Current financial planning tools and techniques facilitating development of financial planning systems are summarized. Also presented are abstracts of some available programs that employ these techniques.

A guide to financial planning tools and techniques

by B. P. Dzielinski

Business planning has become a major management concern within many corporate organizations since business planning systems now assist in the conduct and management of many corporate activities. Common to all planning groups is the rising cost of development, implementation, and maintenance of planning systems and, as a result, financial planning programs and techniques have been formulated to facilitate these areas. The tools presented in this paper may automate one or more tasks in the planning process, establish libraries of proved computational routines in the form of macroinstructions and subroutines, or provide assistance in a planning support area such as data management and report generation.

The purpose of this guide is to provide information to assist business planners and their management in selecting the most appropriate tools for their particular needs in the process of developing business plans. This guide is divided into two parts. The objective of the first section is to acquaint the business and planning manager with a selection of financial planning techniques. The categories of tools and techniques discussed are those used for:

- Data analysis.
- Data generation.
- Financial mathematics.
- Capital investment.

The categories are further subdivided into functions. The second section contains selected abstracts of financial planning programs in alphabetical order. The techniques incorporated in each program are highlighted. Any references mentioned in the abstracts can be obtained from a local IBM branch office.

The financial planning techniques and programs discussed in this paper are those with which the author is most familiar and has found to be useful to business planners. The programs presented in the latter sections are only those which have been distributed by IBM. Other business planning programs have been discussed elsewhere in the literature.[1,2,3]

Data analysis

Data analysis tools and techniques are used to control and provide consistent data required as input to developing planning models. These tools range from elementary calculations of computing ratios and percentages between two data lines and of computing simple and compound growth rates to more sophisticated techniques such as marginal analysis calculations (ratios of the differences between successive values of two data lines).

growth rates

Simple or yearly growth rate computation is the percentage rate of increase from one value to the next successive value in a time series of data. Compound growth rates are usually calculated between some specified base period and some specified ending period and/or successive ending periods. Growth rates may be used in subsequent analysis such as projecting or computing future values of a time series that was based on historical growth rates.

moving average

Data-smoothing techniques are used to reduce the effect of random fluctuations in time series data. One way of suppressing irregular variations is to average the data for several periods. On the assumption that the irregular variations make the values in some periods higher, and in other periods lower than the "normal" levels, averaging over several periods largely cancels out those plus and minus deviations and displays the normal level more clearly. Successive averages moving across the historical data yield a time series with a regular pattern of change which may be extrapolated into the future. This capability is useful for obtaining sales or inventory projections.

seasonal analysis

In many planning applications data is required for forecasting future values. Raw data may have hidden seasonalities and the identification of such factors helps the user to choose the most appropriate projection or forecasting model. Specific seasonal analysis techniques are available in the Business Analysis/BASIC and Forecasting And Modeling System programs (presented later in this paper).

marginal analysis

In marginal analysis scaled ratios of the differences between successive values of two time series of data are calculated. Thus it provides a measure of relationships between the variation of one variable to the variation in another variable.

correlation analysis

Correlation analysis is a way of screening statistical data in the form of successive observations on a set of variables. It is a summary coefficient for expressing the degree of relationship between variables. The principal output of correlation analysis is the array of coefficients (decimals between -1 and $+1$) which express the strength of relationship or similarity between variables. Variations of this method are *autocorrelation*, a technique for measuring the relationship between a given time series of values and the same values shifted forward or backward by various time periods, and *crosscorrelation* which computes relationships between two different sets of data.

Data generation

The kinds of data generation capabilities provided by planning programs are based on techniques ranging from simple extrapolation of historical trends to regression techniques.

extrapolation by growth rates

Extrapolation with growth rates is based on historical data and can be made by simple or compound growth rates (computed or given) and exponential smoothing techniques. Compound growth rate methods are adequate for most cases when the data appears fairly stable. In these cases the rate is computed from end points only and thus the intermediate values are ignored. This can be shown using the compound growth rate formula as follows:

$$\left[\frac{\text{value}_{t+n}}{\text{value}_t}\right]^{\frac{1}{n}} - 1$$

where t and $t + n$ are the first and last periods in the time series. The growth rate can be a decimal number (for example, 0.055 is a 5.5 percent growth rate per period). A typical formula for extrapolating the last value in a time series for a specified number of periods is:

$$\text{value}_{t+1} = \text{multiplier} \times \text{value}_t \qquad \text{for } t = n, n + 1, n + 2, \cdots$$

