'particulars','period 1','period 2','period 3','period 4'
320 print
330 print
340 print 'extruded tons',t(1),t(2),t(3),t(4)
350 print 'packing waste',w(1),w(2),w(3),w(4)
360 print 'making loss',l(1),l(2),l(3),l(4)
370 print                ,'----------','----------','----------','----------'
380 print 'enrobbed tons',r(1),r(2),r(3),r(4)
390 print
400 print
410 print              ,'requisite units'
420 rem   **requisite units breakdown**
430 dim q(5,13),c(5,13),y(13),z(13)
440 dim a(13),b(13)
450 let r1=1
460 get 12:m$,f5,c1
470 for p=1 to 13
480 let q(r1,p)=f5*r(p)
490 let c(r1,p)=q(r1,p)*c1
500 next p
510 print
520 print m$;f5*100;'%'
530 print 'production(tons)',q(r1,1),q(r1,2),q(r1,3),q(r1,4)
540 print 'unit cost',c1,c1,c1,c1
550 print 'costs',c(r1,1),c(r1,2),c(r1,3),c(r1,4)
560 let r1=r1+1
570 if m$='caramel' then 590
580 goto 460
590 for j=1 to 13
600 for i=1 to (r1-1)
610 let y(j)=y(j)+c(i,j)
620 let z(j)=z(j)+c(i,j)
630 let a(j)=a(j)+q(i,j)
640 let b(j)=b(j)+c(i,j)
650 next i
660 next j
67
```

0

```
    print
680 print 'total tonnage',y(1),y(2),y(3),y(4)
690 print 'total costs',z(1),z(2),z(3),z(4)
700 for j=1 to 13
710 let y(j),z(j)=0
720 next j
730 if gf='lc eclairs' then 750
740 goto 100
750 print 'grand totl tonnage',a(1),a(2),a(3),a(4)
760 print 'grand totl costs',b(1),b(2),b(3),b(4)
770 close 12
780 end
```

```
improve4     14:18    04/23/75   wednesday   uk2

100 remark  *** direct wages budget ***
110 rem f=females employed            a=average weekly hours w=no of week
s
120 rem h=productive hours
130 rem  **calculation of production workers' hours **
140 dim d(13),n(13),f(13),a(13),w(13),h(13),t(13),b(13),c(13),e(13)
150 dim g(10,13),l(10,13),i(10,13),j(10,13),k(10,13)
160 dim u(13),v(13),s(13),x(13),y(13),z(13)
170 open 13,'data4',input
180 get 13:d(1),d(2),d(3),d(4),d(5),d(6),d(7),d(8),d(9),d(10),d(11),d(12
),d(13)
190 get 13:n(1),n(2),n(3),n(4),n(5),n(6),n(7),n(8),n(9),n(10),n(11),n(12
),n(13)
200 get 13:f(1),f(2),f(3),f(4),f(5),f(6),f(7),f(8),f(9),f(10),f(11),f(12
),f(13)
210 get 13:a(1),a(2),a(3),a(4),a(5),a(6),a(7),a(8),a(9),a(10),a(11),a(12
),a(13)
220 get 13:w(1),w(2),w(3),w(4),w(5),w(6),w(7),w(8),w(9),w(10),w(11),w(12
),w(13)
230 get 13:h(1),h(2),h(3),h(4),h(5),h(6),h(7),h(8),h(9),h(10),h(11),h(12
),h(13)
240 rem t=totl employed
250 for p=1 to 13
260 let t(p)=d(p)+n(p)+f(p)
270 rem b=production workers' hours
280 let b(p)=t(p)*a(p)*w(p)
290 rem c=non productive hours
300 let c(p)=b(p)-h(p)
310 next p
320 rem h9=total annual production in hours
330 rem b9=total annual production workers' hours
340 let h9=h(1)+h(2)+h(3)+h(4)+h(5)+h(6)+h(7)+h(8)+h(9)+h(10)+h(11)+h(12
)+h(13)
350 let b9=b(1)+b(2)+b(3)+b(4)+b(5)+b(6)+b(7)+b(8)+b(9)+b(10)+b(11)+b(12
)+b(13)
360 rem f1=productive percent
370 rem f2=waiting percent
380 rem f3=overlooking percent
390 let f1=h9*100/b9
400 let f2=(100-f1)/3
410 let f3=100-(f1+f2)
420 print
430 print
440 print
450 print 'calculation of productive, waiting, and overlooking percentag
es'
460 print
470 print
480 print 'particulars','period 1','period 2','period 3','period 4'
490 print
500 print 'male day shift',d(1),d(2),d(3),d(4)
510 print 'male night shift',n(1),n(2),n(3),n(4)
520 print 'female day shift',f(1),f(2),f(3),f(4)
530 print    ,'-----','-----','-----','-----'
540 print 'total employed',t(1),t(2),t(3),t(4)
550 print
560
```

```
    print 'av weekly hours',a(1),a(2),a(3),a(4)
570 print 'no of weeks',w(1),w(2),w(3),w(4)
580 print 'working hours',b(1),b(2),b(3),b(4)
590 print 'prodn in hours',h(1),h(2),h(3),h(4)
600 print 'non prod hours',c(1),c(2),c(3),c(4)
610 print
620 print 'productive%',,f1
630 print 'waiting%',,f2
640 print 'overlooking%',,f3
650 get 13:l$,n1,v1,o1
660 get 13:r1,r2,r3,r4,r5
670 let c1=1
680 for p=1 to 13
690 let e(p)=(v1+o1)*w(p)*n1
700 rem g=productive wages
710 let g(c1,p)=(e(p)*f1)/100*r1
720 rem l=overlooking wages
730 let l(c1,p)=(e(p)*f3)/100*r2
740 rem i=waiting wages
750 let i(c1,p)=(e(p)*f2)/100*r3
760 rem j=overtime premiums
770 let j(c1,p)=o1*w(p)*n1*r4
780 rem k=shift premiums
790 let k(c1,p)=e(p)*r5
800next p
810 print l$
820 print '---------------'
830 print 'paid atten hours',e(1),e(2),e(3),e(4)
840 print
850 print 'productive hours',f1*e(1)/100,f1*e(2)/100,f1*e(3)/100,f1*e(4)
/100
860 print 'productive wages',g(c1,1),g(c1,2),g(c1,3),g(c1,4)
870 print
880 print 'overlooking hours',f3*e(1)/100,f3*e(2)/100,f3*e(3)/100,f3*e(4
)/100
890 print 'overlooking wages',l(c1,1),l(c1,2),l(c1,3),l(c1,4)
900 print
910 print 'waiting hours',f2*e(1)/100,f2*e(2)/100,f2*e(3)/100,f2*e(4)/10
0
920 print 'waiting wages',i(c1,1),i(c1,2),i(c1,3),i(c1,4)
930 print
940 print 'overtime hours',o1*n1*w(1),o1*n1*w(2),o1*n1*w(3),o1*n1*w(4)
950 print 'overtime premium',j(c1,1),j(c1,2),j(c1,3),j(c1,4)
960 print
970 if r5=0 then 1000
980 print 'shift hours',e(1),e(2),e(3),e(4)
990 print 'shift premium',k(c1,1),k(c1,2),k(c1,3),k(c1,4)
1000 let c1=c1+1
1010 if l$='female 3 day piece_rate' then 1030
1020 goto 650
1030 for q=1 to 13
1040 for r=1 to (c1-1)
1050 let u(q)=u(q)+g(r,q)
1060 let v(q)=v(q)+l(r,q)
1070 let s(q)=s(q)+i(r,q)
1080 let x(q)=x(q)+j(r,q)
1090 let y(q)=y(q)+k(r,q)
```

```
1100 let z(q)=z(q)+g(r,q)+l(r,q)+i(r,q)+j(r,q)+k(r,q)
1110 next r
1120 next q
1130 print
1140 print ' totl prod wages',u(1),u(2),u(3),u(4)
1150 print 'totl olkg wages',v(1),v(2),v(3),v(4)
1160 print 'totl waitg wages',s(1),s(2),s(3),s(4)
1170 print 'totl otime premium',x(1),x(2),x(3),x(4)
1180 print 'totl shift premium',y(1),y(2),y(3),y(4)
1190 print
1200 print 'totl direct wages',z(1),z(2),z(3),z(4)
1210 close 13
1220 end
```

```
improve5    14:35    04/23/75  wednesday  ul2

1 remark  *** associated employee cost budget ***
2 rem   w=direct wages   r1=e.r.c. pension rate%   r2=sick pay rate%   r3=holiday pay rate%   r4=gift rate%
3 print
4 print
5 print 'associated employee cost budget'
6 print '-------------------------------'
7 print
8 print
9 print 'particulars','period 1','period 2','period 3','period 4'
10 open 14,'data5',input
20 get 14:wf,r1,r2,r3,r4
30 dim w(13),a(13),b(13),c(13),d(13),t(13)
50 get 14:w(1),w(2),w(3),w(4),w(5),w(6),w(7),w(8),w(9),w(10),w(11),w(12),w(13)
70 for p=1 to 13
80 rem a=e.r.c coy pension   b=sick pay   c=holiday pay      d=gifts
90 let a(p)=w(p)*r1
100 let b(p)=w(p)*r2
110 let c(p)=w(p)*r3
120 let d(p)=w(p)*r4
130 let t(p)=a(p)+b(p)+c(p)+d(p)
140 next p
170 print
180 print
190 print wf
191 print '---------------'
200 print 'e.r.c coy pension',a(1),a(2),a(3),a(4)
210 print
220 print 'sick pay',b(1),b(2),b(3),b(4)
230 print
240 print 'hlday pay',c(1),c(2),c(3),c(4)
250 print
260 print 'gifts',d(1),d(2),d(3),d(4)
270 print
280 print 'total a.e.c',t(1),t(2),t(3),t(4)
290 goto 20
291 close14
300 end
```

```
improveC    14:42   04/23/75  wednesday  uk2

1 remark    *** indirect wages budget ***
2 rem h1=normal weekly hours    h2=overtime weekly hours     v=no of weeks
3 rem n1=average number employed    r1=wage rate     r2=overtime rate per hour
4 rem r3=shift rate per hour
5 print
6 print
7 print  ,'indirect wages budget'
8 print  ,'---------------------'
9 print
10 print 'particulars','period 1','period 2','period 3','period 4'
15 dim v(13),a(13),b(13),c(13),t(13)
20 open 15,'dataC',input
30 get 15:v(1),v(2),v(3),v(4),v(5),v(6),v(7),v(8),v(9),v(10),v(11),v(12),v(13)
50 get 15:i$,n1,h1,h2
70 get 15:r1,r2,r3
80 for p=1 to 13
81 rem a=wages cost
90 let a(p)=(h1+h2)*v(p)*n1*r1
91 rem b=overtime premiums
100 let b(p)=h2*v(p)*n1*r2
101 rem c=shift premiums
110 let c(p)=(h1+h2)*v(p)*n1*r3
111 rem t=total indirect wages
120 let t(p)=a(p)+b(p)+c(p)
130 next p
131 print
132 print
133 print
134 print
160 print
170 print
200 print i$
201 print '-------------'
210 print 'wage rate=';r1
220 print 'paid atten hours',(h1+h2)*v(1)*n1,(h1+h2)*v(2)*n1,(h1+h2)*v(3)*n1,(h1+h2)*v(4)*n1
230 print 'wages',a(1),a(2),a(3),a(4)
240 print
245 print 'overtime rate=';r2
250 print 'overtime hours',h2*n1*v(1),h2*n1*v(2),h2*n1*v(3),h2*n1*v(4)
260 print 'overtime premiums',b(1),b(2),b(3),b(4)
270 print
290 if c(1)=0 then 320
305 print 'shift prem rate=';r3
310 print 'shift wkg hours',(h1+h2)*n1*v(1),(h1+h2)*n1*v(2),(h1+h2)*n1*v(3),(h1+h2)*n1*v(4)
320 print 'shift premiums',c(1),c(2),c(3),c(4)
330 print
340 print 'totl indir wages',t(1),t(2),t(3),t(4)
350 goto 50
351 close 15
360 end
```

```
improve7    14:51   04/23/75  wednesday  uk2

1 remark *** direct fixed salaries budget ***
2 rem n1=no on staff   s1=annual salary   i1=increases   r1=reductions
3 rem w=no of weeks    t1=threshold
4 rem i2=budgeted increase%                   rf=staff classification
5 print
6 print
7 print
8 print   ,'direct fixed salaries budget'
9 print
10 open 16,'data7',input
15 dim w(13),s(13),o(13),a(13)
20 get 16:w(1),w(2),w(3),w(4),w(5),w(6),w(7),w(8),w(9),w(10),w(11),w(12),w(13)
40 get 16:rf,n1,s1,i1,r1
41 rem s2=amended salary
43 get 16:t1,i2
50 let s2=(s1*n1)+i1-r1
51 rem t2=threshold payments
60 let t2=t1*n1
61 rem i3=budgeted increases
70 let i3=(s2*i2)/100
71 rem s3=budgeted salary
80 let s3=s2+t2+i3
90 for p=1 to 13
91 rem no of weeks in the year=47.6
100 let s(p)=w(p)/47.6*s3
110 next p
111 rem  **calculation of overtime payment**
121 rem n2=no working overtime   h1=av overtime hours per week per person  r1=overtime rate per hour
130 get 16:n2,h1,r1
131 rem o1=overtime payments
140 let o1=n2*h1*r1*47.6
150 for p=1 to 13
160 let o(p)=w(p)*n2*h1*r1
170 next p
171 rem  **calculation of shift premium payments**
181 rem n3=no working on night shifts   r2=shift premium per week
190 get 16:n3,r2
200 let a1=n3*r2*47.6
210 for p=1 to 13
220 let a(p)=n3*r2*w(p)
230 next p
240 print rf;n1;'on staff'
250 print '----------------------'
270 print 'salaries',,s1*n1
280 print
290 print 'increases',,i1
300 print 'reductions',,r1
310 print  ,,'-------'
320 print 'net change',,i1-r1
330 print ,,'-------'
340 print 'amended salaries',,s2
350 print
360 print 'threshold payment',,t2
370 print 'budgeted increase',,i3
379 print  ,,'-------'
380 print 'bgt salaries',,s3
400 print  ,,'-------'
410 print
420 print n2;'on overtime'
```

```
4
 30 print 'overtime paymt',,o1
440 print
450 print n3;'on ngt shift'
460 print '---------------------'
470 print 'shift premiums',,a1
480 print  ,,'-------'
490 print 'total remuneration',,s3+o1+a1
500 print  ,,'-------'
510 goto 40
511 close 16
520 end
```

APPENDIX 5

APL MODEL LISTINGS

```
      ∇FORECAST[⎕]∇
    ∇ FORECAST
[1]   'ENTER NUMBER OF PRODUCT GROUPS'
[2]   PG←⎕
[3]   'NUMBER OF RAW MATERIALS/INGREDIENTS?'
[4]   RM←⎕
[5]   'PLANNING HORIZON - NUMBER OF PERIODS TO BE COVERED?'
[6]   HZ←⎕
[7]   DIM1←3ρPG,RM,HZ
[8]   DIM2←2ρPG,HZ
[9]   DIM3←2ρRM,HZ
[10]  DIM4←2ρ4,HZ
[11]  DIM5←2ρ5,HZ
[12] L1:'DO YOU WANT A PROFIT FORECAST?'
[13]  '(REPLY YES OR NO)'
[14]  →('N'=1↑ANS←⍞)/L2
[15]  CALCSALES
[16]  CALCVARCOSTS
[17]  CALCFIXCOSTS
[18]  CALCPROFITS
[19]  'DO YOU WANT A STATEMENT OF PROFIT FORECAST?'
[20]  →L2×⍳'N'=1↑ANS←⍞
[21]  PRINTPROFITA
[22]  PRINTPROFITB
[23]  ' '
[24]  ' '
[25]  ' '
[26]  ' '
[27] L2:'DO YOU WANT A CASH FORECAST BASED ON LATEST PROFIT FORECAST?'
[28]  '(REPLY YES OR NO)'
[29]  →L3×⍳'N'=1↑ANS←⍞
[30]  CALCFGCHANGES
[31]  CALCPPMCHANGES
[32]  CALCRMCHANGES
[33]  CALCSTLOANCHANGES
[34]  CALCDEBTSCHANGE
[35]  CALCCREDITSCHANGE
[36]  CALCCASH
[37]  'DO YOU WANT A STATEMENT OF CASH FORECAST?'
[38]  →L3×⍳'N'=1↑ANS←⍞
[39]  PRINTCASHA
[40]  PRINTCASHB
[41]  ' '
[42]  ' '
[43] L3:'MORE FORECASTS?'
[44]  →('N'=1↑ANS←⍞)/0
[45]  →L1
    ∇
```

```
      )LOAD UMT01
SAVED  13.41.22 05/19/76
      )FNS
APPORTION       APPORTIONPPM    CALCCASH        CALCCREDITSCHANGE       CALCDEBTSCHANGE CALCFGCHANGES   CALCFIXCOSTS
CALCPPMCHANGES  CALCPROFITS     CALCRMCHANGES   CALCSALES       CALCSTLOANCHANGES       CALCVARCOSTS    EXPAND  EXPD
EXPDRM  FMT     FORECAST        INLINE  PRINTCASHA      PRINTCASHB      PRINTPROFITA    PRINTPROFITB    TESTPPM

      ∇CALCSALES[⎕]∇
    ∇ CALCSALES
[1]   'BASIC SELLING PRICES PER TON OF EACH PRODUCT GROUP?'
[2]   P1←⎕÷1000
[3]   'ALLOWABLE PRICE INCREASE PERCENT?'
[4]   I1←⎕
[5]   P1←EXPD(P1+(P1×I1)÷100)
[6]   'SALES VOLUME FORECASTS IN TONS OVER PLANNED PERIODS?'
[7]   Q←⎕
[8]   SALEINC←Q×P1
[9]   TOTSALEINC←+/[1]SALEINC
    ∇


      ∇CALCVARCOSTS[⎕]∇
    ∇ CALCVARCOSTS
[1]   'PRICE PER TON OF EACH RAW MATERIAL?'
[2]   P2←⎕÷1000
[3]   P2←⌊10000000×P2
[4]   P2A←P2
[5]   P2←EXPDRM P2
[6]   'USAGE IN TONS OF EACH RAW MATERIAL PER TON OF EACH PRODUCT GROUP?'
[7]   Q2←⌊10000×⎕
[8]   Q2A←Q2
[9]   Q2←EXPAND Q2
[10]  DMATL←DIM2ρ0
[11]  P←1
[12]  J←1
[13] L1:DMATL[P;]←DMATL[P;]+(P2[J;]×Q2[P;J;]÷100000000000)
[14]  J←J+1
[15]  →L1×⍳J≤RM
[16]  P←P+1
[17]  J←1
[18]  →L1×⍳P≤PC
[19]  DIRMATL←DMATL×Q
[20]  'STD DIRECT LABOUR COST PER TON OF EACH PRODUCT GROUP?'
[21]  LC2←⎕÷1000
[22]  LC2←EXPD LC2
[23]  'EXPECTED LABOUR EFFICIENCY PERCENT FOR EACH PRODUCT GROUP?'
[24]  E2←⎕
[25]  E2←EXPD E2
[26]  DWAGES←LC2×100÷E2
[27]  DIRWAGES←Q×DWAGES
[28] ⍝AEC=A.E.C. PERCENT
[29]  AEC←25
[30]  PACTVARCOSTS←DIRMATL+DIRWAGES+AEC×DIRWAGES÷100
[31]  'VARIABLE  DISTRIBUTION COST PER TON OF EACH PRODUCT GROUP?'
[32]  D2←⎕÷1000
[33]  D2←EXPD D2
[34]  DISTVARCOSTS←Q×D2
[35]  'VARIABLE  SELLING COST - PERCENT OF SALES - OF EACH PRODUCT GROUP?'
```

```
[36]  S2←⎕
[37]  S2←EXPD S2
[38]  SELLVARCOSTS←SALEINC×S2÷100
[39]  TOTVARCOSTS←FACTVARCOSTS+DISTVARCOSTS+SELLVARCOSTS
    ∇


      ∇CALCFIXCOSTS[⎕]∇
    ∇ CALCFIXCOSTS
[1]   'FIXED FACTORY SALARIES AND WAGES OF EACH PERIOD?'
[2]   W3←⎕
[3]   ' FACTORY RENT, RATES AND TAXES OF EACH PERIOD?'
[4]   R3←⎕
[5]   'FACTORY POWER, HEAT AND LIGHT OF EACH PERIOD?'
[6]   H3←⎕
[7]   OC←DEPRECN←DIM5ρ0
[8]   'ORIGINAL COSTS OF EACH CATEGORY OF FIXED ASSETS AT BEGINNG OF FIRST PERIOD?'
[9]   OC[;1]←⎕
[10]  'ADDITIONS TO EACH CATEGORY OF FIXED ASSETS IN EACH PERIOD?'
[11]  A3←⎕
[12]  'COSTS OF EACH CATEGORY OF FIXED ASSETS DISPOSED IN EACH PERIOD?'
[13]  CD3←⎕
[14]  'PROCEEDS OF DISPOSALS OF EACH CATEGORY OF FIXED ASSETS IN EACH PERIOD?'
[15]  D3←⎕
[16] ⍝DR3= DEPRECIATION RATE OF FIXED ASSETS
[17]  DR3←5ρ2.5 7.5 12.5 15 20
[18]  P←1
[19] L1:DEPRECN[;P]←((DR3÷13)×OC[;P]+A3[;P]-CD3[;P])÷100
[20]  P←P+1
[21]  →(P>HZ)/L30
[22]  OC[;P]←OC[;P-1]+A3[;P-1]-CD3[;P-1]
[23]  →L1
[24] L30:MNGTCHG←HZρ0
[25]  'MANAGEMENT CHARGES AND RELATED PERIOD?'
[26]  '(ENTER TWO ITEMS ONLY)'
[27]  'ENTER 55 TO BYPASS OR END INPUT OF MNGT CHARGES'
[28] L10:IN←INLINE 2
[29]  →L2×⍳IN[1]=55
[30]  →L20×⍳(IN[2]∊⍳HZ)
[31]  'INVALID INPUT RE-ENTER COMPLETE LINE'
[32]  →L10
[33] L20:MNGTCHG[IN[2]]←IN[1]
[34]  →L10
[35] L2:'OTHER FIXED FACTORY COSTS OF EACH PERIOD?'
[36]  OF3←⎕
[37]  FACTFIXCOSTS←MNGTCHG+OF3+H3+R3+W3+(AEC×W3÷100)+0.6395×+/[1]DEPRECN
[38]  'FIXED DISTRIBUTION SALARIES AND WAGES OF EACH PERIOD?'
[39]  W4←⎕
[40]  'OTHER FIXED DISTRIBUTION EXPENSES OF EACH PERIOD?'
[41]  OF4←⎕
[42]  DISTFIXCOSTS←OF4+W4+(AEC×W4÷100)+0.1045×+/[1]DEPRECN
[43]  'FIXED SELLING SALARIES AND WAGES OF EACH PERIOD?'
[44]  W5←⎕
[45]  'OTHER FIXED SELLING EXPENSES OF EACH PERIOD?'
[46]  OF5←⎕
[47]  SELLFIXCOSTS←OF5+W5+(AEC×W5÷100)+0.056×+/[1]DEPRECN
[48] .TOTFIXCOSTS←FACTFIXCOSTS+DISTFIXCOSTS+SELLFIXCOSTS
    ∇
```

```
     ∇CALCPROFITS[⎕]∇
   ∇ CALCPROFITS
[1]   'DIRECT MARKETING EXPENSES OF EACH PRODUCT GROUP?'
[2]   DMKGEXP←⎕
[3]   GCONT←TOTSALEINC-+/[1]TOTVARCOSTS
[4]   NCONT←GCONT-+/[1]DMKGEXP
[5]   GCONTPERCNT←(GCONT×100)÷TOTSALEINC
[6]   NCONTPERCNT←(NCONT×100)÷TOTSALEINC
[7]   TRDGPROFITS←NCONT-TOTFIXCOSTS
   ∇


     ∇PRINTPROFITA[⎕]∇
   ∇ PRINTPROFITA
[1]   'DATE OF MAKING THE FORECASTS?'
[2]   FCSTDATE←⎕
[3]   'ENTER NO OF PERIODS TO BE INCLUDED IN FIRST REPORT'
[4]   RP←⎕
[5]   DIM6←2ρ13,RP
[6]   RW←(RP×12)ρ' (1,123,120)'
[7]   TABPROFIT←DIM6ρ0
[8]   DESCPROFIT←13 20ρ' '
[9]   DESCPROFIT[1;]←'SALES INCOME        '
[10]  DESCPROFIT[2;]←'FACTORY VAR COSTS   '
[11]  DESCPROFIT[3;]←'DISTRIBN VAR COSTS  '
[12]  DESCPROFIT[4;]←'SELLING VAR COSTS   '
[13]  DESCPROFIT[5;]←'TOTAL VAR COSTS     '
[14]  DESCPROFIT[6;]←'GROSS CONTRIBUTION  '
[15]  DESCPROFIT[7;]←'DIRECT MKTG EXPENSES'
[16]  DESCPROFIT[8;]←'NET CONTRIBUTION    '
[17]  DESCPROFIT[9;]←'FACTORY FIXED COSTS '
[18]  DESCPROFIT[10;]←'DISTRIBN FIXED COSTS'
[19]  DESCPROFIT[11;]←'SELLING FIXED COSTS '
[20]  DESCPROFIT[12;]←'TOTAL FIXED COSTS   '
[21]  DESCPROFIT[13;]←'TRDG PROFITS BF INT '
[22]  TABPROFIT[1;]←RP↑TOTSALEINC
[23]  TABPROFIT[2;]←RP↑(+/[1]FACTVARCOSTS)
[24]  TABPROFIT[3;]←RP↑(+/[1]DISTVARCOSTS)
[25]  TABPROFIT[4;]←RP↑(+/[1]SELLVARCOSTS)
[26]  TABPROFIT[5;]←RP↑(+/[1]TOTVARCOSTS)
[27]  TABPROFIT[6;]←RP↑GCONT
[28]  TABPROFIT[7;]←RP↑(+/[1]DMKGEXP)
[29]  TABPROFIT[8;]←RP↑NCONT
[30]  TABPROFIT[9;]←RP↑FACTFIXCOSTS
[31]  TABPROFIT[10;]←RP↑DISTFIXCOSTS
[32]  TABPROFIT[11;]←RP↑SELLFIXCOSTS
[33]  TABPROFIT[12;]←RP↑TOTFIXCOSTS
[34]  TABPROFIT[13;]←RP↑TRDGPROFITS
[35]  'ALIGN PAPER AT PAGE END AND CARRIAGE RETURN'
[36]  X←⍞
[37]  (22ρ' '),'CADBURY SCHWEPPES LIMITED-CONFECTIONERY GROUP'
[38]  HD←(27ρ' '),'FORECAST PROFIT STATEMENT AT';'  12/12/12'FMT FCSTDATE
[39]  (37ρ' '),'FOR FIRST ';RP;' PERIODS'
[40]  ' '
[41]  ' POUNDS IN 000 '
[42]  (22ρ' '),((RP×12)ρ'   PERIOD    ')
[43]  ' '
[44]  N←1
```

```
[45] L1:(DESCPROFIT[N;],RW)FMT(TABPROFIT[N;])
[46]  N←N+1
[47]  →L2×ι(N≠2)∧(N≠5)∧(N≠6)∧(N≠8)∧(N≠9)∧(N≠12)∧(N≠13)
[48]  (20ρ' '),((12×RP)ρ'  ----------')
[49] L2:→L3×ι(N≠14)
[50]  (20ρ' '),((12×RP)ρ'  ==========')
[51] L3:→L1×ιN≤13
    ∇


     ∇PRINTPROFITB[⎕]∇
    ∇ PRINTPROFITB
[1]   DIM7←2ρ13,(HZ-RP)
[2]   RY←((HZ-RP)×12)ρ' (1,123,120)'
[3]   TABPROFIT←DIM7ρ0
[4]   TABPROFIT[1;]←(HZ-RP)↑RP↓TOTSALEINC
[5]   TABPROFIT[2;]←(HZ-RP)↑RP↓(+/[1]FACTVARCOSTS)
[6]   TABPROFIT[3;]←(HZ-RP)↑RP↓(+/[1]DISTVARCOSTS)
[7]   TABPROFIT[4;]←(HZ-RP)↑RP↓(+/[1]SELLVARCOSTS)
[8]   TABPROFIT[5;]←(HZ-RP)↑RP↓(+/[1]TOTVARCOSTS)
[9]   TABPROFIT[6;]←(HZ-RP)↑RP↓GCONT
[10]  TABPROFIT[7;]←(HZ-RP)↑RP↓(+/[1]DMKGEXP)
[11]  TABPROFIT[8;]←(HZ-RP)↑RP↓NCONT
[12]  TABPROFIT[9;]←(RP-HZ)↑RP↓FACTFIXCOSTS
[13]  TABPROFIT[10;]←(HZ-RP)↑RP↓DISTFIXCOSTS
[14]  TABPROFIT[11;]←(HZ-RP)↑RP↓SELLFIXCOSTS
[15]  TABPROFIT[12;]←(HZ-RP)↑RP↓TOTFIXCOSTS
[16]  TABPROFIT[13;]←(HZ-RP)↑RP↓TRDGPROFITS
[17]  (22ρ' '),'CADBURY SCHWEPPES LIMITED-CONFECTIONERY GROUP'
[18]  HD←(27ρ' '),'FORECAST PROFIT STATEMENT AT';'  12/12/12'FMT FCSTDATE
[19]  (37ρ' '),'FOR LATER  ';(HZ-RP);' PERIODS'
[20]  ' '
[21]  ' POUNDS IN 000 '
[22]  (22ρ' '),(((HZ-RP)×12)ρ'   PERIOD   ')
[23]  ' '
[24]  N←1
[25] L1:(DESCPROFIT[N;],RY)FMT(TABPROFIT[N;])
[26]  N←N+1
[27]  →L2×ι(N≠2)∧(N≠5)∧(N≠6)∧(N≠8)∧(N≠9)∧(N≠12)∧(N≠13)
[28]  (20ρ' '),((12×(HZ-RP))ρ'  ----------')
[29] L2:→L3×ι(N≠14)
[30]  (20ρ' '),((12×(HZ-RP))ρ'  ==========')
[31] L3:→L1×ιN≤13
[32]  ' '
[33]  ' '
[34]  ' '
[35]  ' '
[36]  ' '
    ∇
```

```
      ∇CALCFGCHANGES[⎕]∇
    ∇ CALCFGCHANGES
      DIM20←2ρ2,HZ
     ⍝ FG PFLE=CL FG STKS FOR ALL PERIODS LAST YEAR÷ CL FG STK FOR P1 LAST YEAR
      OPSTKFG←CLSTKFG←FGPFLE←DIM20ρ0
      FGPFLE[1;]←1 0.59466 0.73365 0.94689 1.25094 1.39797 1.55433 1.7107 1.80495 1.28536 0.90379 1.10556 1.28831
      FGPFLE[2;]←1 1.17027 1.17045 1.06818 1.05651 0.9422 0.75111 0.75411 0.77166 0.70523 0.71681 0.70541 0.69236
      'OP STK OF ROL AND OTHER FG AT PERIOD 1?'
      OPFG←⎕
      FGPFLE1←0.77617 1.44439
      CLFG←OPFG×FGPFLE1
      CLSTKFG[1;]←FGPFLE[1;]×1↑CLFG
      CLSTKFG[2;]←FGPFLE[2;]×1↓CLFG
      OPSTKFG[;1]←OPFG
      P←2
     L1:OPSTKFG[;P]←CLSTKFG[;P-1]
      P←P+1
      →L1×⍳P≤HZ
      FGCHGS←OPSTKFG-CLSTKFG
    ∇
```

```
vm/370 online     ljh359 asyosu

l cad01 m
ENTER PASSWORD:
****[redacted]
DASD 190 LINKED R/O; R/W BY BSPCMSYS; R/O BY 014 USERS
LOGON AT 15:51:08 GMT TUESDAY 05/25/76
a p l / c m s
clear ws
      )LOAD UMT04
SAVED  14.26.34 04/22/76
      )FNS
AMENDAEC        AMENDCASH         AMENDCREDITORS  AMENDDEBTORS    AMENDDISTVC     AMENDDMKGEXP    AMENDFGSTKS
AMENDFIXCOSTS   AMENDFORECASTS    AMENDLABC       AMENDLABEFF     AMENDOTHERS     AMENDPPMSTKS    AMENDPROFITS    AMENDRMP
AMENDRMSTKS     AMENDRMU          AMENDSALES      AMENDSELLVC     AMENDSTLOANS    AMENDVARCOSTS   CALCCASH
CALCCREDITSCHANGE        CALCDEBTSCHANGE CALCFGCHANGES   CALCFIXCOSTS    CALCPPMCHANGES  CALCPROFITS     CALCRMCHANGES
CALCSALES       CALCSTLOANCHANGES         CALCVARCOSTS    CASHT   CREDITORS       DEBTORS EXPAND  EXPD    EXPDRM  FGSTKS
FIXCOSTS        FMT     FORECAST          INLINE  PPMSTKS PRCASH  PRINTCASHA      PRINTCASHB      PRINTPROFITA
PRINTPROFITB    PROFITS PRPROFITS         RMSTKS  SALES   STLOANS VARCOSTS


      ∇CALCFGCHANGES[⎕]∇
    ∇ CALCFGCHANGES
[1]   'FG STOCK OF EACH PRODUCT GROUP AT BEGINNG OF FIRST PERIOD?'
[2]   BM←PROPFIXCOSTS←OPSTKFG←CLSTKFG←DIM2ρ0
[3]   OPSTKFG[;1]←⎕
[4]  ⍝ H7=STOCK HLDG PERIODS - NO OF WEEKS SALE
[5]   H7←PGρ5
[6]   H7←EXPD H7
[7]  ⍝BM=FACTORY COST OF SALES
[8]   PROPFIXCOSTS←(+/FACTFIXCOSTS)×DIRWAGES÷+/+/DIRWAGES
[9]   BM←FACTVARCOSTS+PROPFIXCOSTS
[10]  P←1
[11] L3:CLSTKFG[;P]←(BM[;P+1]×(4⌊H7[;P])÷4)+(BM[;P+2]×(0⌈(H7[;P]-4))÷4)
[12]  P←P+1
[13]  →L3×⍳P≤11
[14]  P←12
[15]  CLSTKFG[;P]←(BM[;P+1]×H7[;P]÷4)
[16]  P←P+1
[17]  CLSTKFG[;P]←BM[;P]×H7[;P]÷4
[18]  P←2
[19] L1:OPSTKFG[;P]←CLSTKFG[;P-1]
[20]  P←P+1
[21]  →(P>HZ)/L2
[22]  →L1
[23] L2:FGCHGS←OPSTKFG-CLSTKFG
    ∇
```

```
      ∇CALCPPMCHANGES[⎕]∇
    ∇ CALCPPMCHANGES
[1]   DIM20←2⍴2,HZ
[2]  ⍝ PPMPFLE=CL PPM STKS FOR ALL PERIODS LAST YEAR÷ CL PPM STK FOR P1 LAST YEAR
[3]   OPSTKPPM←CLSTKPPM←PPMPFLE←DIM20⍴0
[4]   PPMPFLE[1;]←1 0.9864 1.02306 1.0136 1.61206 2.39148 3.11111 3.53341 3.67475 3.06623 2.41041 1.82535 1.24542
[5]   PPMPFLE[2;]←1 0.83445 0.73693 0.82451 0.70591 0.73522 0.74111 0.75236 0.76161 0.70163 0.68535 0.65707 0.60874
[6]   'OP STK OF CRUMB AND OTHER PPM AT PERIOD 1?'
[7]   OPPPM←⎕
[8]   PPMPFLE1←0.80281 1.64282
[9]   CLPPM←OPPPM×PPMPFLE1
[10]  CLSTKPPM[1;]←PPMPFLE[1;]×1↑CLPPM
[11]  CLSTKPPM[2;]←PPMPFLE[2;]×1↓CLPPM
[12]  OPSTKPPM[;1]←OPPPM
[13]  P←2
[14] L1:OPSTKPPM[;P]←CLSTKPPM[;P-1]
[15]  P←P+1
[16]  →L1×⍳P≤HZ
[17]  PPMCHGS←OPSTKPPM-CLSTKPPM
    ∇
```

```
      ∇CALCRMCHANGES[⎕]∇
    ∇ CALCRMCHANGES
[1]   DIM21←2⍴3,HZ
[2]  ⍝ RMPFLE=CL RM STKS FOR ALL PERIODS LAST YEAR÷ CL RM STK FOR P1 LAST YEAR
[3]   OPSTKRM←CLSTKRM←RMPFLE←DIM21⍴0
[4]   RMPFLE[1;]←1 1 1 1 1 1 1 1 1 1 1 1 1
[5]   RMPFLE[2;]←1 0.94735 1.12984 1.06921 0.92576 0.92566 0.58111 0.58533 0.5593 0.54008 0.49897 0.53594 0.6013
[6]   RMPFLE[3;]←1 1.0036 1.03225 0.99468 0.94332 0.93549 0.90111 0.87709 0.85987 0.83028 0.78034 0.74025 0.60733
[7]   'OP STK OF BEANS, OTHER EDIBLES AND PKG MATLS  AT PERIOD 1?'
[8]   OPRM←⎕
[9]   RMPFLE1←0.93777 1.66311 1.64653
[10]  CLRM←OPRM×RMPFLE1
[11]  CLSTKRM[1;]←RMPFLE[1;]×1↑CLRM
[12]  CLSTKRM[2;]←RMPFLE[2;]×1↑1↓CLRM
[13]  CLSTKRM[3;]←RMPFLE[3;]×2↓CLRM
[14]  OPSTKRM[;1]←OPRM
[15]  P←2
[16] L1:OPSTKRM[;P]←CLSTKRM[;P-1]
[17]  P←P+1
[18]  →L1×⍳P≤HZ
[19]  RMCHGS←OPSTKRM-CLSTKRM
[20] ⍝ BM=FACTORY COST OF SALES
[21] ⍝ BG=MATERIAL COST OF PRODUCTION
[22] ⍝BG1=MATERIAL COST OF SALES
[23] ⍝BG2=MATERIAL COST OF FG PPM CHANGES
[24]  BM←BG1←PROPFIXCOSTS←DIM2⍴0
[25]  BG←BG2←HZ⍴0
[26]  PROPFIXCOSTS←(+/FACTFIXCOSTS)×DIRWAGES÷+/+/DIRWAGES
[27]  BM←FACTVARCOSTS+PROPFIXCOSTS
[28]  BG1←BM×EXPD((+/DIRMATL)÷+/BM)
[29]  BG2←((+/[1]FGCHGS)++/[1]PPMCHGS)×((+/+/DIRMATL)÷+/+/BM)
[30]  BG←(+/[1]BG1)-BG2
    ∇
```