The multiplier is specified as a decimal number; for example, a 10 percent growth rate is 1.1. On the other hand, if the data happens to be erratic and/or cyclical, then depending on what part of the cycle the end points occur, growth rates can be either over or understated. One solution is to consider all of the points in computing trends and/or compound growth rates. This can be done using regression techniques.

extrapolation by curve fitting

In extrapolation by curve fitting, statistical methods are used to determine an equation relating values to time. An equation of a given type may be chosen, based on the business analyst's judgment regarding the historical pattern of the values over time. Regression calculations can then be run to determine the constants for an equation whose calculated values will fit the historical data as closely as possible. Some example curve-fitting methods are now described.

Straight-line arithmetic trend. A straight-line curve may be fitted to the historical time series employing the following formula:

$$Y = a + bt$$

The values for the coefficients a and b are calculated by standard regression techniques. The value for the coefficient b represents the increment – the period increase or decrease.

Straight-line geometric trend. In this procedure, fitting a curve to a historical time series can be described as:

$$\log Y = a + bt$$

Thus, the formula yields a regression statement in terms of logarithms. In this formula b is a logarithm increment representing the annual rate of increase for extrapolating data into the future. As an example, if a least squares calculation yields a value for $b = 0.041$, then antilog $0.041 = 1.099$ shows that the trend line grows at a compound growth rate of 9.9 percent per year.

extrapolation with causal models

Although regression models used in extrapolating data usually involve time-series analysis with time periods as observation points, the method is also applied to cross-section data, using groups of customers, products, and so forth as observation points. The regression technique is then used to develop an explanation of differences in the values of some variable in terms of the different characteristics of these points.

Once the regression equation has been determined, the values of a model, such as in a sales forecast model, are forecasted (or extrapolated) by predicting the values of the explanatory variables in future periods and then inserting those values in the regression equation to calculate the corresponding level of sales.

The regression approach takes many forms. Instead of relating total sales, for example, to total values of the explanatory variables, the analyst may relate changes in the sales from a previous period to the changes in the values of explanatory variables, and this in terms either of absolute changes or of percent changes. A detailed discussion of the construction and use of regression models appears elsewhere in this issue.[4]

interpolation

In many planning applications, data may be available for only a few observation points. Missing values can be estimated using interpolation capabilities such as linear, polynomial, and sum-of-the-years'-digits (increasing and/or decreasing) projection methods.

Monte Carlo

Monte Carlo is a technique for generating data that is used in simulations of various planning processes where some variables can only be estimated in terms of an average value and some variation about that average. Based on these inputs, the technique generates future values. The BUDPLAN program product contains routines for generating such data (presented later as a program abstract).

transformations

Transformations are techniques that essentially create new variables from existing variables. For example, simple ratio and percentage calculations can be used for creating new line items of data from other line items of data. As an example, for a whole set of line items in a balance sheet, percentages of gross profit may be calculated for each of these line items. Other capabilities include converting the values in a line item of data into a line item of accumulative values and/or into a single or total value. Conversely a single or total value can be spread into a series of values using, for example, seasonal factors as inputs. Additional transformation techniques applied to data include square roots, powers, addition, multiplication, logarithms, exponential differences, and so forth.

exponential smoothing

Exponential smoothing is a technique for projecting values from past values measured at regular intervals of time. If historical values are available, it is possible to make simple forecasts for successive periods into the future. The formula for new values is a weighted sum of the last actual value and the last new (forecasted) value:

$$\text{New value (forecast)} = (\text{weight}) \times (\text{last actual}) + (1\text{-weight}) \times (\text{last forecast})$$

with weight running between 0 and 1. The best value or weight in the formula can be found by testing how much the forecasts deviate from actuals for various settings of the weight. Some variants of exponential smoothing automatically adjust the weight if the time series suddenly changes its fundamental nature. More general exponential smoothing methods handle data with seasonal factors.

depreciation

A variety of investment depreciation methods are offered by financial planning programs as follows:

- Straight-line method.
- Double-Declining-Balance method (DDB).
- Sum-of-the-Years'-Digits method (SYD).
- Other consistent methods such as those based on production, equipment units.