```
      ∇CALCPPMCHANGES[⎕]∇
    ∇ CALCPPMCHANGES
[1]    'PPM STOCK OF EACH PRODUCT GROUP AT BEGINNING OF FIRST PERIOD?'
[2]    OPSTKPPM←CLSTKPPM←DIM2ρ0
[3]    OPSTKPPM[;1]←⎕
[4]   ⍝PC8= PRODUCTION CYCLE IN WEEKS
[5]    PC8←PGρ2
[6]    PC8←EXPD PC8
[7]    CLSTKPPM←(4⌊PC8)×(BM-FGCHGS)÷4
[8]    P←2
[9]   L1:OPSTKPPM[;P]←CLSTKPPM[;P-1]
[10]   P←P+1
[11]   →L1×⍳P≤NZ
[12]   PPMCHGS←OPSTKPPM-CLSTKPPM
    ∇


      ∇CALCRMCHANGES[⎕]∇
    ∇ CALCRMCHANGES
[1]    'RM STOCKS OF EACH CATEGORY AT BEGINNG OF FIRST PERIOD?'
[2]    OPSTKRM←CLSTKRM←DIM3ρ0
[3]    CLSTKRMPG←DIM2ρ0
[4]    OPSTKRM[;1]←⎕
[5]   ⍝H9= STOCK HLDG PERIODS-NO OF WEEKS PRODUCTION
[6]    H9←PGρ8
[7]    H9←EXPD H9
[8]   ⍝BG=FACTORY MATERIAL  COST OF PRODUCTION
[9]    BG←(BM-FGCHGS+PPMCHGS)×EXPD((+/DIRMATL)÷+/BM)
[10]   P←1
[11]  L4:CLSTKRMPG[;P]←(BG[;P+1]×(4⌊H9[;P])÷4)+(BG[;P+2]×(0⌈(H9[;P]-4))÷4)
[12]   P←P+1
[13]   →L4×⍳P≤11
[14]   P←12
[15]   CLSTKRMPG[;P]←BG[;P+1]×H9[;P]÷4
[16]   P←P+1
[17]   CLSTKRMPG[;P]←BG[;P]×H9[;P]÷4
[18]   P←1
[19]   J←1
[20]  L1:CLSTKRM[P;]←CLSTKRM[P;]+CLSTKRMPG[J;]×(P2[P;]×Q2[J;P;]÷100000000000)÷DMATL[J;]
[21]   J←J+1
[22]   →L1×⍳J≤PG
[23]   P←P+1
[24]   →(P>RM)/L2
[25]   J←1
[26]   →L1
[27]  L2:P←2
[28]  L3:OPSTKRM[;P]←CLSTKRM[;P-1]
[29]   P←P+1
[30]   →L3×⍳P≤NZ
[31]   RMCHGS←OPSTKRM-CLSTKRM
    ∇
```

```
    ∇CALCSTLOANCHANGES[⎕]∇
  ∇ CALCSTLOANCHANGES
    'SHORT-TERM LOANS AT BEGINNG OF FIRST PERIOD?'
    CI10←⎕
    'CL ST LOANS FOR ALL PERIODS?'
    CLSTLOANS←⎕
    OPSTLOANS←CI10,¯1↓CLSTLOANS
    STLOANCHGS←OPSTLOANS-CLSTLOANS
  ∇


    ∇CALCDEBTSCHANGE[⎕]∇
  ∇ CALCDEBTSCHANGE
    'BALANCES ON TRADE, INTER-CO, DEVELOPMENT GRANTS AND ASSET DISPOSAL'
    'DEBTORS ACCOUNTS AT BEGINNG OF FIRST PERIOD?'
    OPDEBTS←CLDEBTS←DIM4ρ0
    OPDEBTS[;1]←⎕
   ⍝ V11=V.A.T. PERCENT
    V11←HZρ8
   ⍝ CT11= TRADE DEBTS COLLECTION PERIOD IN WEEKS
    CT11←HZρ6
    PCT11←6
   ⍝ CI11= INTER-CO DEBTS COLLECTION PERIOD IN WEEKS
    CI11←HZρ4
    PCI11←4
   ⍝G11= DEVELOPMENT GRANTS ALLOWED-PERCENT OF CAPITAL EXPENDITURES
    G11←HZρ40
    P11←HZρ0.3523
    INTERCOSALES←(SALEINC[31;]×P11)+SALEINC[32;]+SALEINC[33;]+SALEINC[35;]+SALEINC[41;]+SALEINC[42;]+SALEINC[43;]
    TRSALES←TOTSALEINC-INTERCOSALES
    INTERCOSALES←INTERCOSALES+INTERCOSALES×V11÷100
    TRSALES←TRSALES+TRSALES×V11÷100
    P←1
    CLDEBTS[1;P]←TRSALES[P]+(OPDEBTS[1;P]×(0⌈(PCT11-4))÷PCT11)
    CLDEBTS[2;P]←INTERCOSALES[P]+(OPDEBTS[2;P]×(0⌈(PCI11-4))÷PCI11)
    CLDEBTS[3;P]←((+/[1]A3)[P]×G11[P]÷100)+(OPDEBTS[3;P]×(8-4)÷8)
    CLDEBTS[4;P]←(+/[1]D3)[P]+OPDEBTS[4;P]×(6-4)÷6
    P←P+1
    OPDEBTS[;P]←CLDEBTS[;P-1]
 L1:CLDEBTS[1;P]←TRSALES[P]+(TRSALES[P-1]×(0⌈(CT11[P-1]-4))÷4)
    CLDEBTS[2;P]←INTERCOSALES[P]+(INTERCOSALES[P-1]×(0⌈(CI11[P-1]-4))÷4)
    CLDEBTS[3;P]←((+/[1]A3)[P]×G11[P]÷100)+(((+/[1]A3)[P-1]×G11[P-1]÷100)×0⌈(8-4)÷4)
    CLDEBTS[4;P]←(+/[1]D3)[P]+(+/[1]D3)[P-1]×(0⌈(6-4))÷4
    P←P+1
    →(P>HZ)/L2
    OPDEBTS[;P]←CLDEBTS[;P-1]
    →L1
 L2:DEBTSCHG←OPDEBTS-CLDEBTS
  ∇
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```
     ∇CALCCREDITSCHANGE[⎕]∇
    ∇ CALCCREDITSCHANGE
[1]   'BALANCES ON TRADE, EXPENSE, PAYROLL, INTER-CO AND V.A.T. CREDITORS'
[2]   'ACCOUNTS AT BEGINNING OF FIRST PERIOD?'
[3]   OPCREDITS←CLCREDITS←DIM5ρ0
[4]   OPCREDITS[;1]←⎕
[5]  ⍝PM12=PERCENT OF MATERIAL PURCHASES IN REVENUE EXPENSES
[6]   PM12←HZρ12
[7]  ⍝PM12A=PERCENT OF MATERIAL PURCHASES IN CAPITAL EXPENDITURES
[8]   PM12A←HZρ45
[9]  ⍝CS12=TRADE CREDITORS SETTLEMENT PERIOD IN WEEKS
[10]  CS12←HZρ8
[11]  PCS12←8
[12] ⍝P12=PERCENT OF INTER-CO TRANSACTIONS IN CREDITS
[13]  P12←HZρ20
[14] ⍝IS12=INTER-CO CREDITS SETTLEMENT PERIOD IN WEEKS
[15]  IS12←HZρ4
[16]  PIS12←4
[17] ⍝DD12=PERCENT DEDUCTIONS FROM PAYROLLS
[18]  DD12←HZρ22
[19] ⍝DA12=ACCRUED EXPENSES DISBURSEMENT PERIOD IN WEEKS
[20]  DA12←HZρ2
[21]  PDA12←2
[22]  MATPURCH←(DG-(+/[1]RMCHGS))+((+/[1]A3)×PM12A÷100)+(PM12×((+/[1]DMKGEXP)+OF3+OF4+OF5)÷100)
[23]  TRPURCH←(100-P12)×MATPURCH÷100
[24]  INCOPURCH←(P12×MATPURCH÷100)+MNGTCHG
[25]  PAYROLLS←((ABC×W3+W4+W5)÷100)+W3+W4+W5+(+/[1]FACTVARCOSTS)-+/[1]DIRMATL
[26]  EXPENSES←(+/[1]DISTVARCOSTS)+(+/[1]SELLVARCOSTS)+R3+H3+(OF3+OF4+OF5+(+/[1]DMKGEXP))×(100-PM12)÷100
[27]  EXPENSES←EXPENSES+((+/[1]A3)×(100-PM12A)÷100)
[28]  VAT←TOTSALEINC×V11÷100
[29]  P←1
[30]  CLCREDITS[1;P]←TRPURCH[P]+OPCREDITS[1;P]×(PCS12-4)÷PCS12
[31]  CLCREDITS[2;P]←EXPENSES[P]+OPCREDITS[2;P]×(0⌈(PDA12-4))÷PDA12
[32]  CLCREDITS[3;P]←PAYROLLS[P]×2÷4
[33]  CLCREDITS[4;P]←INCOPURCH[P]+OPCREDITS[4;P]×(PIS12-4)÷PIS12
[34]  CLCREDITS[5;P]←VAT[P]
[35]  P←P+1
[36]  OPCREDITS[;P]←CLCREDITS[;P-1]
[37] L1:CLCREDITS[1;P]←TRPURCH[P]+(TRPURCH[P-1]×(0⌈(CS12[P-1]-4))÷4)
[38]  CLCREDITS[2;P]←EXPENSES[P]+(EXPENSES[P-1]×(0⌈(DA12[P-1]-4))÷4)
[39]  CLCREDITS[3;P]←PAYROLLS[P]×2÷4
[40]  CLCREDITS[4;P]←INCOPURCH[P]+(INCOPURCH[P-1]×(0⌈(IS12[P-1]-4))÷4)
[41]  →(P∊4 7 11)/L3
[42]  CLCREDITS[5;P]←VAT[P]+OPCREDITS[5;P]
[43]  →L4
[44] L3:CLCREDITS[5;P]←VAT[P]
[45] L4:P←P+1
[46]  →(P>HZ)/L2
[47]  OPCREDITS[;P]←CLCREDITS[;P-1]
[48]  →L1
[49] L2:CREDITSCHG←OPCREDITS-CLCREDITS
    ∇
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```
      ∇CALCCASH[⎕]∇
    ∇ CALCCASH
[1]   'CORPORATION TAX,DIVIDENDS AND OTHER CASH PAYMENTS FOR ALL PERIODS?'
[2]   TDC←⎕
[3]   'CASH RECEIPTS ON SHARE ISSUES, SALE OF INVESTMENTS AND'
[4]   'OTHER RECEIPTS FOR ALL PERIODS?'
[5]   SIR←⎕
[6]   'CASH BALANCE AT BEGINNING OF FIRST PERIOD?'
[7]   OPCASH←CLCASH←CLCASHPREINT←FACHGS←CACHGS←RECEIPTS←PAYMENTS←INT←HZρ0
[8]   OPCASH[1]←⎕
[9]  ⍝RI=RATE OF INTEREST
[10]  RI←HZρ11 11 11 11 11 11 10 10 10 10 10 10 10
[11]  RI←RI÷13
[12] ⍝ FACHGS=NET CHANGES IN FIXED ASSETS
[13] ⍝        =COST OF ADDITIONS - PROCEEDS OF SALES
[14]  P←1
[15] L1:FACHGS[P]←(+/[1]A3)[P]-(+/[1]D3)[P]
[16]  CACHGS[P]←(+/[1]RMCHGS)[P]+(+/[1]FGCHGS)[P]+(+/[1]PPMCHGS)[P]+STLOANCHGS[P]+(+/[1]DEBTSCHG)[P]
[17]  RECEIPTS[P]←CACHGS[P]+TRDGPROFITS[P]+(+/[1]DEPRECN)[P]+(+/[1]SIR)[P]
[18]  PAYMENTS[P]←(+/[1]CREDITSCHG)[P]+(+/[1]TDC)[P]+FACHGS[P]
[19]  CLCASHPREINT[P]←OPCASH[P]+RECEIPTS[P]-PAYMENTS[P]
[20]  INT[P]←CLCASHPREINT[P]×RI[P]÷(100-RI[P])
[21]  CLCASH[P]←CLCASHPREINT[P]+INT[P]
[22]  P←P+1
[23]  →(P>HZ)/L2
[24]  OPCASH[P]←CLCASH[P-1]
[25]  →L1
[26] L2:CASHCHG←CLCASH-OPCASH
    ∇
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```
      ∇PRINTCASHA[⎕]∇
    ∇ PRINTCASHA
[1]   RX←(12×RP)⍴' (1,123,120)'
[2]   DESCCASH←14 25⍴' '
[3]   DESCCASH[1;]←'OPENING BALANCE          '
[4]   DESCCASH[2;]←'TRADING PROFITS          '
[5]   DESCCASH[3;]←'DEPRECIATION             '
[6]   DESCCASH[4;]←'OTHER RECEIPTS           '
[7]   DESCCASH[5;]←'DECR/(INCR) IN RAW MATLS '
[8]   DESCCASH[6;]←'DECR/(INCR) IN P P MATLS '
[9]   DESCCASH[7;]←'DECR/(INCR) IN FND GOODS '
[10]  DESCCASH[8;]←'DECR/(INCR) IN ST LOANS  '
[11]  DESCCASH[9;]←'DECR/(INCR) IN DEBTORS   '
[12]  DESCCASH[10;]←'INCR/(DECR) IN CREDITORS '
[13]  DESCCASH[11;]←'NET DECR/(INCR) IN ASSETS'
[14]  DESCCASH[12;]←'OTHER PAYMENTS           '
[15]  DESCCASH[13;]←'INTEREST CHARGES         '
[16]  DESCCASH[14;]←'CLOSING BALANCE          '
[17]  DIM8←2⍴14,RP
[18]  TABCASH←DIM8⍴0
[19]  TABCASH[1;]←RP↑OPCASH
[20]  TABCASH[2;]←RP↑TRDGPROFITS
[21]  TABCASH[3;]←RP↑(+/[1]DEPRECN)
[22]  TABCASH[4;]←RP↑(+/[1]SIR)
[23]  TABCASH[5;]←RP↑(+/[1]RMCHGS)
[24]  TABCASH[6;]←RP↑(+/[1]PPMCHGS)
[25]  TABCASH[7;]←RP↑(+/[1]FGCHGS)
[26]  TABCASH[8;]←RP↑STLOANCHGS
[27]  TABCASH[9;]←RP↑(+/[1]DEBTSCHG)
[28]  TABCASH[10;]←RP↑(-(+/[1]CREDITSCHG))
[29]  TABCASH[11;]←RP↑-FACHGS
[30]  TABCASH[12;]←RP↑(-(+/[1]TDC))
[31]  TABCASH[13;]←RP↑INT
[32]  TABCASH[14;]←RP↑CLCASH
[33]  'ALIGN PAPER AT PAGE END AND CARRIAGE RETURN'
[34]  N←⍞
[35]  (22⍴' '),'CADBURY SCHWEPPES LIMITED - CONFECTIONERY GROUP'
[36]  (27⍴' '),'FORECAST CASH STATEMENT AT';'  12/12/12'FMT FCSTDATE
[37]  (33⍴' '),'FOR THE FIRST ';RP;' PERIODS'
[38]  ' '
[39]  '  POUNDS IN 000 '
[40]  (27⍴' '),((RP×12)⍴'   PERIOD    ')
[41]  ' '
[42]  N←1
[43] L1:(DESCCASH[N;],RX)FMT(TABCASH[N;])
[44]  N←N+1
[45]  →L2×⍳(N≠14)
[46]  (25⍴' '),((12×RP)⍴'  ----------')
[47] L2:→L3×⍳(N≠15)
[48]  (25⍴' '),((12×RP)⍴'  ==========')
[49] L3:→L1×⍳N≤14
    ∇
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      ∇PRINTCASHB[⎕]∇
    ∇ PRINTCASHB
[1]   RZ←(12×(HZ-RP))ρ' (1,123,120)'
[2]   DIM9←2ρ14,(HZ-RP)
[3]   TABCASH←DIM9ρ0
[4]   TABCASH[1;]←(HZ-RP)↑RP↓OPCASH
[5]   TABCASH[2;]←(HZ-RP)↑RP↓TRDGPROFITS
[6]   TABCASH[3;]←(HZ-RP)↑RP↓(+/[1]DEPRECN)
[7]   TABCASH[4;]←(HZ-RP)↑RP↓(+/[1]SIR)
[8]   TABCASH[5;]←(HZ-RP)↑RP↓(+/[1]RMCHGS)
[9]   TABCASH[6;]←(HZ-RP)↑RP↓(+/[1]PPMCHGS)
[10]  TABCASH[7;]←(HZ-RP)↑RP↓(+/[1]FGCHGS)
[11]  TABCASH[8;]←(HZ-RP)↑RP↓STLOANCHGS
[12]  TABCASH[9;]←(HZ-RP)↑RP↓(+/[1]DEBTSCHG)
[13]  TABCASH[10;]←(HZ-RP)↑RP↓(-(+/[1]CREDITSCHG))
[14]  TABCASH[11;]←(HZ-RP)↑RP↓-FACHGS
[15]  TABCASH[12;]←(HZ-RP)↑RP↓(-(+/[1]TDC))
[16]  TABCASH[13;]←(HZ-RP)↑RP↓INT
[17]  TABCASH[14;]←(HZ-RP)↑RP↓CLCASH
[18]  (22ρ' '),'CADBURY SCHWEPPES LIMITED - CONFECTIONERY GROUP'
[19]  (27ρ' '),'FORECAST CASH STATEMENT AT';'  12/12/12'FMT FCSTDATE
[20]  (33ρ' '),'FOR THE LATER ';(HZ-RP);' PERIODS'
[21]  ' '
[22]  '  POUNDS IN 000 '
[23]  (27ρ' '),(((HZ-RP)×12)ρ'   PERIOD   ')
[24]  ' '
[25]  N←1
[26] L1:(DESCCASH[N;],RZ)FMT(TABCASH[N;])
[27]  N←N+1
[28]  →L2×⍳(N≠14)
[29]  (25ρ' '),((12×(HZ-RP))ρ'  ----------')
[30] L2:→L3×⍳(N≠15)
[31]  (25ρ' '),((12×(HZ-RP))ρ'  ==========')
[32] L3:→L1×⍳N≤14
[33]  ' '
[34]  ' '
[35]  ' '
[36]  ' '
[37]  ' '
[38]  ' '
[39]  ' '
[40]  ' '
[41]  ' '
[42]  ' '
[43]  ' '
[44]  ' '
[45]  ' '
[46]  ' '
[47]  ' '
[48]  ' '
[49]  ' '
    ∇
```

```
      ∇AMENDFORECASTS[⎕]∇
    ∇ AMENDFORECASTS
[1]   L1:'DO YOU WANT TO AMEND PROFIT FORECASTS?'
[2]    '(REPLY YES OR NO)'
[3]    →L2×⍳'N'=1↑ANS←⍞
[4]    AMENDPROFITS
[5]   L2:PRPROFITS
[6]    ' '
[7]    ' '
[8]    ' '
[9]    ' '
[10]   ' '
[11]   ' '
[12]   ' '
[13]   'DO YOU WANT TO AMEND CASH FORECASTS?'
[14]   '(REPLY YES OR NO)'
[15]   →L3×⍳'N'=1↑ANS←⍞
[16]   AMENDCASH
[17]  L3:PRCASH
[18]   ' '
[19]   ' '
[20]   ' '
[21]   ' '
[22]   ' '
[23]   ' '
[24]   ' '
[25]   ' '
[26]   ' '
[27]   ' '
[28]   ' '
[29]   ' '
[30]   'MORE  AMENDMENTS?'
[31]   →L4×⍳'N'=1↑ANS←⍞
[32]   →L1
[33]  L4:'END OF AMENDING FORECASTS'
    ∇
```

```
     ∇AMENDPROFITS[⎕]∇
    ∇ AMENDPROFITS
[1]  L2:'YOU HAVE THE FOLLOWING OPTIONS IN AMENDING PROFIT FORECASTS                       '
[2]   ' '
[3]   '   OPTION NO          OPTION'
[4]   '       1          AMENDING CALCULATION OF SALES'
[5]   '       2          AMENDING CALCULATION OF VARIABLE COSTS'
[6]   '       3          AMENDING CALCULATION OF FIXED COSTS'
[7]   '       4          AMENDING DIRECT MARKETING EXPENSES'
[8]   '      99          END OF DESIRED PROFIT FORECAST AMENDMENTS'
[9]   ' '
[10]  'TYPE IN OPTION NO FOR DESIRED AMENDMENT'
[11] L1:IN←INLINE 1
[12]  →L3×⍳IN[1]=99
[13]  →L4×⍳IN[1]=1
[14]  →L5×⍳IN[1]=2
[15]  →L6×⍳IN[1]=3
[16]  →L7×⍳IN[1]=4
[17]  'INVALID OPTION NO RE-TYPE'
[18]  →L1
[19] L4:AMENDSALES
[20]  →L2
[21] L5:AMENDVARCOSTS
[22]  →L2
[23] L6:AMENDFIXCOSTS
[24]  →L2
[25] L7:AMENDDMKGEXP
[26]  →L2
[27] L3:' '
[28]  'END OF DESIRED PROFIT FORECAST AMENDMENTS'
[29]  ' '
    ∇
```

```
     ∇PRPROFITS[⎕]∇
    ∇ PRPROFITS
[1]   SALES
[2]   VARCOSTS
[3]   FIXCOSTS
[4]   PROFITS
[5]   'DO YOU WANT AN AMENDED PROFIT FORECAST STATEMENT?'
[6]   '(REPLY YES OR NO)'
[7]   →L18×⍳'N'=1↑ANS←⍞
[8]   PRINTPROFITA
[9]   PRINTPROFITB
[10] L18:
    ∇
```

```
      ∇AMENDSALES[⎕]∇
    ∇ AMENDSALES
[1]   'DO YOU WANT TO AMEND SELLING PRICES?'
[2]   →L7×⍳'N'=1↑ANS←⍞
[3]   'ARE YOU MAKING PERCENTAGE ADJUSTMENTS?'
[4]   '(REPLY  YES  OR  NO)'
[5]   →L4×⍳'N'=1↑ANS←⍞
[6]   'ENTER  PRODUCT GROUP   EARLIEST PERIOD   LATEST PERIOD   PERCENTAGE CHANGE'
[7]   'P.G.         2                   5                10                14'
[8]   'GROUP 55 INDICATES END OF PERCENTAGE ADJUSTMENTS WITH VALUE CHANGES TO FOLLOW'
[9]   'GROUP 99 INDICATES END OF CHANGES TO SELLING PRICES'
[10] L2:IN←INLINE 4
[11]  →L4×⍳IN[1]=55
[12]  →L7×⍳IN[1]=99
[13]  →L3×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
[14]  'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[15]  →L2
[16] L3:P1[IN[1];IN[2]]←P1[IN[1];IN[2]]+P1[IN[1];IN[2]]×IN[4]÷100
[17]  IN[2]←IN[2]+1
[18]  →L3×⍳IN[2]≤IN[3]
[19]  →L2
[20] L4:'ENTER   PRODUCT GROUP   EARLIEST PERIOD   LATEST PERIOD   REVISED S.P'
[21]  'P.G.          2                  7                 12                7.50'
[22]  'GROUP 99 INDICATES END OF CHANGES TO SELLING PRICES'
[23] L5:IN←INLINE 4
[24]  →L7×⍳IN[1]=99
[25]  →L6×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
[26]  'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[27]  →L5
[28] L6:P1[IN[1];IN[2]]←IN[4]
[29]  IN[2]←IN[2]+1
[30]  →L6×⍳IN[2]≤IN[3]
[31]  →L5
[32] L7:'END OF AMENDING SELLING PRICES'
[33]  'YOU CAN AMEND THE SALES VOLUME FORECASTS'
[34]  'BY PERCENTAGE ADJUSTMENTS, VALUE ADJUSTMENTS AND'
[35]  'VALUE CHANGES IN THAT ORDER'
[36]  'DO YOU WANT TO AMEND SALES VOLUME FORECASTS?'
[37]  →L16×⍳'N'=1↑ANS←⍞
[38]  'ARE YOU MAKING PERCENTAGE ADJUSTMENTS?'
[39]  →L10×⍳'N'=1↑ANS←⍞
[40]  'ENTER PRODUCT GROUP   EARLIEST PERIOD   LATEST PERIOD   PERCENTAGE ADJUSTMENT'
[41]  'GROUP 55 INDICATES END OF PERCENTAGE ADJUSTMENTS WITH VALUE ADJSTS  TO FOLLOW'
[42]  'GROUP 77 INDICATES END OF VALUE ADJSMTS WITH VALUE CHANGES TO FOLLOW'
[43]  'GROUP 99 INDICATES END OF CHANGES'
[44] L8:IN←INLINE 4
[45]  →L10×⍳IN[1]=55
[46]  →L13×⍳IN[1]=77
[47]  →L16×⍳IN[1]=99
[48]  →L9×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
[49]  'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[50]  →L8
[51] L9:Q[IN[1];IN[2]]←Q[IN[1];IN[2]]+Q[IN[1];IN[2]]×IN[4]÷100
[52]  IN[2]←IN[2]+1
```

```
 →L9×⍳IN[2]≤IN[3]
 →L8
L10:'ARE YOU MAKING VALUE ADJUSTMENTS?'
 →L13×⍳'N'=1↑ANS←⍞
 'ENTER   PRODUCT GROUP   EARLIEST PERIOD   LATEST PERIOD   VALUE ADJSMT'
 'GROUP 77 INDICATES END OF VALUE ADJSMT WITH VALUE CHANGES TO FOLLOW'
 'GROUP 99 INDICATES END OF SALES VOLUME FORECASTS'
L11:IN←INLINE 4
 →L16×⍳IN[1]=99
 →L13×⍳IN[1]=77
 →L12×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
 'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
 →L11
L12:Q[IN[1];IN[2]]←Q[IN[1];IN[2]]+IN[4]
 IN[2]←IN[2]+1
 →L12×⍳IN[2]≤IN[3]
 →L11
L13:'DO YOU WANT TO CHANGE VALUES?'
 '(REPLY YES OR NO)'
 →L16×⍳'N'=1↑ANS←⍞
 'ENTER   PRODUCT GROUP   EARLIEST PERIOD   LATEST PERIOD   REVISED VALUE'
 'GROUP 99 INDICATES END OF CHANGES TO SALES VOLUME FORECASTS'
L14:IN←INLINE 4
 →L16×⍳IN[1]=99
 →L15×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
 'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
 →L14
L15:Q[IN[1];IN[2]]←IN[4]
 IN[2]←IN[2]+1
 →L15×⍳IN[2]≤IN[3]
 →L14
L16:'END OF AMENDING SALES'
 ∇
```

```
    ∇AMENDVARCOSTS[⎕]∇
   ∇ AMENDVARCOSTS
[1]  L1:'YOU HAVE THE FOLLOWING OPTIONS IN AMENDING VARIABLE COSTS'
[2]   ' '
[3]   '  OPTION NO            OPTIONS'
[4]   '        1          AMEND COST PER UNIT OF RAW MATERIALS/INGREDIENTS'
[5]   '        2          AMEND USAGE PER TON  OF EACH RM FOR EACH PRODUCT GROUP'
[6]   '        3          AMEND STD DIRECT LABOUR COST PER TON FOR EACH PRODUCT GROUP'
[7]   '        4          AMEND EXPECTED LABOUR EFFICIENCY PERCENTS FOR EACH PRODUCT GROUP'
[8]   '        5          AMEND A.E.C. PERCENT'
[9]   '        6          AMEND VARIABLE DISTRIBUTION COST PER TON FOR EACH PRODUCT GROUP'
[10]  '        7          AMEND VARIABLE SELLING COST PERCENT FOR EACH PRODUCT GROUP'
[11]  '       99          INDICATES END OF CHANGES TO VARIABLE COSTS'
[12]  ' '
[13]  'ENTER OPTION NO FOR DESIRED AMENDMENTS'
[14] LA1:IN←INLINE 1
[15]  →L9×⍳IN[1]=99
[16]  →L2×⍳IN[1]=1
[17]  →L3×⍳IN[1]=2
[18]  →L4×⍳IN[1]=3
[19]  →L5×⍳IN[1]=4
[20]  →L6×⍳IN[1]=5
[21]  →L7×⍳IN[1]=6
[22]  →L8×⍳IN[1]=7
[23]  'INVALID OPTION NO  RE-ENTER'
[24]  →LA1
[25] L2:AMENDRMP
[26]  →L1
[27] L3:AMENDRMU
[28]  →L1
[29] L4:AMENDLABC
[30]  →L1
[31] L5:AMENDLABEFF
[32]  →L1
[33] L6:AMENDAEC
[34]  →L1
[35] L7:AMENDDISTVC
[36]  →L1
[37] L8:AMENDSELLVC
[38]  →L1
[39] L9:'END OF AMENDING VARIABLE COSTS'
   ∇
```

```
      ∇AMENDRMP[⎕]∇
    ∇ AMENDRMP
[1]   P2←P2÷10000000
[2]   ' '
[3]   'ARE YOU MAKING PERCENTAGE ADJUSTMENTS?'
[4]   →L4×⍳'N'=1↑ANS←⍞
[5]   ' '
[6]   'ENTER  RAW MATERIAL TYPE   EARLIEST PERIOD   LATEST PERIOD   PERCENTAGE ADJST'
[7]   'RAW MATERIAL  55  INDICATES END OF PERCENTAGE ADJUSTMENTS WITH VALUE CHANGES TO FOLLOW'
[8]   'RAW MATERIAL  99  INDICATES END OF CHANGES TO RAW MATERIAL PRICES  '
[9]  L2:IN←INLINE 4
[10]  →L4×⍳IN[1]=55
[11]  →L7×⍳IN[1]=99
[12]  →L3×⍳(IN[1]∊⍳RM)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
[13]  'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[14]  →L2
[15] L3:P2[IN[1];IN[2]]←P2[IN[1];IN[2]]+P2[IN[1];IN[2]]×IN[4]÷100
[16]  IN[2]←IN[2]+1
[17]  →L3×⍳IN[2]≤IN[3]
[18]  →L2
[19] L4:'ENTER  RAW MATERIAL TYPE   EARLIEST PERIOD  LATEST PERIOD REVISED UNIT COST'
[20]  ' '
[21]  'RAW MATERIAL  99  INDICATES END OF CHANGES'
[22] L5:IN←INLINE 4
[23]  →L7×⍳IN[1]=99
[24]  →L6×⍳(IN[1]∊⍳RM)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
[25]  'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[26]  →L5
[27] L6:P2[IN[1];IN[2]]←IN[4]÷1000
[28]  IN[2]←IN[2]+1
[29]  →L6×⍳IN[2]≤IN[3]
[30]  →L5
[31] L7:P2←⌊10000000×P2
[32]  'END OF AMENDING RAW MATERIAL PRICES'
    ∇
```

```
      ∇AMENDRMU[⎕]∇
    ∇ AMENDRMU
[1]    P←1
[2]   L1:Q2[P;;]←Q2[P;;]÷10000
[3]    P←P+1
[4]    →L1×⍳P≤PG
[5]    'ARE YOU MAKING PERCENTAGE ADJUSTMENTS?'
[6]    →L4×⍳'N'=1↑ANS←⍞
[7]    ' '
[8]    'ENTER   PRODUCT GROUP   RAW MATERIAL TYPE   EARLIEST PERIOD   LATEST PERIOD   PERCENTAGE ADJST'
[9]    'PRODUCT GROUP 55 INDICATES END OF PERCENTAGE ADJUSTMENTS WITH VALUE CHANGES TO FOLLOW'
[10]   'PRODUCT  GROUP 99  INDICATES END OF CHANGES TO RAW MATERIAL USAGES  '
[11]  L2:IN←INLINE 5
[12]   →L4×⍳IN[1]=55
[13]   →L7×⍳IN[1]=99
[14]   →L3×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳RM)∧(IN[3]∊⍳HZ)∧(IN[4]∊⍳HZ)
[15]   'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[16]   →L2
[17]  L3:Q2[IN[1];IN[2];IN[3]]←Q2[IN[1];IN[2];IN[3]]+Q2[IN[1];IN[2];IN[3]]×IN[5]÷100
[18]   IN[3]←IN[3]+1
[19]   →L3×⍳IN[3]≤IN[4]
[20]   →L2
[21]  L4:'ENTER  PRODUCT GROUP     RAW MATERIAL TYPE   EARLIEST PERIOD LATEST PERIOD   REVISED USAGE'
[22]   ' '
[23]   'RAW MATERIAL  99  INDICATES END OF CHANGES'
[24]  L5:IN←INLINE 5
[25]   →L7×⍳IN[1]=99
[26]   →L6×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳RM)∧(IN[3]∊⍳HZ)∧(IN[4]∊⍳HZ)
[27]   'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[28]   →L5
[29]  L6:Q2[IN[1];IN[2];IN[3]]←IN[5]
[30]   IN[3]←IN[3]+1
[31]   →L6×⍳IN[3]≤IN[4]
[32]   →L5
[33]  L7:P←1
[34]  L8:Q2[P;;]←⌊10000×Q2[P;;]
[35]   P←P+1
[36]   →L8×⍳P≤PG
[37]   'END OF AMENDING RAW MATERIAL USAGES'
    ∇
```

```
      ∇AMENDLABC[⎕]∇
    ∇ AMENDLABC
[1]    ' '
[2]    'ARE YOU MAKING PERCENTAGE ADJUSTMENTS?'
[3]    →L4×⍳'N'=1↑ANS←⍞
[4]    ' '
[5]    'ENTER  PRODUCT GROUP   EARLIEST PERIOD   LATEST PERIOD   PERCENTAGE ADJST'
[6]    'PRODUCT GROUP     55  INDICATES END OF PERCENTAGE ADJUSTMENTS WITH VALUE CHANGES TO FOLLOW'
[7]    'PRODUCT GROUP     99  INDICATES END OF CHANGES TO STD DIRECT LABOUR COSTS PER 000 OUTERS '
[8]   L2:IN←INLINE 4
[9]    →L4×⍳IN[1]=55
[10]   →L7×⍳IN[1]=99
[11]   →L3×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
[12]   'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[13]   →L2
[14]  L3:LC2[IN[1];IN[2]]←LC2[IN[1];IN[2]]+LC2[IN[1];IN[2]]×IN[4]÷100
[15]   IN[2]←IN[2]+1
[16]   →L3×⍳IN[2]≤IN[3]
[17]   →L2
[18]  L4:'ENTER  PRODUCT GROUP   PERIOD   REVISED UNIT COST'
[19]   ' '
[20]   'PRODUCT GROUP     99  INDICATES END OF CHANGES'
[21]  L5:IN←INLINE 3
[22]   →L7×⍳IN[1]=99
[23]   →L6×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳HZ)
[24]   'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[25]   →L5
[26]  L6:LC2[IN[1];IN[2]]←IN[3]÷1000
[27]   →L5
[28]  L7:'END OF AMENDING STD DIRECT LABOUR COST PER 000 OUTERS'
    ∇
```

```
      ∇AMENDLABEFF[⎕]∇
    ∇ AMENDLABEFF
[1]   'YOU ARE MAKING VALUE CHANGES ONLY'
[2]   'ENTER PRODUCT GROUP   EARLIEST PERIOD   LATEST PERIOD  REVISED EFFCY'
[3]   'E.G.          3                  3                   9             105'
[4]   'PRODUCT GROUP    99   INDICATES END OF CHANGES TO LABOUR EFFICIENCY PERCENTAGES'
[5]  L1:IN←INLINE 4
[6]   →L3×⍳IN[1]=99
[7]   →L2×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
[8]   'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[9]   →L1
[10] L2:E2[IN[1];IN[2]]←IN[4]
[11]  IN[2]←IN[2]+1
[12]  →L2×⍳IN[2]≤IN[3]
[13]  →L1
[14] L3:'END OF AMENDING LABOUR EFFICIENCY PERCENTAGES'
    ∇


      ∇AMENDAEC[⎕]∇
    ∇ AMENDAEC
[1]   AEC←HZ⍴AEC
[2]   'YOU ARE MAKING VALUE CHANGES ONLY'
[3]   'ENTER    EARLIEST PERIOD   LATEST PERIOD   REVISED AEC PERCENT     '
[4]   'E.G.             3                  9                  35            '
[5]   'NUMBER   99   INDICATES END OF CHANGES TO A.E.C. PERCENTAGES '
[6]  L1:IN←INLINE 3
[7]   →L3×⍳IN[1]=99
[8]   →L2×⍳(IN[1]∊⍳HZ)∧(IN[2]∊⍳HZ)
[9]   'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[10]  →L1
[11] L2:AEC[IN[1]]←IN[3]
[12]  IN[1]←IN[1]+1
[13]  →L2×⍳IN[1]≤IN[2]
[14]  →L1
[15] L3:'END OF AMENDING A.E.C. PERCENTAGES'
    ∇
```

```
     ∇AMENDDISTVC[⎕]∇
    ∇ AMENDDISTVC
[1]   ' '
[2]   'ARE YOU MAKING PERCENTAGE ADJUSTMENTS?'
[3]   →L4×⍳'N'=1↑ANS←⍞
[4]   ' '
[5]   'ENTER  PRODUCT GROUP   EARLIEST PERIOD   LATEST PERIOD   PERCENTAGE ADJST'
[6]   'PRODUCT GROUP     55  INDICATES END OF PERCENTAGE ADJUSTMENTS WITH VALUE CHANGES TO FOLLOW'
[7]   'PRODUCT GROUP     99  INDICATES END OF CHANGES TO VARIABLE DIST COSTS PER 000 OUTERS  '
[8]  L2:IN←INLINE 4
[9]   →L4×⍳IN[1]=55
[10]  →L7×⍳IN[1]=99
[11]  →L3×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
[12]  'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[13]  →L2
[14] L3:D2[IN[1];IN[2]]←D2[IN[1];IN[2]]+D2[IN[1];IN[2]]×IN[4]÷100
[15]  IN[2]←IN[2]+1
[16]  →L3×⍳IN[2]≤IN[3]
[17]  →L2
[18] L4:'ENTER  PRODUCT GROUP   PERIOD   REVISED UNIT COST'
[19]  ' '
[20]  'PRODUCT GROUP     99  INDICATES END OF CHANGES'
[21] L5:IN←INLINE 3
[22]  →L7×⍳IN[1]=99
[23]  →L6×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳HZ)
[24]  'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[25]  →L5
[26] L6:D2[IN[1];IN[2]]←IN[3]÷1000
[27]  →L5
[28] L7:'END OF AMENDING VAR DIST COSTS'
    ∇
```