The input variables are asset value and asset life. Asset life is expressed in years or in total equipment units; variation in the time an asset enters depreciation in the first year, and in some cases, salvage value. A description of a method of developing depreciation formulas is referenced.[5]

The following discussion shows the advantage of accumulating depreciation allowances as much as the law will allow. Without depreciation, for any one year:

$$\text{Earnings} = \text{Revenue} - \text{Cost}$$

$$\text{After-tax Earnings} = \text{Earnings} - t\ (\text{Earnings})$$

where t is the tax rate. With a depreciation allowance:

$$\begin{aligned}\text{After-tax earnings} &= \text{Earnings} - t\ (\text{Earnings-Depreciation}) \\ &= (1 - t)\ \text{Earnings} + t\ (\text{Depreciation})\end{aligned}$$

since depreciation is allowed as a deduction in computing the amount taxable.

Over the total life of the asset, the amount of depreciation is generally equal to the initial asset value and hence, is independent of the method of calculating allowances for each year. However the acceleration of an allowance is, in effect, an interest-free loan of amount t-times the accelerated allowance during the period for which it is accelerated.

In the *straight-line method*, the adjusted basis for depreciation (frequently, but not always, the book value or cost of the asset), less the estimated salvage value, is recovered evenly over the useful life of the asset.

Using the *double-declining-balance method*, a uniform rate of depreciation may be applied, not exceeding twice the straight-line rate without adjustment for salvage value, to the undepreciated balance of the asset. To be eligible for this method, the asset must have a useful life of three or more years.

In the first year of the investment's life, the Depreciation Charge (DC) is:

$$\text{DC }(1) = \frac{\text{twice the investment cost}}{n}$$

where n is the life of the asset in years. The second year's depreciation charge is:

$$\text{DC }(2) = \text{DC }(1)\left(1 - \frac{2}{n}\right)$$

and so on until it becomes more advantageous to switch to straight-line depreciation. The best year to switch over to straight line is:

$$\left(\frac{n}{2} + 1\right) \text{ years}$$

Salvage value is not factored in until the switch to straight-line depreciation. At this time the expected salvage value is subtracted from the remaining asset value and the remainder is divided by the residual life in years.

The depreciation rate for any year in the *sum-of-the-years'-digits* method is a fraction, the numerator of which is the remaining life of the asset at the beginning of each year, and the denominator of which is the sum of the digits representing the years of estimated life. For example, if the useful life is five years, the depreciation rate would be:

$$\begin{aligned} \frac{5}{1+2+3+4+5} &= \frac{5}{15} = 0.333 \text{ for the first year} \\ &= \frac{4}{15} = 0.267 \text{ for the second year} \\ &= \frac{3}{15} = 0.200 \text{ for the third year} \\ &= \frac{2}{15} = 0.133 \text{ for the fourth year} \\ &= \frac{1}{15} = 0.067 \text{ for the fifth year} \end{aligned}$$

Under this method, cost must be reduced by estimated salvage value before computing depreciation. Like the declining-balance method, eligible assets must have a life of three or more years.

Businessmen may select any of the described methods to calculate depreciation. The choice of the method to be used and the investment life period depends on the financial strategy of the firm and federal tax regulations. The annual amount of depreciation is classified as a deductible expense for income tax purposes. It should be noted that depreciation expense does not cause cash outflows. Once the choice is made, however, it can be changed only to the extent permitted by the IRS Code. To aid in this choice, the amount of depreciation for any period and the book value at the end of any year for each method of depreciation must be developed from the depreciation routines.

Other financial techniques provided in these programs include *tax calculations*, routines for calculating the effect of the tax loss carry-back and tax loss carry-forward provisions of the 1968 IRS Code, and *retirement of assets*, a routine that computes write-off and change-in-depreciation from the original book life and the age at retirement. The depreciation may be computed by the sum-of-the-years'-digits, double-declining-balance, and straight-line methods.

Other consistent methods for investment depreciation include the *equipment units* method. The assumption is that the property will not release the same amount of service each year. Thus the depreciation is based on the assets' physical units of service. Typical formulas are:

$$U = \frac{C - R}{L}$$

$$D_t = Q_t \times U$$

$$E_t = \sum_{i=1}^{i=t} D_t$$

where:

U = Unit cost of depreciation
C = Cost of the asset
R = Estimated residual value
D_t = Depreciation in the t th year
Q_t = Number of units of asset usage in the t th year
E_t = Total accumulated depreciation in the t th year
L = Expected life of asset in units

break-even analysis

Break-even analysis, a management tool for profit planning and control, is basically an analytical technique for studying the relation between the level of fixed and variable costs, and profits. If a firm's costs were all variable and none were fixed, the problem of break-even volume would never arise. But, by having some fixed costs, the firm suffers losses up to a given volume. Thus break-even analysis is a formal profit-planning approach based on established relations between costs and revenues. It is a device for determining the point at which sales will just cover total costs. If the firm is to avoid losses, its sales must cover all costs—those which vary directly with production and those which do not change as production levels change.

Break-even analysis can be carried out algebraically as shown in the following:

Let:

P = Sales price per unit
Q = Quantity produced or sold
F = Fixed costs
V = Variable costs per unit

Then:

$$P \times Q = F + (V \times Q)$$
$$(P \times Q) - (V \times Q) = F$$
$$Q \times (P - V) = F$$
$$Q = \frac{F}{P - V} \text{ at break-even } Q$$

The Business Analysis/BASIC program product contains two variations of break-even analysis. The first, termed under *certainty*, computes the break-even point with all values known and fixed. The second variation, termed under *uncertainty*, computes the probability of break-even from input values expressed using expected values and their standard deviations.

Capital investment planning

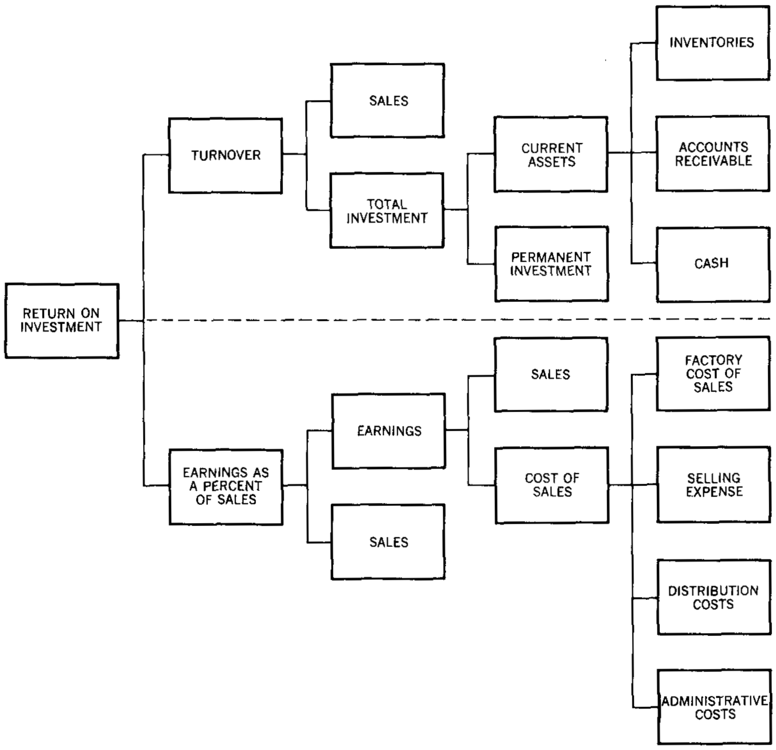
Capital investment planning techniques provide a capability for evaluating the financial consequences of proposed capital expenditures. The development of an effective system for managing capital expenditures requires a complex combination of disciplines:

- Application of economic theory at several points.
- Financial mathematics.
- Economic forecasting.
- Techniques for projecting the amount and timing of outlays and revenues.
- Comparisons of activity with projections.

In making decisions regarding capital investment opportunities, a company usually requires an objective, a means of evaluating or measuring the economic advantage (or disadvantage) of proposed investments, and a criterion of acceptance or rejection. Some of the more common techniques for analyzing return on investments to be discussed are:

- Payback method.
- duPont method.
- Accounting method.
- Net Present-Value method (NPV).
- Internal Rate-of-Return method (IRR).
- Risk analysis using the Monte Carlo method.