```
      ∇AMENDSELLVC[⎕]∇
    ∇ AMENDSELLVC
[1]    'YOU ARE MAKING VALUE CHANGES ONLY'
[2]    'ENTER PRODUCT GROUP   EARLIEST PERIOD   LATEST PERIOD  REVISED PERCENT'
[3]    'E.G.          3                  3                9              10.5'
[4]    'PRODUCT GROUP   99   INDICATES END OF CHANGES TO VARIABLE SELLING COST PERCENTAGE '
[5]   L1:IN←INLINE 4
[6]    →L3×⍳IN[1]=99
[7]    →L2×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳NZ)∧(IN[3]∊⍳NZ)
[8]    'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[9]    →L1
[10]  L2:S2[IN[1];IN[2]]←IN[4]
[11]   IN[2]←IN[2]+1
[12]   →L2×⍳IN[2]≤IN[3]
[13]   →L1
[14]  L3:'END OF AMENDING VARIABLE SELLING COST PERCENTAGES'
    ∇
```

```
    ∇AMENDFIXCOSTS[⎕]∇
  ∇ AMENDFIXCOSTS
   ⍝ GROUPING OF VARIABLES INTO A MATRIX
    DIM12←2ρ13,HZ
    FEXP←DIM12ρ0
    FEXP[1;]←W3
    FEXP[2;]←W4
    FEXP[3;]←W5
    FEXP[4;]←R3
    FEXP[5;]←H3
    FEXP[6;]←OF3
    FEXP[7;]←OF4
    FEXP[8;]←OF5
    FEXP[9;]←A3[1;]
    FEXP[10;]←A3[2;]
    FEXP[11;]←A3[3;]
    FEXP[12;]←A3[4;]
    FEXP[13;]←A3[5;]
    'YOU CAN MAKE THE CHANGES IN THE FOLLOWING ORDER'
    'PERCENTAGE ADJUSTMENTS, VALUE ADJUSTMENTS FOLLOWED BY VALUE CHANGES'
    ' '
    'THE ITEM NUMBERS WITH RESPECTIVE EXPENSE CATEGORIES ARE'
    ' ITEM NO       CATEGORY OF EXPENSE'
    '     1         FIXED FACTORY SALARIES AND WAGES'
    '     2         FIXED DISTRIBUTION SALARIES AND WAGES'
    '     3         FIXED SELLING SALARIES AND WAGES'
    '     4         FIXED FACTORY RENT, RATES AND TAXES'
    '     5         FIXED FACTORY POWER, HEAT AND LIGHT'
    '     6         OTHER FIXED FACTORY EXPENSES'
    '     7         OTHER FIXED DISTRIBUTION EXPENSES'
    '     8         OTHER FIXED SELLING EXPENSES'
    '     9         ADDITIONS TO FIXED ASSETS-BLDGS 2.5 PERCNT'
    '    10         ADDITIONS TO FIXED ASSETS-PLANT 7.5 PERCNT'
    '    11         ADDITIONS TO FIXED ASSETS-VEHICLES 12.5 PERCNT'
    '    12         ADDITIONS TO FIXED ASSETS-PLANT 15 PERCNT'
    '    13         ADDITIONS TO FIXED ASSETS-VEH EQUIP 20 PERCNT'
    '    55         INDICATES END OF PERCENTAGE ADJUSTMENTS'
    '    77         INDICATES END OF VALUE ADJUSTMENTS'
    '    99         INDICATES END OF CHANGES TO FIXED COSTS'
    ' '
    ' '
    'ARE YOU MAKING PERCENTAGE ADJUSTMENTS?'
    →L3×ι'N'=1↑ANS←⍞
    'ENTER   ITEM NO   EARLIEST PERIOD   LATEST PERIOD  PERCENT ADJST'
    'E.G.       4             12               15            12.5'
    ' '
    'ITEM NO 55 INDICATES END OF PERCENTAGE ADJUSTMENTS FOLLOWED BY VALUE ADJUSTMENTS'
    'ITEM NO 77 INDICATES END OF VALUE ADJUSTMENTS FOLLOWED BY VALUE CHANGES'
    'ITEM NO 99 INDICATES END OF CHANGES'
   L1:IN←INLINE 4
    →L9×ιIN[1]=99
    →L6×ιIN[1]=77
    →L3×ιIN[1]=55
    →L2×ι(IN[1]∊ι13)∧(IN[2]∊ιHZ)∧(IN[3]∊ιHZ)
    'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
    →L1
   L2:FEXP[IN[1];IN[2]]←FEXP[IN[1];IN[2]]+FEXP[IN[1];IN[2]]×IN[4]÷100
```

```
[56]  IN[2]←IN[2]+1
[57]  →L2×⍳IN[2]≤IN[3]
[58]  →L1
[59] L3:'ARE YOU MAKING VALUE ADJUSTMENTS?'
[60]  →L6×⍳'N'=1↑ANS←⍞
[61]  'ENTER   ITEM NO   EARLIEST PERIOD   LATEST PERIOD   VALUE ADJSMT'
[62]  'E.G.      1              8                 12             ¯200'
[63]  'ITEM 77 INDICATES END OF VALUE ADJSMTS FOLLOWED BY VALUE CHANGES'
[64]  'ITEM 99 INDICATES END OF CHANGES'
[65] L4:IN←INLINE 4
[66]  →L9×⍳IN[1]=99
[67]  →L6×⍳IN[1]=77
[68]  →L5×⍳(IN[1]∊⍳13)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
[69]  'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[70]  →L4
[71] L5:FEXP[IN[1];IN[2]]←FEXP[IN[1];IN[2]]+IN[4]
[72]  IN[2]←IN[2]+1
[73]  →L5×⍳IN[2]≤IN[3]
[74]  →L4
[75] L6:'ARE YOU MAKING VALUE CHANGES?'
[76]  →L9×⍳'N'=1↑ANS←⍞
[77]  'ENTER   ITEM NO   EARLIEST PERIOD   LATEST PERIOD   REVISED VALUE'
[78]  'E.G.      5             13                 16             24000'
[79]  'ITEM 99 INDICATES END OF CHANGES'
[80] L7:IN←INLINE 4
[81]  →L9×⍳IN[1]=99
[82]  →L8×⍳(IN[1]∊⍳13)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
[83]  'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[84]  →L7
[85] L8:FEXP[IN[1];IN[2]]←IN[4]
[86]  IN[2]←IN[2]+1
[87]  →L8×⍳IN[2]≤IN[3]
[88]  →L7
[89] ⍝ DISPERSING THE MATRIX INTO VARIABLES FOR MODEL PROCESSING
[90] L9:W3←FEXP[1;]
[91]  W4←FEXP[2;]
[92]  W5←FEXP[3;]
[93]  R3←FEXP[4;]
[94]  H3←FEXP[5;]
[95]  OF3←FEXP[6;]
[96]  OF4←FEXP[7;]
[97]  OF5←FEXP[8;]
[98]  A3[1;]←FEXP[9;]
[99]  A3[2;]←FEXP[10;]
[100]  A3[3;]←FEXP[11;]
[101]  A3[4;]←FEXP[12;]
[102]  A3[5;]←FEXP[13;]
[103]  'END OF AMENDING FIXED COSTS'
    ∇
```

```
      ∇AMENDDMKGEXP[⎕]∇
    ∇ AMENDDMKGEXP
     'YOU CAN MAKE PERCENTAGE ADJUSTMENTS, VALUE ADJUSTMENTS AND'
     'VALUE CHANGES IN THAT ORDER'
     ' '
     'ARE YOU MAKING PERCENTAGE ADJUSTMENTS?'
     →L4×⍳'N'=1↑ANS←⍞
     ' '
     'ENTER  PRODUCT GROUP   EARLIEST PERIOD   LATEST PERIOD   PERCENTAGE ADJST'
     'PRODUCT GROUP     55  INDICATES END OF PERCENTAGE ADJUSTMENTS WITH VALUE ADJUSTMENTS TO FOLLOW'
     'PRODUCT GROUP 77 INDICATES END OF VALUE ADJSMTS WITH VALUE CHANGES TO FOLLOW'
     'PRODUCT GROUP     99  INDICATES END OF CHANGES TO DIRECT MARKETING EXPENSES'
    L2:IN←INLINE 4
     →L4×⍳IN[1]=55
     →L7×⍳IN[1]=77
     →L11×⍳IN[1]=99
     →L3×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
     'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
     →L2
    L3:DMKGEXP[IN[1];IN[2]]←DMKGEXP[IN[1];IN[2]]+DMKGEXP[IN[1];IN[2]]×IN[4]÷100
     IN[2]←IN[2]+1
     →L3×⍳IN[2]≤IN[3]
     →L2
    L4:'ARE YOU MAKING VALUE ADJUSTMENTS?'
     →L7×⍳'N'=1↑ANS←⍞
     'ENTER  PRODUCT GROUP   EARLIEST PERIOD   LATEST PERIOD   VALUE ADJSMT'
     'PRODUCT GROUP 77 INDICATES END OF VALUE ADJSMT WITH VALUE CHANGES TO FOLLOW'
     'PRODUCT GROUP 99 INDICATES END OF CHANGES'
     ' '
    L5:IN←INLINE 4
     →L7×⍳IN[1]=77
     →L11×⍳IN[1]=99
     →L6×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
     'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
     →L5
    L6:DMKGEXP[IN[1];IN[2]]←DMKGEXP[IN[1];IN[2]]+IN[4]
     IN[2]←IN[2]+1
     →L6×⍳IN[2]≤IN[3]
     →L5
    L7:'ARE YOU MAKING VALUE CHANGES?'
     →L11×⍳'N'=1↑ANS←⍞
     'ENTER PRODUCT GROUP   EARLIEST PERIOD   LATEST PERIOD   REVISED VALUE'
     'PRODUCT GROUP 99 INDICATES END OF CHANGES'
    L8:IN←INLINE 4
     →L11×⍳IN[1]=99
     →L9×⍳(IN[1]∊⍳PG)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
     'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
     →L8
    L9:DMKGEXP[IN[1];IN[2]]←IN[4]
     IN[2]←IN[2]+1
     →L9×⍳IN[2]≤IN[3]
     →L8
    L11:'END OF AMENDING DIRECT MARKETING EXPENSES'
    ∇
```

```
      ∇SALES[⎕]∇
    ∇ SALES
[1]   SALEINC←Q×P1
[2]   TOTSALEINC←+/[1]SALEINC
    ∇



      ∇VARCOSTS[⎕]∇
    ∇ VARCOSTS
[1]   DMATL←DIM2ρ0
[2]   P←1
[3]   J←1
[4]  L1:DMATL[P;]←DMATL[P;]+(P2[J;]×Q2[P;J;]÷100000000000)
[5]   J←J+1
[6]   →L1×⍳J≤RM
[7]   P←P+1
[8]   J←1
[9]   →L1×⍳P≤PG
[10]  DIRMATL←DMATL×Q
[11]  DWAGES←LC2×100÷E2
[12]  DIRWAGES←Q×DWAGES
[13]  AEC←DIM2ρAEC
[14]  FACTVARCOSTS←DIRMATL+DIRWAGES+AEC×DIRWAGES÷100
[15]  DISTVARCOSTS←Q×D2
[16]  SELLVARCOSTS←SALEINC×S2÷100
[17]  TOTVARCOSTS←FACTVARCOSTS+DISTVARCOSTS+SELLVARCOSTS
    ∇
```

```
      ∇FIXCOSTS[⎕]∇
    ∇ FIXCOSTS
[1]   OPFA←OC[;1]
[2]   OC←DEPRECN←DIM5⍴0
[3]   OC[;1]←OPFA
[4]   P←1
[5]  L1:DEPRECN[;P]←((DR3÷13)×OC[;P]+A3[;P]-CD3[;P])÷100
[6]   P←P+1
[7]   →(P>HZ)/L2
[8]   OC[;P]←OC[;P-1]+A3[;P-1]-CD3[;P-1]
[9]   →L1
[10] L2:AEC←HZ⍴,AEC
[11]  FACTFIXCOSTS←MNGTCHG+OF3+H3+R3+W3+(AEC×W3÷100)+0.8395×+/[1]DEPRECN
[12]  DISTFIXCOSTS←OF4+W4+(AEC×W4÷100)+0.1045×+/[1]DEPRECN
[13]  SELLFIXCOSTS←OF5+W5+(AEC×W5÷100)+0.056×+/[1]DEPRECN
[14]  TOTFIXCOSTS←FACTFIXCOSTS+DISTFIXCOSTS+SELLFIXCOSTS
    ∇
```

```
      ∇PROFITS[⎕]∇
    ∇ PROFITS
[1]   GCONT←TOTSALEINC-+/[1]TOTVARCOSTS
[2]   NCONT←GCONT-+/[1]DMKGEXP
[3]   GCONTPERCNT←(GCONT×100)÷TOTSALEINC
[4]   NCONTPERCNT←(NCONT×100)÷TOTSALEINC
[5]   TRDGPROFITS←NCONT-TOTFIXCOSTS
    ∇
```

```
    ∇AMENDCASH[⎕]∇
  ∇ AMENDCASH
  L9:'YOU HAVE THE FOLLOWING OPTIONS IN AMENDING CASH FORECST'
   ' '
   '   OPTION NO          OPTIONS'
   '       1        CALCULATION OF RAW MATERIAL STOCKS'
   '       2        CALCULATION OF PARTLY PROCESSED M/TL STOCKS'
   '       3        CALCULATION OF FINISHED GOODS STOCKS'
   '       4        CALCULATION OF SHORT TERM LOANS'
   '        5       CALCULATION OF DEBTORS BALANCES'
   '       6        CALCULATION OF CREDITORS BALANCES'
   '       7        CALCULATION OF OTHER RECEIPTS AND PAYMENTS'
   '       99       END OF DESIRED CASH FORECAST AMENDMENTS'
   ' '
   'TYPE IN OPTION NO FOR DESIRED AMENDMENT'
  L8:IN←INLINE 1
   →L10×⍳IN[1]=99
   →L11×⍳IN[1]=1
   →L12×⍳IN[1]=2
   →L13×⍳IN[1]=3
   →L14×⍳IN[1]=4
   →L15×⍳IN[1]=5
   →L16×⍳IN[1]=6
   →L17×⍳IN[1]=7
   'INVALID OPTION NO RE-TYPE'
   →L8
  L11:AMENDRMSTKS
   →L9
  L12:AMENDPPMSTKS
   →L9
  L13:AMENDFGSTKS
   →L9
  L14:AMENDSTLOANS
   →L9
  L15:AMENDDEBTORS
   →L9
  L16:AMENDCREDITORS
   →L9
  L17:AMENDOTHERS
   →L9
  L10:'END OF DESIRED CASH FORECAST AMENDMENTS'
   ' '
  ∇
```

```
     ∇AMENDRMSTKS[⎕]∇
    ∇ AMENDRMSTKS
[1]   'YOU CAN AMEND STOCK PATTERNS AND LEVELS'
[2]   'DO YOU WANT TO CHANGE STOCK PATTERNS?'
[3]   →L3×⍳'N'=1↑ANS←⍞
[4]   'ENTER RM TYPE     NEW PATTERN(13 ITEMS)'
[5]   'RM TYPE 55 INDICATES END OF PATTERN CHANGES WITH LEVEL CHANGES TO FOLLOW'
[6]   'RM TYPE 99 INDICATES END OF CHANGES TO RM STOCKS'
[7]  L1:IN←INLINE 14
[8]   →L3×⍳IN[1]=55
[9]   →L6×⍳IN[1]=99
[10]  →L2×⍳IN[1]∊⍳3
[11]  'INVALID INPUT RE-ENTER COMPLETE LINE'
[12]  →L1
[13] L2:RMPFLE[IN[1];]←1↓IN
[14]  →L1
[15] L3:'YOU ARE MAKING STOCK LEVEL CHANGES'
[16]  'ENTER RM TYPE     PERCNT CHANGE'
[17]  'RM TYPE 99 INDICATES END OF CHANGES TO RM STOCKS'
[18] L4:IN←INLINE 2
[19]  →L6×⍳IN[1]=99
[20]  →L5×⍳IN[1]∊⍳3
[21]  'INVALID INPUT RE-ENTER COMPLETE LINE'
[22]  →L4
[23] L5:RMPFLE1[IN[1]]←((100+IN[2])×CLPM[IN[1]]÷100)÷OPRM[IN[1]]
[24]  →L4
[25] L6:'END OF AMENDING RM STOCKS'
    ∇
```

```
      ∇AMENDPPMSTKS[⎕]∇
    ∇ AMENDPPMSTKS
[1]    'YOU CAN AMEND STOCK PATTERNS AND LEVELS'
[2]    'DO YOU WANT TO CHANGE STOCK PATTERNS?'
[3]    →L3×⍳'N'=1↑ANS←⍞
[4]    'ENTER PPM TYPE     NEW PATTERN(13 ITEMS)'
[5]    'PPM TYPE 55 INDICATES END OF PATTERN CHANGES WITH LEVEL CHANGES TO FOLLOW'
[6]    'PPM TYPE 99 INDICATES END OF CHANGES TO PPM STOCKS'
[7]   L1:IN←INLINE 14
[8]    →L3×⍳IN[1]=55
[9]    →L6×⍳IN[1]=99
[10]   →L2×⍳IN[1]∊⍳2
[11]   'INVALID INPUT RE-ENTER COMPLETE LINE'
[12]   →L1
[13]  L2:PPMPFLE[IN[1];]←1↓IN
[14]   →L1
[15]  L3:'YOU ARE MAKING STOCK LEVEL CHANGES'
[16]   'ENTER PPM TYPE     PERCNT CHANGE'
[17]   'PPM TYPE 99 INDICATES END OF CHANGES TO PPM STOCKS'
[18]  L4:IN←INLINE 2
[19]   →L6×⍳IN[1]=99
[20]   →L5×⍳IN[1]∊⍳2
[21]   'INVALID INPUT RE-ENTER COMPLETE LINE'
[22]   →L4
[23]  L5:PPMPFLE1[IN[1]]←((100+IN[2])×CLPPM[IN[1]]÷100)÷OPPPM[IN[1]]
[24]   →L4
[25]  L6:'END OF AMENDING PPM STOCKS'
    ∇
```