Figure 1 Schematic of duPont return-on-investment method



payback method

The measure of *payback period*—that is, the number of years required for the earnings on the investment to pay back the original outlay with no allowance for capital wastage—is widely used to measure investment value. Under this method, an investment is chosen over another one if its payback period is shorter. Payback can also serve as a coarse screen to pick out high-profit projects that are so clearly desirable as to require no refined rate-of-return estimates and to reject quickly those projects that show such poor promise that they do not merit thorough economic analysis. The payback formula can be expressed as:

$$\text{Payback} = \frac{\text{Net investment}}{\text{Average annual operating income (cash flow)}}$$

duPont method

The duPont method relies on gross profit on sales and turnover as a return criteria rather than externally dictated interest rates. This method, considered especially appropriate for manufacturers with large capital investments, begins with an analysis of the relation of investment in operating assets and the income statement pattern, all funneled into a final figure representing the rate-of-return on investment.

The nature of the duPont method, simplified somewhat, is shown in Figure 1. This figure is divided into two major lines of relation. The upper part represents total current assets plus permanent investment (property, plant, equipment). Sales divided by total investment equals the investment turnover, which is the final figure in the upper half of the figure. The lower part begins at the right with an analysis of the income statement. Sales minus the cost of sales gives earnings; and earnings divided by sales gives the profit margin (or earnings) on sales. Turnover is then multiplied by earnings to sales to give return-on-investment. The duPont method can be summarized as follows:

$$\frac{\text{Sales}}{\text{Investment}} \times \frac{\text{Profit-return}}{\text{Sales}} = \frac{\text{Profit-return}}{\text{Investment}}$$

accounting method

The accounting method, the reciprocal of the payback method, estimates investment worth by computing rate of return as the ratio of the investment's earnings averaged over its life (less depreciation) to the average lifetime investment (one-half the total investment). This method can be expressed as:

$$\text{Return} = \frac{\text{Annual income} - \dfrac{\text{Investment}}{\text{Estimated life}}}{\dfrac{\text{Investment}}{2}}$$

This method differs from the following NPV or IRR methods because it is insensitive to variations in the time patterns of investment outlays and earnings. By taking an annual average of earnings over the life of a project, the accounting method ignores the earning trends.

time patterns

Operating cash flows can be derived as average annual amounts for evaluating any investment opportunity. Often, however, one finds that the economic benefits gained from an investment project are patterned unevenly over time. The introduction of a new product, for example, may show slowly rising cash inflows from year to year, or even an initial period of zero inflows until momentum is gained. The patterns of cash flows affect the relative desirability of the investment, depending on the method of calculating the measure of desirability. It is, therefore, useful for the analyst to identify the time dimension of the investment opportunity. The data in Table 1 show such a recognition of the time dimension, which will be useful when the concept of present value is used to analyze investment opportunities.

net present-value method

The Net Present-Value (NPV) method consists of the calculation of the present worth of the different projects in relation to the rate-of-return given as input. The criterion states that the higher the net present value, the more desirable the project.

Table 1 Time pattern of proposed investment for NPV and IRR methods

Time period	*Investment (Cash outflow)*	*Type of outlay*	*Operating cash inflows*
0	$100,000	Immediate investment in new equipment	--
1	30,000	Investment in working capital	$ 5,000
2	--		10,000
3	20,000	Additional investment in working capital	25,000
4	--		40,000
5	--		50,000
6	--		50,000
7	--		50,000
8	--		25,000
9	(50,000)	Recovery of working capital and salvage value of equipment	25,000

Specifically the NPV of an investment is the difference between the total of the discounted income (returns or savings) and the total of the discounted expenses (capital expenditures, investment cost) as illustrated in the following formula:

$$NPV = \sum_{t=1}^{t=n} \frac{R_t}{(1+i)^t} - \sum_{t=1}^{t=n} \frac{C_t}{(1+i)^t}$$

where:

n = Life of the investment project (in years)
i = Discount rate
R_t = Revenue of year t
C_t = Investment cost (expenses) of year t

internal rate-of-return method

The Internal Rate-of-Return (IRR) method (sometimes referred to as the *yield* method) consists of finding the interest rate that sets the net present-value to zero. Hence, the investment that yields the greatest rate of return is the investment of greatest value. In other words, the IRR on an investment is the interest that equates the total of the discounted income to the total of the discounted expenses (the interest rate that equates the net present value to zero). The IRR formula is:

$$\sum_{t=1}^{t=n} \frac{R_t}{(1+i_0)^t} = \sum_{t=1}^{t=n} \frac{C_t}{(1+i_0)^t}$$

where:

i_0 = Calculated IRR
n = Life of the investment project in years
R_t = Revenue in year t
C_t = Investment cost (expenses) in year t

In many investment opportunities cash flows form an uneven pattern of values such as depicted in Table 1. In this case the yield (IRR) must be found by trial-and-error—that is, starting with an assumed rate, a net present-value is determined. If the result is positive, a higher rate is tried; if the result is negative, a lower rate is indicated. The mathematical trial-and-error routines, available in many financial planning programs, quickly compute the rate of return. The planner or analyst supplies only the investment and revenue data required to the routine.

As an example, return on investment for a new investment proposal can be performed on the data shown in Table 1 using the Planning Systems Generator II program (discussed in the section containing abstracts). Specified as inputs to the program are revenue or cash inflows (positive values) and investment or cash outflows (negative values) as shown in Table 2. The calculation results in a percentage (rate of return) and any non-zero, residual net present-value. This particular example results in an IRR or return on investment of 16.5 percent with a residual NPV of 0.2.

risk analysis

The problem of deciding among alternative capital investment opportunities is not one of projecting return on investment under any given set of assumptions. Instead, it resides in the assumptions and in their impact, and each assumption involves its own degree of uncertainty—that is, risk. There is a way to help the executive sharpen his key capital investment decisions by providing him with a realistic measurement of the risks involved. Supported with this measurement, which evaluates for him the risk at each possible level of return, he is then in a position to measure more knowledgeably alternative courses of action against corporate objectives.

Risk is generally expressed in terms of probabilities. Therefore, a simulation technique such as the Monte Carlo method is generally used in risk analysis programs to determine the frequency of occurrence of each individual rate of return and net present-value. It then becomes possible to derive the risk of a project failing to yield an acceptable return. Using this approach, management takes the various levels of return on investment, cash flows, and other results of a proposed outlay and arrives at an estimate of the changes (probability level) for each potential outcome.

Capital investment decisions may be based on discounted cash flow calculations. For example, investment A may have an expected internal rate of return of 10.2 percent while for investment B a 12.3 percent return can be expected. The resulting output from this technique can portray a schedule that gives the most likely return from A, but also indicates that A has 1 chance

Table 2 Inputs for return-on-investment calculation

Time period	*Cash outflow*	*Cash inflow*
0	−100.0	– –
1	− 30.0	5.0
2	– –	10.0
3	− 20.0	25.0
4	– –	40.0
5	– –	50.0
6	– –	50.0
7	– –	50.0
8	– –	25.0
9	50.0	25.0

in 20 of being a total loss, 1 in 10 of earning 5–6 percent, 2 in 10 of earning 8–10 percent and 1 in 50 of acclaiming a 30 percent rate of return. From this same example analysis, the most likely rate of return from investment B can be obtained, and also can show that B has 1 chance in 10 of resulting in a total loss, 1 in 10 of earning from 4–5 percent return, 2 in 10 of paying between 9–11 percent, and only 1 chance in 100 of attaining 30 percent. In this example, the estimates of the rates of return provided by the two analyses would not be substantially different. However, with the added information, investment B no longer looks like the clearly better choice, since with A the chances of substantial gain are higher and the risks of loss are lower.

The risk analysis technique can also be used for a *sensitivity analysis*. The purpose of sensitivity analysis is to determine the influence of each factor on the outcome, and thus, to identify the factors most critical in the investment decision because of their high leverage, high uncertainty, or both. In a sensitivity analysis, equally likely variations in the values of each factor are made systematically to determine their effect on the outcome, or net present-value.

Concluding remarks

The techniques presented in this paper introduce one to the categories and functions of financial planning programming tools. It is hoped that this information will assist programmers, planners, and their management in the design and implementation of present and future financial planning systems.

ABSTRACTS of some financial planning tools currently available as programs are presented next. Indicated in each abstract are the particular techniques used.