```
      ∇AMENDFGSTKS[⎕]∇
    ∇ AMENDFGSTKS
[1]   'YOU CAN AMEND STOCK PATTERNS AND LEVELS'
[2]   'DO YOU WANT TO CHANGE STOCK PATTERNS?'
[3]   →L3×⍳'N'=1↑ANS←⍞
[4]   'ENTER FG TYPE     NEW PATTERN(13 ITEMS)'
[5]   'FG TYPE 55 INDICATES END OF PATTERN CHANGES WITH LEVEL CHANGES TO FOLLOW'
[6]   'FG TYPE 99 INDICATES END OF CHANGES TO FG STOCKS'
[7]  L1:IN←INLINE 14
[8]   →L3×⍳IN[1]=55
[9]   →L6×⍳IN[1]=99
[10]  →L2×⍳IN[1]∊⍳2
[11]  'INVALID INPUT RE-ENTER COMPLETE LINE'
[12]  →L1
[13] L2:FGPFLE[IN[1];]←1↓IN
[14]  →L1
[15] L3:'YOU ARE MAKING STOCK LEVEL CHANGES'
[16]  'ENTER FG TYPE     PERCNT CHANGE'
[17]  'FG TYPE 99 INDICATES END OF CHANGES TO FG STOCKS'
[18] L4:IN←INLINE 2
[19]  →L6×⍳IN[1]=99
[20]  →L5×⍳IN[1]∊⍳2
[21]  'INVALID INPUT RE-ENTER COMPLETE LINE'
[22]  →L4
[23] L5:FGPFLE1[IN[1]]←((100+IN[2])×CLFG[IN[1]]÷100)÷OPFG[IN[1]]
[24]  →L4
[25] L6:'END OF AMENDING FG STOCKS'
    ∇
```

```
      ∇AMENDSTLOANS[⎕]∇
    ∇ AMENDSTLOANS
[1]   'YOU CAN MAKE PERCENTAGE ADJUSTMENTS, VALUE ADJUSTMENTS'
[2]   'AND VALUE CHANGES IN THAT ORDER'
[3]   ' '
[4]   'ARE YOU MAKING PERCENTAGE ADJUSTMENTS?'
[5]   →L3×⍳'N'=1↑ANS←⍞
[6]   'ENTER   EARLIEST PERIOD   LATEST PERIOD   PERCENTAGE ADJSMT'
[7]   '    55 INDICATES END OF PERCENTAGE ADJSMT FOLLOWED BY VALUE ADJSMT'
[8]   '    77 INDICATES END OF VALUE ADJSMT FOLLOWED BY VALUE CHANGES'
[9]   '    99 INDICATES END OF CHANGES TO SHORT TERM LOANS '
[10] L1:IN←INLINE 3
[11]  →L9×⍳IN[1]=99
[12]  →L6×⍳IN[1]=77
[13]  →L3×⍳IN[1]=55
[14]  →L2×⍳(IN[1]∊⍳HZ)∧(IN[2]∊⍳HZ)
[15]  'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[16]  →L1
[17] L2:CLSTLOANS[IN[1]]←CLSTLOANS[IN[1]]+CLSTLOANS[IN[1]]×IN[3]÷100
[18]  IN[1]←IN[1]+1
[19]  →L2×⍳IN[1]≤IN[2]
[20]  →L1
[21] L3:'ARE YOU MAKING VALUE ADJUSTMENTS?'
[22]  →L6×⍳'N'=1↑ANS←⍞
[23]  'ENTER   EARLIEST PERIOD   LATEST PERIOD   VALUE ADJSMT'
[24]  '    77 INDICATES END OF VALUE ADJSMT FOLLOWED BY VALUE CHANGES'
[25]  '    99 INDICATES END OF CHANGES TO ST LOANS '
[26] L4:IN←INLINE 3
[27]  →L9×⍳IN[1]=99
[28]  →L6×⍳IN[1]=77
[29]  →L5×⍳(IN[1]∊⍳HZ)∧(IN[2]∊⍳HZ)
[30]  'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[31]  →L4
[32] L5:CLSTLOANS[IN[1]]←CLSTLOANS[IN[1]]+IN[3]
[33]  IN[1]←IN[1]+1
[34]  →L5×⍳IN[1]≤IN[2]
[35]  →L4
[36] L6:'ARE YOU MAKING VALUE CHANGES?'
[37]  →L9×⍳'N'=1↑ANS←⍞
[38]  'ENTER   EARLIEST PERIOD   LATEST PERIOD   REVISED VALUE'
[39]  '    99 INDICATES END OF CHANGES TO ST LOANS '
[40] L7:IN←INLINE 3
[41]  →L9×⍳IN[1]=99
[42]  →L8×⍳(IN[1]∊⍳HZ)∧(IN[2]∊⍳HZ)
[43]  'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[44]  →L7
[45] L8:CLSTLOANS[IN[1]]←IN[3]
[46]  IN[1]←IN[1]+1
[47]  →L8×⍳IN[1]≤IN[2]
[48]  →L7
[49] L9:'END OF AMENDING SHORT TERM LOANS'
    ∇
```

```
      ∇AMENDDEBTORS[⎕]∇
    ∇ AMENDDEBTORS
[1]   ⍝ GROUPING THE VARIABLES INTO A MATRIX
[2]    DIM13←2⍴5,HZ
[3]    DEBTSVAR←DIM13⍴0
[4]    DEBTSVAR[1;]←V11
[5]    DEBTSVAR[2;]←P11
[6]    DEBTSVAR[3;]←CT11
[7]    DEBTSVAR[4;]←CI11
[8]    DEBTSVAR[5;]←G11
[9]    'YOU HAVE THE FOLLOWING OPTIONS IN AMENDING DEBTORS '
[10]   ' '
[11]   '    ITEM NO      CATEGORY OF ITEM'
[12]   '       1         V.A.T. PERCENT'
[13]   '       2         PERCENT OF INTER-CO SALES TO TOTAL SALES'
[14]   '       3         TRADE DEBTS COLLECTION PERIOD-WEEKS'
[15]   '       4         INTER-CO DEBTS COLLECTION PERIOD-WEEKS'
[16]   '       5         DEVELOPMENT GRANTS ALLOWED-PERCENT OF CAPITAL EXPD'
[17]   '      99         END OF CHANGES TO DEBTORS'
[18]   ' '
[19]   'YOU CAN MAKE VALUE CHANGES'
[20]   'ENTER   ITEM NO   EARLIEST PERIOD   LATEST PERIOD   REVISED VALUE'
[21]  L1:IN←INLINE 4
[22]   →L3×⍳IN[1]=99
[23]   →L2×⍳(IN[1]∊⍳5)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
[24]   'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[25]   →L1
[26]  L2:DEBTSVAR[IN[1];IN[2]]←IN[4]
[27]   IN[2]←IN[2]+1
[28]   →L2×⍳IN[2]≤IN[3]
[29]   →L1
[30]  ⍝DISPERSING THE MATRIX INTO RESPECTIVE VARIABLES
[31]  ⍝    FOR MODEL PROCESSING
[32]  L3:V11←DEBTSVAR[1;]
[33]   P11←DEBTSVAR[2;]
[34]   CT11←DEBTSVAR[3;]
[35]   CI11←DEBTSVAR[4;]
[36]   G11←DEBTSVAR[5;]
[37]   'END OF AMENDING DEBTORS'
    ∇
```

```
      ∇AMENDCREDITORS[⎕]∇
    ∇ AMENDCREDITORS
[1]   ⍝ GROUPING THE VARIABLES INTO A MATRIX
[2]    DIM14←2⍴7,HZ
[3]    CREDITSVAR←DIM14⍴0
[4]    CREDITSVAR[1;]←PM12
[5]    CREDITSVAR[2;]←PM12A
[6]    CREDITSVAR[3;]←CS12
[7]    CREDITSVAR[4;]←P12
[8]    CREDITSVAR[5;]←IS12
[9]    CREDITSVAR[6;]←DD12
[10]   CREDITSVAR[7;]←DA12
[11]   'YOU HAVE THE FOLLOWING OPTIONS IN AMENDING CREDITORS    '
[12]   ' '
[13]   '   ITEM NO       CATEGORY OF ITEM'
[14]   '               PERCENT OF MATERIAL PURCHASES IN'
[15]   '        1             REVENUE EXPENSES'
[16]   '        2             CAPITAL EXPENDITURES'
[17]   '        3        TRADE CREDITORS SETTLEMENT PERIOD-WEEKS'
[18]   '        4        PERCENT OF INTER-CO CREDIT TRANSACTIONS'
[19]   '        5        INTER-CO CREDITS SETTLEMENT PERIOD-WEEKS'
[20]   '        6        PERCENT DEDUCTIONS FROM PAYROLLS'
[21]   '        7        ACCRUED EXPENSES DISBURSEMENT PERIOD-WEEKS'
[22]   '       99        END OF CHANGES TO CREDITORS'
[23]   ' '
[24]   'YOU CAN MAKE VALUE CHANGES'
[25]   'ENTER   ITEM NO   EARLIEST PERIOD   LATEST PERIOD   REVISED VALUE'
[26]  L1:IN←INLINE 4
[27]   →L3×⍳IN[1]=99
[28]   →L2×⍳(IN[1]∊⍳7)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
[29]   'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[30]   →L1
[31]  L2:CREDITSVAR[IN[1];IN[2]]←IN[4]
[32]   IN[2]←IN[2]+1
[33]   →L2×⍳IN[2]≤IN[3]
[34]   →L1
[35]  ⍝ DISPERSING THE MATRIX INTO RESPECTIVE VARIABLES
[36]  ⍝        FOR MODEL PROCESSING
[37]  L3:PM12←CREDITSVAR[1;]
[38]   PM12A←CREDITSVAR[2;]
[39]   CS12←CREDITSVAR[3;]
[40]   P12←CREDITSVAR[4;]
[41]   IS12←CREDITSVAR[5;]
[42]   DD12←CREDITSVAR[6;]
[43]   DA12←CREDITSVAR[7;]
[44]   'END OF AMENDING CREDITORS'
    ∇
```

```
    ∇AMENDOTHERS[⎕]∇
  ∇ AMENDOTHERS
  ⍝ GROUPING TWO MATRICES INTO ONE
   DIM15←2ρ6,HZ
   SIRTDC←DIM15ρ0
   SIRTDC[1;]←SIR[1;]
   SIRTDC[2;]←SIR[2;]
   SIRTDC[3;]←SIR[3;]
   SIRTDC[4;]←TDC[1;]
   SIRTDC[5;]←TDC[2;]
   SIRTDC[6;]←TDC[3;]
   'YOU HAVE THE FOLLOWING OPTIONS IN AMENDING OTHER CASH ITEMS '
   ' '
   '  ITEM NO       CATEGORY OF ITEM'
   '     1         CASH RECEIPTS ON ISSUE OF SHARES'
   '     2         CASH RECEIPTS ON SALE OF INVESTMENTS'
   '     3         OTHER MISC CASH RECEIPTS'
   '     4         CORPORATION TAX PAYMENTS'
   '     5         DIVIDEND PAYMENTS'
   '     6         OTHER MISC CASH PAYMENTS'
   '    55         END OF PERCENTAGE ADJST FOLLOWED BY VALUE ADJSMTS'
   '    77         END OF VALUE ADJSMTS FOLLOWED BY VALUE CHANGES'
   '    99         END OF CHANGES TO CASH ITEMS'
   ' '
   'ARE YOU MAKING PERCENTAGE ADJUSTMENTS?'
   →L3×⍳'N'=1↑ANS←⍞
   'ENTER   ITEM NO   EARLIEST PERIOD   LATEST PERIOD   PERCENT ADJSMT'
   ' ITEM 55 INDICATES END OF PERCENTAGE ADJSMT FOLLOWED BY VALUE ADJSMT'
   ' ITEM 77 INDICATES END OF VALUE ADJSMT FOLLOWED BY VALUE CHANGES'
   ' ITEM 99 INDICATES END OF CHANGES TO CASH ITEMS'
  L1:IN←INLINE 4
   →L9×⍳IN[1]=99
   →L6×⍳IN[1]=77
   →L3×⍳IN[1]=55
   →L2×⍳(IN[1]∊⍳6)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
   'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
   →L1
  L2:SIRTDC[IN[1];IN[2]]←SIRTDC[IN[1];IN[2]]×(IN[4]+100)÷100
   IN[2]←IN[2]+1
   →L2×⍳IN[2]≤IN[3]
   →L1
  L3:'ARE YOU MAKING VALUE ADJUSTMENTS?'
   →L6×⍳'N'=1↑ANS←⍞
   'ENTER   ITEM NO   EARLIEST PERIOD   LATEST PERIOD   VALUE ADJSMT'
   ' ITEM 77 INDICATES END OF VALUE ADJSMT FOLLOWED BY VALUE CHANGES'
   ' ITEM 99 INDICATES END OF CHANGES TO CASH ITEMS'
  L4:IN←INLINE 4
   →L9×⍳IN[1]=99
   →L6×⍳IN[1]=77
   →L5×⍳(IN[1]∊⍳6)∧(IN[2]∊⍳HZ)∧(IN[3]∊⍳HZ)
   'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
   →L4
  L5:SIRTDC[IN[1];IN[2]]←SIRTDC[IN[1];IN[2]]+IN[4]
   IN[2]←IN[2]+1
   →L5×⍳IN[2]≤IN[3]
   →L4
  L6:'ARE YOU MAKING VALUE CHANGES?'
```

```
[56]   →L9×ι'N'=1↑ANS←⍞
[57]   'ENTER   ITEM NO   EARLIEST PERIOD   LATEST PERIOD   REVISED VALUE'
[58]   ' ITEM 99 INDICATES END OF CHANGES TO CASH ITEMS'
[59]  L7:IN←INLINE 4
[60]   →L9×ιIN[1]=99
[61]   →L8×ι(IN[1]∊ι6)∧(IN[2]∊ιNZ)∧(IN[3]∊ιNZ)
[62]   'INVALID INPUT LINE RE-ENTER COMPLETE LINE'
[63]   →L7
[64]  L8:SIRTDC[IN[1];IN[2]]←IN[4]
[65]   IN[2]←IN[2]+1
[66]   →L8×ιIN[2]≤IN[3]
[67]   →L7
[68]  ⍝ DISPERSING THE MATRIX INTO TWO MATRICES
[69]  L9:SIR[1;]←SIRTDC[1;]
[70]   SIR[2;]←SIRTDC[2;]
[71]   SIR[3;]←SIRTDC[3;]
[72]   TDC[1;]←SIRTDC[4;]
[73]   TDC[2;]←SIRTDC[5;]
[74]   TDC[3;]←SIRTDC[6;]
[75]   'END OF AMENDING CASH ITEMS'
     ∇
```

```
      ∇PRCASH[⎕]∇
    ∇ PRCASH
[1]   FGSTKS
[2]   PPMSTKS
[3]   RMSTKS
[4]   STLOANS
[5]   DEBTORS
[6]   CREDITORS
[7]   CASHT
[8]   'DO YOU WANT AN AMENDED CASH FORECAST STATEMENT?'
[9]   '(REPLY YES OR NO)'
[10]  →L19×ι'N'=1↑ANS←⍞
[11]  PRINTCASHA
[12]  PRINTCASHB
[13] L19:
    ∇
```

```
    ∇FGSTKS[⎕]∇
  ∇ FGSTKS
    DIM20←2⍴2,HZ
    OPSTKFG←CLSTKFG←DIM20⍴0
    CLFG←OPFG×FGPFLE1
    CLSTKFG[1;]←FGPFLE[1;]×1↑CLFG
    CLSTKFG[2;]←FGPFLE[2;]×1↓CLFG
    OPSTKFG[;1]←OPFG
    P←2
   L1:OPSTKFG[;P]←CLSTKFG[;P-1]
    P←P+1
    →L1×⍳P≤HZ
    FGCHGS←OPSTKFG-CLSTKFG
  ∇
```

```
    ∇PPMSTKS[⎕]∇
  ∇ PPMSTKS
    DIM20←2⍴2,HZ
    OPSTKPPM←CLSTKPPM←DIM20⍴0
    CLPPM←OPPPM×PPMPFLE1
    CLSTKPPM[1;]←PPMPFLE[1;]×1↑CLPPM
    CLSTKPPM[2;]←PPMPFLE[2;]×1↓CLPPM
    OPSTKPPM[;1]←OPPPM
    P←2
   L1:OPSTKPPM[;P]←CLSTKPPM[;P-1]
    P←P+1
    →L1×⍳P≤HZ
    PPMCHGS←OPSTKPPM-CLSTKPPM
  ∇
```

```
    ∇RMSTKS[⎕]∇
  ∇ RMSTKS
    DIM21←2⍴3,HZ
    OPSTKRM←CLSTKRM←DIM21⍴0
    CLRM←OPRM×RMPFLE1
    CLSTKRM[1;]←RMPFLE[1;]×1↑CLRM
    CLSTKRM[2;]←RMPFLE[2;]×1↑1↓CLRM
    CLSTKRM[3;]←RMPFLE[3;]×2↓CLRM
    OPSTKRM[;1]←OPRM
    P←2
   L1:OPSTKRM[;P]←CLSTKRM[;P-1]
    P←P+1
    →L1×⍳P≤HZ
    RMCHGS←OPSTKRM-CLSTKRM
    BM←BG1←PROPFIXCOSTS←DIM2⍴0
    BG←BG2←HZ⍴0
    PROPFIXCOSTS←(+/FACTFIXCOSTS)×DIRWAGES÷+/+/DIRWAGES
    BM←FACTVARCOSTS+PROPFIXCOSTS
    BG1←BM×EXPD((+/DIRMATL)÷+/BM)
    BG2←((+/[1]FGCHGS)++/[1]PPMCHGS)×((+/+/DIRMATL)÷+/+/BM)
    BG←(+/[1]BG1)-BG2
  ∇
```

```
      ∇STLOANS[⎕]∇
    ∇ STLOANS
[1]   OPSTLOANS←CI10,¯1↓CLSTLOANS
[2]   STLOANCHGS←OPSTLOANS-CLSTLOANS
    ∇



      ∇DEBTORS[⎕]∇
    ∇ DEBTORS
[1]   INTERCOSALES←(SALEINC[31;]×P11)+SALEINC[32;]+SALEINC[33;]+SALEINC[35;]+SALEINC[41;]+SALEINC[42;]+SALEINC[43;]
[2]   TRSALES←TOTSALEINC-INTERCOSALES
[3]   INTERCOSALES←INTERCOSALES+INTERCOSALES×V11÷100
[4]   TRSALES←TRSALES+TRSALES×V11÷100
[5]   OPD←OPDEBTS[;1]
[6]   OPDEBTS←CLDEBTS←DIM4ρ0
[7]   OPDEBTS[;1]←OPD
[8]   P←1
[9]   CLDEBTS[1;P]←TRSALES[P]+(OPDEBTS[1;P]×(0⌈(PCT11-4))÷PCT11)
[10]  CLDEBTS[2;P]←INTERCOSALES[P]+(OPDEBTS[2;P]×(0⌈(PCI11-4))÷PCI11)
[11]  CLDEBTS[3;P]←((+/[1]A3)[P]×G11[P]÷100)+(OPDEBTS[3;P]×(8-4)÷8)
[12]  CLDEBTS[4;P]←(+/[1]D3)[P]+OPDEBTS[4;P]×(6-4)÷6
[13]  P←P+1
[14]  OPDEBTS[;P]←CLDEBTS[;P-1]
[15] L1:CLDEBTS[1;P]←TRSALES[P]+(TRSALES[P-1]×(0⌈(CT11[P-1]-4))÷4)
[16]  CLDEBTS[2;P]←INTERCOSALES[P]+(INTERCOSALES[P-1]×(0⌈(CI11[P-1]-4))÷4)
[17]  CLDEBTS[3;P]←((+/[1]A3)[P]×G11[P]÷100)+(((+/[1]A3)[P-1]×G11[P-1]÷100)×(0⌈(8-4))÷4)
[18]  CLDEBTS[4;P]←(+/[1]D3)[P]+((+/[1]D3)[P-1]×(0⌈(6-4))÷4)
[19]  P←P+1
[20]  →(P>HZ)/L2
[21]  OPDEBTS[;P]←CLDEBTS[;P-1]
[22]  →L1
[23] L2:DEBTSCHG←OPDEBTS-CLDEBTS
    ∇
```