BA/BASIC *Business Analysis/BASIC*

- Availability: Program Product

- Description
  Business Analysis/BASIC is a comprehensive set of interactive tools written in the BASIC language, that can assist the business analyst in preparing financial plans and in analyzing investment opportunities. Interactive features include instructional messages, flexible control of calculations, extensive error checking, and data editing. The program contains three general functions: data file management, spread-sheet analysis, and quantitative economic analysis. The financial planning routines include:

  Time-series analysis calculations using moving average, seasonal analysis, cyclical analysis, autocovariance/autocorrelation, crosscovariance/cross-correlation, exponential smoothing, and simple regression.

  Depreciation of assets using straight-line, double-declining-balance, sum-of-the-years'-digits, and equipment units methods.

  Break-even analysis under certainty and uncertainty.

  Return on investment using payback method, duPont method, accounting method, and discounted cash-flow methods (NPV and IRR).

  Multiple and single loan analysis.

  Lease versus purchase analysis.

  Make versus buy analysis.

- Programming systems

Operating systems:	System/360 of System/370 configurations with the Interactive Terminal Facility (ITF) under DOS, OS (MFT or MVT), or MVT with Time Sharing Operation (TSO). System/370 configurations with ITF under OS/VS1 or OS/VS2 in Virtual-Real Mode; or under OS/VS2 with TSO in Virtual Mode; or OS/MFT, OS/MVT, OS/VS1, or OS/VS2 in Virtual-Real Mode under VM/370; or DOS/VS in Virtual-Real Mode; or DOS or DOS/VS in Virtual-Real Mode under VM/370. This program also operates on a System/3 Model 6.
Programming language:	BASIC
Mode of operation:	Terminal-oriented, time sharing using IBM 2741

- Documentation

Program identification numbers:	5734-XMB (OS and DOS) and 5703-XM3 (System/3 Model 6)
General Information Manual:	GH20-1175
Program Reference Manual:	SH20-1264

BUDPLAN *Budgets and Plans Generator*

- Availability: Program Product

- Description
  BUDPLAN is an application program that processes logic statements, print specifications, and data cards supplied by the user producing plans such as budgets, operating plans, and strategic plans. These plans are two-dimensional reports where, for example, lines represent balance sheet items and columns represent time periods.

  BUDPLAN consists of three phases. Phase 1 analyzes the logic statements and generates PL/I statements used as input to Phase 3. Phase 2 analyzes the print specifications and generates print commands that are also used as an input to Phase 3. Phase 3 is the budgets and plans generator, processing the planning data and producing reports as required.

Planning concepts:
Subset concept. A particular part of a business plan, such as a department, product line, or market, is called a subset. A subset may also be related to a group of departments. For example, if the company sells products A, B, C and D, and if subsets 01, 02, 03, and 04 are the respective marketing plans of these products, subset 05 can be the consolidated marketing plan for all these products. To produce the marketing plan for product A, the user specifies the data to be processed, the calculation to be executed, and the report to be printed. The planner can use the same planning logic and, therefore, the same program, for several subsets. He can also produce the output reports with the same print specifications for several subsets.
View concept. An iteration or view is the processing of one or several subsets. It is the development of a plan by the user's model of one hypothesis concerning company development, sales forecasting, and so forth. One or several views can be processed within one computer run. BUDPLAN provides the capability to summarize or consolidate data. Therefore, the user can transfer data from one subset to other subsets during the same view. Through several views and by modifying some of his input data, the user can text several cases or hypotheses about company plans. Data can be transferred between two subsets that do not belong to the same view, thus permitting the differences on the most significant figures to be printed when several plans are compared.

Subroutines that perform specialized calculations include the following:

Simple and compound growth rates.

Marginal analysis calculations between the increments of two data lines.

Extrapolation using continuation, simple, or yearly growth rates.

Extrapolation of a previous result given the growth amounts and/or the growth rate for the forecast periods.

Interpolation using linear, sum-of-the-years'-digits, or compound growth rates methods.

Average production cost as a function of the volume of production.

Net present-value calculation of revenues or expenses.

Internal rate-of-return calculation of an investment.

Ratios and percentages.

Spreading a value into partial amounts by a specific distribution pattern.

Interest and the repayment of a loan for each period.

Normally distributed random number generation for given mean and standard deviation.

- Programming systems
  Operating systems: System/360 and System/370 configurations of OS/MFT and OS/MVT; System/370 configurations of OS/VS1 and OS/VS2; or any of the previous operating systems executing under VM/370.
  Programming language: PL/I
  Mode of operation: batch

- Documentation
  Program identification number: 5734-F51
  General Information Manual: GH19-1038
  Program Reference Manual: SH19-1040

Forecasting And Modeling System[4] **FAMS**

- Availability: Program Product

- Description
  FAMS is a collection of statistical and data handling routines used for fore-

casting. FAMS can be used for time-series or cross-section models and also for single- or simultaneous-equation models. The forecasting techniques include the following:

- Plotting data series.
- Transformations such as square root, multiply, add, reciprocal, and logorithm.
- Simple correlation.
- Exponential smoothing.
- Polynomial regression.
- Seasonal decomposition.
- Ordinary least squares.
- Stepwise least squares.
- Two-stage least squares.
- Statistical measurements such as t-value, F-value, and Durbin-Watson d statistic.
- Growth rate and growth amount.

- Programming systems

Operating systems:	System/360 configurations under DOS, OS/MFT and OS/MVT. System/370 configurations under DOS, DOS/VS, OS/MFT, OS/MVT, OS/VS1, and OS/VS2; or under the control of any of the six latter operating systems executing under VM/370.
Programming language:	FORTRAN IV
Model of operation:	batch

- Documentation

Program identification numbers:	5736-XS4(DOS) and 5734-XS7(OS)
General Information Manual:	GH19-4000
Program Reference Manual:	SH19-4001

MINI-PLAN *Business Planning for System/3, Model 10*[6]

- Availability: Field Developed Program
- Description
MINI-PLAN is designed to provide for the financial planner and analyst a framework within which financial planning models may be developed. The user is provided with methods for planning-data file creation and maintenance; for using standard planning functions to perform certain commonly used calculations and for printing multiple standard reports including input worksheets, single column, and double column reports to display original input data and results of any computations. MINI-PLAN provides subset facilities similar to those in PSG II and BUDPLAN. The techniques available include:

  Extrapolation using compound growth rate or continuation methods.

  Interpolation using the linear method.

  Percentage calculations.

- Programming systems

Operating systems:	MINI-PLAN operates under the System Control Program (SCP) for disk System/3 (5702-SCI) Version 5. Program products required are FORTRAN III (5702-FOI).
Programming language:	FORTRAN III

- Documentation

Program identification number:	5798-AKB
Program Description/Operations Manual:	SB21-0590

Planning Systems Generator II[7] **PSG II**

- Availability: Program Product
- Description
PSG II contains the same subset and view concepts previously described in the BUDPLAN abstract. It provides the means to produce and evaluate a variety of financial plans. The user builds financial models within the framework of PSG II. Methods are provided for organizing planning data, for establishing computational logic to be applied to the data, and for generating data displays and reports. The user writes the logic in FORTRAN and, to aid in the development of models, he can use the PSG II library of planning functions to perform certain commonly used calculations. Using the PSG II print specfications, the planner can have input worksheets, single and double column reports, and three types of charts produced to display selected data. Transfer of planning data from one model to another and consolidation of the results of detail models into more comprehensive models are additional facilities provided. Financial planning techniques include:

  Simple and compound growth rates.

  Marginal analysis calculation between the increments of two data lines.

  Extrapolation using continuation, simple, or yearly growth rate methods.

  Extrapolation of a previous result given the growth amounts and/or the growth rate for the forecasted periods.

  Interpolation using linear, sum-of-the-years'-digits, or compound growth rate methods.

  Depreciation of assets (straight-line, sum-of-the-years'-digits, and double-declining-balance methods).

  Average production cost as a function of the volume of production.

  Discounted cash-flow calculation using the internal rate-of-return method.

  Ratios and percentages.

  Spreading a value into partial amounts by a specific distribution pattern.

  Year-to-date accumulation.

  Retirement of assets

  Tax carry-forward and carry-back calculation.

- Programming systems

Operating systems:	System/360 configurations under DOS, OS/MFT, and OS/MVT; System/370 configurations under DOS, DOS/VS, OS/MFT, OS/MVT, OS/VS1, and OS/VS2; or under the control of any of the six preceding operating systems executing under VM/370.
Programming language:	FORTRAN and Assembler Language
Mode of operation:	batch

- Documentation

	DOS	OS
Program identification numbers:	5736-XT1	5734-XT1
General Information Manual:	GH20-1035	GH20-1035
Program Reference Manual:	SH20-1174	SH20-1042

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