```
      ∇CREDITORS[⎕]∇
    ∇ CREDITORS
[1]   MATPURCH←(BG-(+/[1]RMCHGS))+((+/[1]A3)×PM12A÷100)+(PM12×((+/[1]DMKGEXP)+OF3+OF4+OF5)÷100)
[2]   TRPURCH←(100-P12)×MATPURCH÷100
[3]   INCOPURCH←(P12×MATPURCH÷100)+MNGTCHG
[4]   PAYROLLS←((AEC×W3+W4+W5)÷100)+W3+W4+W5+(+/[1]FACTVARCOSTS)-+/[1]DIRMATL
[5]   EXPENSES←(+/[1]DISTVARCOSTS)+(+/[1]SELLVARCOSTS)+P3+H3+(OF3+OF4+OF5+(+/[1]DMKGEXP))×(100-PM12)÷100
[6]   EXPENSES←EXPENSES+((+/[1]A3)×(100-PM12A)÷100)
[7]   VAT←TOTSALEINC×V11÷100
[8]   OPC←OPCREDITS[;1]
[9]   OPCREDITS←CLCREDITS←DIM5⍴0
[10]  OPCREDITS[;1]←OPC
[11]  P←1
[12]  CLCREDITS[1;P]←TRPURCH[P]+OPCREDITS[1;P]×(PCS12-4)÷PCS12
[13]  CLCREDITS[2;P]←EXPENSES[P]+OPCREDITS[2;P]×(0⌈(PDA12-4))÷PDA12
[14]  CLCREDITS[3;P]←PAYROLLS[P]×2÷4
[15]  CLCREDITS[4;P]←INCOPURCH[P]+OPCREDITS[4;P]×(PIS12-4)÷PIS12
[16]  CLCREDITS[5;P]←VAT[P]
[17]  P←P+1
[18]  OPCREDITS[;P]←CLCREDITS[;P-1]
[19] L1:CLCREDITS[1;P]←TRPURCH[P]+(TRPURCH[P-1]×(0⌈(CS12[P-1]-4))÷4)
[20]  CLCREDITS[2;P]←EXPENSES[P]+(EXPENSES[P-1]×(0⌈(DA12[P-1]-4))÷4)
[21]  CLCREDITS[3;P]←PAYROLLS[P]×2÷4
[22]  CLCREDITS[4;P]←INCOPURCH[P]+(INCOPURCH[P-1]×(0⌈(IS12[P-1]-4))÷4)
[23]  →(P∊4 7 11)/L3
[24]  CLCREDITS[5;P]←VAT[P]+OPCREDITS[5;P]
[25]  →L4
[26] L3:CLCREDITS[5;P]←VAT[P]
[27] L4:P←P+1
[28]  →(P>HZ)/L2
[29]  OPCREDITS[;P]←CLCREDITS[;P-1]
[30]  →L1
[31] L2:CREDITSCHG←OPCREDITS-CLCREDITS
    ∇

      ∇CASHT[⎕]∇
    ∇ CASHT
[1]   OCH←OPCASH[1]
[2]   OPCASH←CLCASH←CLCASHPREINT←FACHGS←CACHGS←RECEIPTS←PAYMENTS←INT←HZ⍴0
[3]   OPCASH[1]←OCH
[4]   P←1
[5]  L1:FACHGS[P]←(+/[1]A3)[P]-(+/[1]D3)[P]
[6]   CACHGS[P]←(+/[1]RMCHGS)[P]+(+/[1]FGCHGS)[P]+(+/[1]PPMCHGS)[P]+STLOANCHGS[P]+(+/[1]DEBTSCHG)[P]
[7]   RECEIPTS[P]←CACHGS[P]+TRDGPROFITS[P]+(+/[1]DEPRECN)[P]+(+/[1]SIR)[P]
[8]   PAYMENTS[P]←(+/[1]CREDITSCHG)[P]+(+/[1]TDC)[P]+FACHGS[P]
[9]   CLCASHPREINT[P]←OPCASH[P]+RECEIPTS[P]-PAYMENTS[P]
[10]  INT[P]←CLCASHPREINT[P]×RI[P]÷(100-RI[P])
[11]  CLCASH[P]←CLCASHPREINT[P]+INT[P]
[12]  P←P+1
[13]  →(P>HZ)/L2
[14]  OPCASH[P]←CLCASH[P-1]
[15]  →L1
[16] L2:CASHCHG←CLCASH-OPCASH
    ∇
```

```
      ∇FORECASTBALSHT[⎕]∇
    ∇ FORECASTBALSHT
[1]   CALCFA
[2]   CALCDEPN
[3]   CALCINV
[4]   CALCOTHERAC
[5]   CALCSHCAP
[6]   CALCDIV
[7]   CALCCPNTAX
[8]   CALCSURPLUS
[9]   CALCPANDL
[10]  CALCFINCE
[11]  'DO YOU WANT A STATEMENT OF FORECAST FINANCIAL POSITION?'
[12]  →L1×⍳'N'=1↑ANS←⍞
[13]  PRINTFINCEA
[14]  PRINTFINCEB
[15] L1:
    ∇

      ∇CALCFA[⎕]∇
    ∇ CALCFA
[1]   OPFA←CLFA←DIM5⍴0
[2]   OPFA[;1]←OC[;1]
[3]   P←1
[4]  L1:CLFA[;P]←OPFA[;P]+A3[;P]-CD3[;P]
[5]   P←P+1
[6]   →(P>HZ)/L2
[7]   OPFA[;P]←CLFA[;P-1]
[8]   →L1
[9]  L2:
    ∇

      ∇CALCDEPN[⎕]∇
    ∇ CALCDEPN
[1]   OPDEPN←CLDEPN←DEPNS←DIM5⍴0
[2]   'DEPRECIATION PROVISION AT BEGINNING OF PLAN PERIOD?'
[3]   OPDEPN[;1]←⎕
[4]   'DEPRE PROVISION RELATING TO DISPOSED ASSETS?'
[5]   DEPNS←⎕
[6]   P←1
[7]  L1:CLDEPN[;P]←OPDEPN[;P]+DEPRECN[;P]-DEPNS[;P]
[8]   P←P+1
[9]   →(P>HZ)/L2
[10]  OPDEPN[;P]←CLDEPN[;P-1]
[11]  →L1
[12] L2:
    ∇
```

```
    ∇CALCINV[⎕]∇
  ∇ CALCINV
   OPINV←CLINV←HZρ0
   'INVESTMENTS AT COST AT BEGINNING OF PLAN PERIOD?'
   OPINV[1]←⎕
   P←1
  L1:CLINV[P]←OPINV[P]-SIR[2;P]
   P←P+1
   →(P>HZ)/L2
   OPINV[P]←CLINV[P-1]
   →L1
  L2:
  ∇
```

```
    ∇CALCOTHERAC[⎕]∇
  ∇ CALCOTHERAC
   OPOAC←CLOAC←HZρ0
   'BALANCE B/F ON OTHER ACCOUNTS AT BEGINNING OF PLAN PERIOD?'
   'ENTER (-) FOR CREDIT BALANCES'
   OPOAC[1]←⎕
   P←1
  L1:CLOAC[P]←OPOAC[P]+TDC[3;P]-SIR[3;P]
   P←P+1
   →(P>HZ)/L2
   OPOAC[P]←CLOAC[P-1]
   →L1
  L2:
  ∇
```

```
    ∇CALCSHCAP[⎕]∇
  ∇ CALCSHCAP
   OPSHCAP←CLSHCAP←HZρ0
   'BALANCE B/F ON SHARE CAPITAL AT BEGINNING OF PLAN PERIOD?'
   OPSHCAP[1]←⎕
   P←1
  L1:CLSHCAP[P]←OPSHCAP[P]+SIR[1;P]
   P←P+1
   →(P>HZ)/L2
   OPSHCAP[P]←CLSHCAP[P-1]
   →L1
  L2:
  ∇
```

```
    ∇CALCDIV[⎕]∇
  ∇ CALCDIV
   PDIV←OPPDIV←CLPDIV←HZρ0
  ⍝ DIVR=RATE OF DIVIDENDS
   DIVR←12
   DIV←(1↑(HZ-1)↓CLSHCAP×DIVR)÷100
   →L1×⍳HZ>13
   PDIV[HZ]←(DIV×HZ)÷13
   →L2
  L1:DIV1←(1↑12↓CLSHCAP×DIVR)÷100
   PDIV[13]←DIV1
   PDIV[HZ]←DIV×(HZ-13)÷13
  L2:'BALANCE B/F ON PROPOSED DIVIDENDS AT BEGINNING OF PLAN PERIOD?'
   OPPDIV[1]←⎕
   P←1
  L3:CLPDIV[P]←OPPDIV[P]+PDIV[P]-TDC[2;P]
   P←P+1
   →(P>HZ)/L4
   OPPDIV[P]←CLPDIV[P-1]
   →L3
  L4:
  ∇

    ∇CALCCPNTAX[⎕]∇
  ∇ CALCCPNTAX
   CPNTAX←OPFTAX←CLFTAX←HZρ0
  ⍝ CPNR = RATE OF CORPORATION TAX
   CPNR←52
   P←1
  L1:CPNTAX[P]←(TRDGPROFITS[P]×CPNR)÷100
   P←P+1
   →L1×⍳P≤HZ
   TAX←0
   P←1
   →L5×⍳HZ≤13
  L2:TAX←TAX+CPNTAX[P]
   →L3×⍳P=13
   CPNTAX[P]←0
   P←P+1
   →L2×⍳P≤13
  L3:CPNTAX[P]←TAX
   TAX←0
   P←14
  L5:TAX←TAX+CPNTAX[P]
   →L6×⍳P=HZ
   CPNTAX[P]←0
   P←P+1
   →L5×⍳P≤HZ
  L6:CPNTAX[P]←TAX
   'BALANCE B/F ON TAX RESERVES AT BEGINNING OF PLAN PERIOD?'
   OPFTAX[1]←⎕
   P←1
  L7:CLFTAX[P]←OPFTAX[P]+CPNTAX[P]-TDC[1;P]
   P←P+1
   →(P>HZ)/L8
   OPFTAX[P]←CLFTAX[P-1]
   →L7
  L8:
  ∇
```

```
      ∇CALCSURPLUS[⎕]∇
    ∇ CALCSURPLUS
[1]    OPSRPLS←CLSRPLS←HZρ0
[2]    'BALANCE B/F ON ASSETS DISPOSAL PROFITS A/C AT BEGINNING'
[3]    'OF PLAN PERIOD?'
[4]    OPSRPLS[1]←⎕
[5]    P←1
[6]   L1:CLSRPLS[P]←OPSRPLS[P]+(+/[1]D3)[P]+(+/[1]DEPNS)[P]-(+/[1]CD3)[P]
[7]    P←P+1
[8]    →(P>HZ)/L2
[9]    OPSRPLS[P]←CLSRPLS[P-1]
[10]   →L1
[11]  L2:
    ∇
```

```
      ∇CALCPANDL[⎕]∇
    ∇ CALCPANDL
[1]    OPPL←CLPL←HZρ0
[2]    'BALANCE B/F ON P AND L AT BEGINNING OF PLAN PERIOD?'
[3]    OPPL[1]←⎕
[4]    P←1
[5]   L1:CLPL[P]←OPPL[P]+TRDGPROFITS[P]-(PDIV[P]+CPNTAX[P]-INT[P])
[6]    P←P+1
[7]    →(P>HZ)/L2
[8]    OPPL[P]←CLPL[P-1]
[9]    →L1
[10]  L2:
    ∇
```

```
      ∇CALCFINCE[⎕]∇
    ∇ CALCFINCE
[1]    FCAP←(+/[1]CLFA)+CLINV-+/[1]CLDEPN
[2]    CLSTK←(+/[1]CLSTKRM)+(+/[1]CLSTKPPM)++/[1]CLSTKFG
[3]    CASSETS←CLSTK+CLSTLOANS+CLCASH++/[1]CLDEBTS
[4]    CLIAB←CLPDIV++/[1]CLCREDITS
[5]    WCAP←CASSETS-CLIAB
[6]    TOTCAP←FCAP+WCAP+CLOAC
[7]    CAPEMPLD←CLSHCAP+CLPL+CLFTAX+CLSRPLS
    ∇
```

```
      ∇PRINTFINCFA[⎕]∇
    ∇ PRINTFINCFA
[1]   RX←(13×RP)ρ' (11,123,120)'
[2]   ⍝ DF=DESCRIPTION OF FINCL ITEMS
[3]   DF←80 25ρ' '
[4]   DF[1;]←'FIXED CAPITAL            '
[5]   DF[2;]←' FIXED ASSETS            '
[6]   DF[3;]←'  COST AT BEGINNING      '
[7]   DF[4;]←'  ADDITIONS              '
[8]   DF[5;]←'                         '
[9]   DF[6;]←'  DISPOSALS              '
[10]  DF[7;]←'  COST TO DATE           '
[11]  DF[8;]←'  DEPN AT BEGINNING      '
[12]  DF[9;]←'  DEPN FOR PERIOD        '
[13]  DF[10;]←'                         '
[14]  DF[11;]←'  DEPN RELATING TO SALES '
[15]  DF[12;]←'  DEPN TO DATE           '
[16]  DF[13;]←'  COST LESS DEPN TO DATE '
[17]  DF[14;]←' INVESTMENTS             '
[18]  DF[15;]←'  AT  BEGINNING          '
[19]  DF[16;]←'  ADDITIONS              '
[20]  DF[17;]←'                         '
[21]  DF[18;]←'  DISPOSALS              '
[22]  DF[19;]←'  INVESTMENTS TO DATE    '
[23]  DF[20;]←'FIXED CAPITAL            '
[24]  DF[21;]←'WORKING CAPITAL          '
[25]  DF[22;]←' CURRENT ASSETS          '
[26]  DF[23;]←'  STOCKS-RAW MATERIALS   '
[27]  DF[24;]←'        -PART PROCESSED  '
[28]  DF[25;]←'        -FINISHED GOODS  '
[29]  DF[26;]←'                         '
[30]  DF[27;]←'  DEBTORS-TRADE          '
[31]  DF[28;]←'         -INTER-COMPANY  '
[32]  DF[29;]←'         -DEV GRANTS     '
[33]  DF[30;]←'         -ASSETS DISPOSAL'
[34]  DF[31;]←'                         '
[35]  DF[32;]←'  SHORT TERM LOANS       '
[36]  DF[33;]←'  CASH  BALANCE          '
[37]  DF[34;]←' CURRENT ASSETS          '
[38]  DF[35;]←' CURRENT LIABILITIES     '
[39]  DF[36;]←'  CREDITORS-TRADE        '
[40]  DF[37;]←'           -EXPENSE      '
[41]  DF[38;]←'           -PAYROLL      '
[42]  DF[39;]←'           -INTER-COMPANY'
[43]  DF[40;]←'           -VAT ACCOUNT  '
[44]  DF[41;]←'                         '
[45]  DF[42;]←'  PROPOSED DIVIDENDS     '
[46]  DF[43;]←'   AT BEGINNING          '
[47]  DF[44;]←'   FOR PERIOD            '
[48]  DF[45;]←'                         '
[49]  DF[46;]←'   AMOUNTS PAID OUT      '
[50]  DF[47;]←'   BALANCE TO DATE       '
[51]  DF[48;]←' CURRENT LIABILITIES     '
[52]  DF[49;]←'WORKING CAPITAL          '
[53]  DF[50;]←'OTHER ACCOUNTS           '
[54]  DF[51;]←' AT BEGINNING            '
[55]  DF[52;]←' FOR PERIOD              '
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DF[53;]←'                              '
DF[54;]←'TOTAL CAPITAL EMPLOYED        '
DF[55;]←'REPRESENTED BY;               '
DF[56;]←'SHARE CAPITAL                 '
DF[57;]←'PROFIT AND LOSS BALANCE       '
DF[58;]←' AT BEGINNING                 '
DF[59;]←' TRADING PROFITS FOR PERD'
DF[60;]←'                              '
DF[61;]←' INTEREST CHARGES             '
DF[62;]←' PROPOSED DIVIDENDS           '
DF[63;]←' CORPORATION TAX PROVISIO'
DF[64;]←'                              '
DF[65;]←' BALANCE TO DATE              '
DF[66;]←'SURPLUS ON ASSET DISPOSAL'
DF[67;]←'  AT BEGINNING                '
DF[68;]←' SALE PROCEEDS                '
DF[69;]←' ORIGINAL COST                '
DF[70;]←' LESS:ACCUMULATED DEPRECN'
DF[71;]←' COST LESS DEPRECIATION  '
DF[72;]←' PROCEEDS LESS NET COST  '
DF[73;]←'  BALANCE TO DATE             '
DF[74;]←'FUTURE TAXATION               '
DF[75;]←' AT BEGINNING                 '
DF[76;]←' PROVISION FOR PERIOD         '
DF[77;]←'                              '
DF[78;]←' AMOUNTS PAID OUT             '
DF[79;]←'                              '
DF[80;]←'CAPITAL EMPLOYED              '
DIM10←2ρ80,RP
TF←DIM10ρ0
TF[1;]←A
TF[2;]←A
TF[3;]←RP↑(+/[1]OPFA)
TF[4;]←RP↑(+/[1]A3)
TF[5;]←RP↑(+/[1](OPFA+A3))
TF[6;]←RP↑(+/[1]CD3)
TF[7;]←RP↑(+/[1]CLFA)
TF[8;]←RP↑(+/[1]OPDEPN)
TF[9;]←RP↑(+/[1]DEPRECN)
TF[10;]←RP↑(+/[1](OPDEPN+DEPRECN))
TF[11;]←RP↑(+/[1]DEPNS)
TF[12;]←RP↑(+/[1]CLDEPN)
TF[13;]←RP↑(+/[1](CLFA-CLDEPN))
TF[14;]←A
TF[15;]←RP↑OPINV
TF[16;]←A
TF[17;]←RP↑OPINV
TF[18;]←RP↑SIR[2;]
TF[19;]←RP↑CLINV
TF[20;]←RP↑FCAP
TF[21;]←RP↑A
TF[22;]←RP↑A
TF[23;]←RP↑(+/[1]CLSTKRM)
TF[24;]←RP↑(+/[1]CLSTKPPM)
TF[25;]←RP↑(+/[1]CLSTKFG)
TF[26;]←RP↑CLSTK
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[112]  TF[27;]←RP↑CLDEBTS[1;]
[113]  TF[28;]←RP↑CLDEBTS[2;]
[114]  TF[29;]←RP↑CLDEBTS[3;]
[115]  TF[30;]←RP↑CLDEBTS[4;]
[116]  TF[31;]←RP↑(+/[1]CLDEBTS)
[117]  TF[32;]←RP↑CLSTLOANS
[118]  TF[33;]←RP↑CLCASH
[119]  TF[34;]←RP↑CASSETS
[120]  TF[35;]←RP↑A
[121]  TF[36;]←RP↑CLCREDITS[1;]
[122]  TF[37;]←RP↑CLCREDITS[2;]
[123]  TF[38;]←RP↑CLCREDITS[3;]
[124]  TF[39;]←RP↑CLCREDITS[4;]
[125]  TF[40;]←RP↑CLCREDITS[5;]
[126]  TF[41;]←RP↑(+/[1]CLCREDITS)
[127]  TF[42;]←RP↑A
[128]  TF[43;]←RP↑CPPDIV
[129]  TF[44;]←RP↑PDIV
[130]  TF[45;]←RP↑(CPPDIV+PDIV)
[131]  TF[46;]←RP↑TDC[2;]
[132]  TF[47;]←RP↑CLPDIV
[133]  TF[48;]←RP↑CLIAB
[134]  TF[49;]←RP↑WCAP
[135]  TF[50;]←RP↑A
[136]  TF[51;]←RP↑OPOAC
[137]  TF[52;]←RP↑(TDC[3;]-STR[3;])
[138]  TF[53;]←RP↑CLOAC
[139]  TF[54;]←RP↑TOTCAP
[140]  TF[55;]←RP↑A
[141]  TF[56;]←RP↑CLSHCAP
[142]  TF[57;]←RP↑A
[143]  TF[58;]←RP↑OPPL
[144]  TF[59;]←RP↑TRDGPROFITS
[145]  TF[60;]←RP↑(OPPL+TRDGPROFITS)
[146]  TF[61;]←RP↑-INT
[147]  TF[62;]←RP↑PDIV
[148]  TF[63;]←RP↑CPNTAX
[149]  TF[64;]←RP↑(PDIV+CPNTAX-INT)
[150]  TF[65;]←RP↑CLPL
[151]  TF[66;]←RP↑A
[152]  TF[67;]←RP↑OPSRPLS
[153]  TF[68;]←RP↑(+/[1]D3)
[154]  TF[69;]←RP↑(+/[1]CD3)
[155]  TF[70;]←RP↑(+/[1]DEPNS)
[156]  TF[71;]←RP↑(+/[1](CD3-DEPNS))
[157]  TF[72;]←RP↑(+/[1](D3+DEPNS-CD3))
[158]  TF[73;]←RP↑CLSRPLS
[159]  TF[74;]←RP↑A
[160]  TF[75;]←RP↑OPFTAX
[161]  TF[76;]←RP↑CPNTAX
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TF[77;]←RP↑(OPFTAX+CPNTAX)
TF[78;]←RP↑TDC[1;]
TF[79;]←RP↑CLFTAX
TF[80;]←RP↑CAPEMPLD
'ALIGN PAPER AT PAGE END AND CARRIAGE RETURN'
N←⎕
(23ρ' '),'CADBURY SCHWEPPES LIMITED - CONFECTIONERY GROUP'
(27ρ' '),'FORECAST FINANCIAL POSITION AT ';'12/12/12'FMT FCSTDATE
(29ρ' '),'AS AT THE ENDS OF THE FIRST ';RP;' PERIODS'
' '
' POUNDS IN 000 '
(29ρ' '),((13×RP)ρ'  PERIOD      ')
' '
N←1
L1:→L7×ιN∊1 2 14 16 21 22 35 42 50 55 57 66 74
 (DF[N;],RX)FMT(TF[N;])
 →L8
L7:DF[N;]
L8:N←N+1
 →L2×ι(N≠5)∧(N≠7)∧(N≠8)∧(N≠10)∧(N≠12)∧(N≠13)∧(N≠17)∧(N≠19)∧(N≠26)∧(N≠27)∧(N≠31)∧(N≠32)
 (25ρ' '),((13×RP)ρ'   --------- ')
L2:→L3×ι(N≠34)∧(N≠41)∧(N≠42)∧(N≠45)∧(N≠47)∧(N≠48)∧(N≠53)∧(N≠60)∧(N≠61)∧(N≠64)∧(N≠65)∧(N≠68)
 (25ρ' '),((13×RP)ρ'   --------- ')
L3:→L4×ι(N≠69)∧(N≠71)∧(N≠72)∧(N≠77)∧(N≠79)
 (25ρ' '),((13×RP)ρ'   --------- ')
L4:→L5×ι(N≠14)∧(N≠20)∧(N≠35)∧(N≠49)∧(N≠54)∧(N≠57)∧(N≠66)∧(N≠74)∧(N≠80)
 (25ρ' '),((13×RP)ρ'  ========== ')
L5:→L6×ι(N≠21)∧(N≠50)∧(N≠55)∧(N≠81)
 (25ρ' '),((13×RP)ρ'  ≠≠≠≠≠≠≠≠≠≠ ')
 →L6×ιN=50
 SNP(N=21 55 81)/28 17 25
L6:→L1×ιN<81
 ∇
```

```
      ∇PRINTFINCEB[⎕]∇
    ∇ PRINTFINCEB
[1]   RY←(13×(HZ-RP))⍴' (11,123,120)'
[2]   DIM11←2⍴80,(HZ-RP)
[3]   TP←DIM11⍴0
[4]   TF[1;]←A
[5]   TF[2;]←A
[6]   TF[3;]←(HZ-RP)↑RP↓(+/[1]OPFA)
[7]   TF[4;]←(HZ-RP)↑RP↓(+/[1]A3)
[8]   TF[5;]←(HZ-RP)↑RP↓(+/[1](OPFA+A3))
[9]   TF[6;]←(HZ-RP)↑RP↓(+/[1]CD3)
[10]  TF[7;]←(HZ-RP)↑RP↓(+/[1]CLFA)
[11]  TF[8;]←(HZ-RP)↑RP↓(+/[1]OPDEPN)
[12]  TF[9;]←(HZ-RP)↑RP↓(+/[1]DEPRECN)
[13]  TF[10;]←(HZ-RP)↑RP↓(+/[1](OPDEPN+DEPRECN))
[14]  TF[11;]←(HZ-RP)↑RP↓(+/[1]DFPLS)
[15]  TF[12;]←(HZ-RP)↑RP↓(+/[1]CLDEPN)
[16]  TF[13;]←(HZ-RP)↑RP↓(+/[1](CLFA-CLDEPN))
[17]  TF[14;]←A
[18]  TF[15;]←(HZ-RP)↑RP↓OPINV
[19]  TF[16;]←A
[20]  TF[17;]←(HZ-RP)↑RP↓OPINV
[21]  TF[18;]←(HZ-RP)↑RP↓SIR[2;]
[22]  TF[19;]←(HZ-RP)↑RP↓CLINV
[23]  TF[20;]←(HZ-RP)↑RP↓FCAP
[24]  TF[21;]←A
[25]  TF[22;]←A
[26]  TF[23;]←(HZ-RP)↑RP↓(+/[1]CLSTKRM)
[27]  TF[24;]←(HZ-RP)↑RP↓(+/[1]CLSTKPPM)
[28]  TF[25;]←(HZ-RP)↑RP↓(+/[1]CLSTKFG)
[29]  TF[26;]←(HZ-RP)↑RP↓CLSTK
[30]  TF[27;]←(HZ-RP)↑RP↓CLDEBTS[1;]
[31]  TF[28;]←(HZ-RP)↑RP↓CLDEBTS[2;]
[32]  TF[29;]←(HZ-RP)↑RP↓CLDEBTS[3;]
[33]  TF[30;]←(HZ-RP)↑RP↓CLDEBTS[4;]
[34]  TF[31;]←(HZ-RP)↑RP↓(+/[1]CLDEBTS)
[35]  TF[32;]←(HZ-RP)↑RP↓CLSTLOANS
[36]  TF[33;]←(HZ-RP)↑RP↓CLCASH
[37]  TF[34;]←(HZ-RP)↑RP↓CASSETS
[38]  TF[35;]←A
[39]  TF[36;]←(HZ-RP)↑RP↓CLCREDITS[1;]
[40]  TF[37;]←(HZ-RP)↑RP↓CLCREDITS[2;]
[41]  TF[38;]←(HZ-RP)↑RP↓CLCREDITS[3;]
[42]  TF[39;]←(HZ-RP)↑RP↓CLCREDITS[4;]
[43]  TF[40;]←(HZ-RP)↑RP↓CLCREDITS[5;]
[44]  TF[41;]←(HZ-RP)↑RP↓(+/[1]CLCREDITS)
[45]  TF[42;]←A
[46]  TF[43;]←(HZ-RP)↑RP↓OPPDIV
[47]  TF[44;]←(HZ-RP)↑RP↓PDIV
[48]  TF[45;]←(HZ-RP)↑RP↓(OPPDIV+PDIV)
[49]  TF[46;]←(HZ-RP)↑RP↓TDC[2;]
[50]  TF[47;]←(HZ-RP)↑RP↓CLPDIV
[51]  TF[48;]←(HZ-RP)↑RP↓CLIAB
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TF[49;]←(HZ-RP)↑RP↓WCAP
TF[50;]←A
TF[51;]←(HZ-RP)↑RP↓CPOAC
TF[52;]←(HZ-RP)↑RP↓(TDC[3;]-SIR[3;])
TF[53;]←(HZ-RP)↑RP↓CLOAC
TF[54;]←(HZ-RP)↑RP↓TOTCAP
TF[55;]←A
TF[56;]←(HZ-RP)↑RP↓CLSHCAP
TF[57;]←A
TF[58;]←(HZ-RP)↑RP↓OPPL
TF[59;]←(HZ-RP)↑RP↓TRDGPROFITS
TF[60;]←(HZ-RP)↑RP↓(OPPL+TRDGPROFITS)
TF[61;]←(HZ-RP)↑RP↓-INT
TF[62;]←(HZ-RP)↑RP↓PDIV
TF[63;]←(HZ-RP)↑RP↓CPNTAX
TF[64;]←(HZ-RP)↑RP↓(PDIV+CPNTAX-INT)
TF[65;]←(HZ-RP)↑RP↓CLPL
TF[66;]←A
TF[67;]←(HZ-RP)↑RP↓CPSRPLS
TF[68;]←(HZ-RP)↑RP↓(+/[1]D3)
TF[69;]←(HZ-RP)↑RP↓(+/[1]CD3)
TF[70;]←(HZ-RP)↑RP↓(+/[1]DEPNS)
TF[71;]←(HZ-RP)↑RP↓(+/[1](CD3-DEPNS))
TF[72;]←(HZ-RP)↑RP↓(+/[1](D3+DEPNS-CD3))
TF[73;]←(HZ-RP)↑RP↓CLSRPLS
TF[74;]←A
TF[75;]←(HZ-RP)↑RP↓OPFTAX
TF[76;]←(HZ-RP)↑RP↓CPNTAX
TF[77;]←(HZ-RP)↑RP↓(OPFTAX+CPNTAX)
TF[78;]←(HZ-RP)↑RP↓TDC[1;]
TF[79;]←(HZ-RP)↑RP↓CLFTAX
TF[80;]←(HZ-RP)↑RP↓CAPEMPLD
 (23ρ' '),'CADBURY SCHWEPPES LIMITED - CONFECTIONERY GROUP'
 (27ρ' '),'FORECAST FINANCIAL POSITION AT ';'12/12/12'FMT FCSTDATE
 (29ρ' '),'AS AT THE ENDS OF THE LATER ';(HZ-RP);' PERIODS'
 ' '
 ' POUNDS IN 000 '
 (29ρ' '),((13×(HZ-RP))ρ'  PERIOD      ')
 ' '
 N←1
L1:→L7×⍳N∊1 2 14 16 21 22 35 42 50 55 57 66 74
 (DF[N;],RY)FMT(TF[N;])
 →L8
L7:DF[N;]
L8:N←N+1
 →L2×⍳(N≠5)∧(N≠7)∧(N≠8)∧(N≠10)∧(N≠12)∧(N≠13)∧(N≠17)∧(N≠19)∧(N≠26)∧(N≠27)∧(N≠31)∧(N≠32)
 (25ρ' '),((13×(HZ-RP))ρ'   --------- ')
L2:→L3×⍳(N≠34)∧(N≠41)∧(N≠42)∧(N≠45)∧(N≠47)∧(N≠48)∧(N≠53)∧(N≠60)∧(N≠61)∧(N≠64)∧(N≠65)∧(N≠68)
 (25ρ' '),((13×(HZ-RP))ρ'   --------- ')
L3:→L4×⍳(N≠69)∧(N≠71)∧(N≠72)∧(N≠77)∧(N≠79)
 (25ρ' '),((13×(HZ-RP))ρ'   --------- ')
L4:→L5×⍳(N≠14)∧(N≠20)∧(N≠35)∧(N≠49)∧(N≠54)∧(N≠57)∧(N≠66)∧(N≠74)∧(N≠80)
 (25ρ' '),((13×(HZ-RP))ρ'  ========== ')
L5:→L6×⍳(N≠21)∧(N≠50)∧(N≠55)∧(N≠81)
 (25ρ' '),((13×(HZ-RP))ρ'  ≠≠≠≠≠≠≠≠≠≠ ')
 →L6×⍳N=50
 SNP(N=21 55 81)/28 17 25
L6:→L1×⍳N<81
∇
```

```
      ∇FMT[⎕]∇
    ∇ Z←P FMT N;DC;DEC;DGT;DP;LP;NFW;NSF;RR;RS;ZIX;I;Q;S;T;U;V;W;⎕IO
[1]    ⎕IO←~I←0
[2]    RR←⍴RS←⍴N
[3]    N←(¯2↑1,(×/¯1↓RS),(RR-1)↓RS)⍴N
[4]    LP←⍳''⍴⍴P←' ',P,' '
[5]   ⍝    ANALYZE PATTERN
[6]    DGT←(P∊DC←'0123456789')/LP
[7]    NFW←(Q≠0)/Q←(1↓T)-¯1↓T←+/((P=' ')/LP)∘.>DGT
[8]    →((¯1↑⍴N)=⍴NFW)/2+⎕LC
[9]    →0=⍴⎕←'LENGTH ERROR'
[10]   NSF←DGT[(T-NFW-1),[1.1]T←+\NFW]
[11]   S←1=+⌿T←≠/(Q←(P='.')/LP)∘.≥(NSF[;,1]-1),NSF[;2]
[12]   Q←S\(∨/S/T)/Q
[13]   DP←0≠DEC←Q×(T←Q=NSF[;1]-1)∨∧/(Q∘.+¯1 1)∊DGT
[14]   DEC←DEC+(~DP)×1+NSF[;2]
[15]   NSF[;1]←NSF[;1]-T
[16]  ⍝    GENERATE REPRESENTATION
[17]   Z←((1↑⍴N),⍴P)⍴P
[18]   Q←,(NFW+DP),[1.1]+⌿≠/DGT∘.≥DEC,1+NSF[;,2]
[19]   Z[;T[⍋T←DGT,DP/DEC]]←Q⍕|N
[20]  ⍝    ADJUST LEADING ZEROS
[21]   S←∨⌿T←<\≠/(ZIX←(P='0')/LP)∘.≥NSF[;,1],DEC
[22]   →(0=⍴Q←(U←~S∨DP)/NSF[;2])/L1
[23]   Z[;Q]←((0=|0.5+|U/N)⌽Z[;Q],[2.1]' ')[;;1]
[24] L1:→(0=1↑⍴T←S⌿(DEC-1),[1.1]S\(∨/T)/ZIX)/L2
[25]   Q←(Q∊DGT)/Q←(,Q∘.≥S)/,T[;2]∘.+S←¯1+⍳1+⌈/Q←-/T
[26]   Z[;Q]←U[2⌈(U←' ',DC)⍳Z[;Q]]
[27]  ⍝    REMOVE TRAILING ZEROS
[28] L2:ZIX←ZIX[⍋ZIX←ZIX,DP/DEC]
[29]   T←⊖<\⊖≠/ZIX∘.≥DEC,NSF[;,2]+1
[30]   →(0=1↑⍴Q←(0<-/Q)⌿Q←((∨⌿T)⌿NSF[;,2]),(∨/T)/ZIX)/L3
[31]   T←(1+Q[;1])∘.-⍳⌈/-/Q
[32]   T←T×P[T]∊DC
[33]   Q←1,((⍴T)⍴(,T)[⍋,1 2 1⍉T∘.+(⍴P)×⍳(⍴T)[1]]),⌽Q[;2]
[34] R1:→(0=×/⍴Q←(U←∨⌿T←Z[;Q[;2 1]]∧.='0 ')⌿Q)/L3
[35]   Z[;Q[;2]]←((U/T)⌽Z[;Q[;2]],[2.1]' ')[;;1]
[36]   Q←0 1↓Q
[37]   →(0≠1↑⍴Q←(0<-/Q[;2,(⍴Q)[2]])⌿Q)/R1
[38]  ⍝    REMOVE COMMAS AND TRAILING DECIMAL POINTS
[39] L3:→(0=⍴Q←(∨/≠/T∘.≥NSF)/T←(P=',')/LP)/L4
[40]   →(0=⍴Q←(∧/P[Q∘.+¯1 1]∊DC)/Q)/L4
[41]   Z[;Q]←' ,'[1+∧/Z[;Q∘.+¯1 1]∊DC]
[42] L4:→(0=⍴Q←DP/DEC)/L5
[43]   Z[;Q]←' .'[1+Z[;Q+1]∊DC]
[44]  ⍝    PROCESS NEGATIVE SYMBOLS
[45] L5:→(∧/' '∧.=P[1 2 1⍉¯1 1∘.+NSF])/L6
[46] R2:→(3=I←1-2×I)/L6
[47]   Q←NSF[;1⌈2×I]
[48]   S←0>N
[49] R3:→(0=⍴V←Q←(T←P[Q+I]≠' ')/Q+I)/R2
[50]   Z[;Q]←((S←T/S)⌽' ',[2.1]Z[;Q])[;;1]
[51] R4:→(0=⍴V←(U←∨⌿T←Z[;V-I]=' ')/V-I)/R3
[52]   Z[;W]←(U/T)⌽Z[;W←V,[1.1]V+I]
[53]   →R4
[54]  ⍝    ADJUST SIZE AND RANK OF RESULT
```

```
[55] L6:Z←0 1↓0 ¯1↓Z
[56]  →(2=RR)/0
[57]  Z←((¯1↓RS),¯1↑⍴Z)⍴Z
    ∇

      ∇INLINE[⎕]∇
    ∇ Z←INLINE Q
[1]   Z←,⍞
[2]   Z←Q↑Z
    ∇
```

```
      ∇EXPAND[⎕]∇
    ∇ X←EXPAND Y
[1]    X←DIM1⍴0
[2]    M←1
[3]    N←1
[4]   L1:X[M;;N]←RM↑Y
[5]    N←N+1
[6]    →L2×⍳N=NZ+1
[7]    →L1
[8]   L2:→L3×⍳M=PG
[9]    M←M+1
[10]   N←1
[11]   Y←RM↓Y
[12]   →L1
[13]  L3:
    ∇
```

```
      ∇EXPD[⎕]∇
    ∇ X←EXPD Y
[1]    X←DIM2⍴0
[2]    N←1
[3]   L1:X[;N]←Y
[4]    N←N+1
[5]    →L1×⍳N≤NZ
    ∇
```

```
      ∇EXPDRM[⎕]∇
    ∇ X←EXPDRM Y
[1]    X←DIM3⍴0
[2]    N←1
[3]   L1:X[;N]←Y
[4]    N←N+1
[5]    →L1×⍳N≤NZ
    ∇
```

```
      ∇SNP[∇
           ∨
           ⎕]∇
    ∇ SNP N
[1]    X←0
[2]   L1:→0×⍳N<X←X+1
[3]    ' '
[4]    →L1
    ∇
```