You wouldn't want to lose a voice in Congress, would you?

You can very easily, by not filling in your Census Form. That's because legislators, both national and state, are based on population. And if you, and enough of your neighbors, feel the Census is a nuisance instead of a necessity, you may not be counted. And if that happens, it may be just enough to lose you a representative.

And that's only one reason you should fill in your Census Form. Because the information you give-about yourself, your house, and your family—is used by the government to determine the needs of your city, county, or neighborhood. It can mean better schools, better recreational facilities, and better housing—as well as a greater voice in Congress. So don't hesitate to fill in your Census Form. It's not only absolutely private (not even the FBI is allowed to see it)—but it's also one good way to help make your community a better place to live.

CENSUS DAY IS APRIL 1

We can't know where we're going if we don't know where we are.
Gentlemen:

I am employed by a large, decentralized corporation with a diversified product line. Manufacturing divisions are located throughout the United States. We also have developed a rather extensive international operation. One of the responsibilities of the Management Services function is to assist management by ensuring that Divisional data processing resources are directed toward the attainment of Divisional and Corporate objectives. The execution of this task does not include evaluation or procedural audits of input/output functions, efficiency of computer programs, etc. We are interested in determining that systems activities are aimed at helping management cope with significant problem areas, that project priorities are assigned in an appropriate manner, and that systems projects can be related to a long range plan that identifies measurable, traceable, cross-checked objectives.

We are attempting to do this by surveying each of the major data processing functions within the Corporation. The surveys are being conducted by teams of 4 to 5 people who make a preliminary analysis of the function, spend 1 to 3 weeks at the facility being surveyed. They then devote 4 to 6 weeks preparing a report for Divisional and Corporate management personnel.

In attempting to develop a practical approach to this task, the following questions are among the many that have developed:

1. Do you know of other major manufacturers that have attempted to perform similar evaluations? Would they be willing to share their experiences?
2. Is there a proven technique for accomplishing this task?
3. What are the key action items that must be performed in a survey of this type?
4. What are the recommended procedures for completing these activities?
5. How do other companies objectively measure their data processing function's contribution to sales, profit, operating efficiency, etc.?
6. What suggestions can you make regarding the structure of the report prepared for management at the end of such a survey?

Any response you can make to the above questions or any other suggestions that you think appropriate will be appreciated.

Two of our advisors responded to this correspondent's query. The first reply follows:

In attempting to answer this request I first had to make the following assumptions:

1. That the decentralized divisional data processing installations have been installed

(To page 4)

PANEL OF ADVISORS:

Under the auspices of Management Services, a panel of management services advisors from leading accounting firms have agreed to answer to the best of their ability questions about any area of management services with which readers would like help. Both questioners and advisors will remain anonymous. One or more of the following members of our panel are responsible for the answers published in this department:

William E. Arnstein, Main Lafrentz & Co., New York

March-April, 1970

Published by eGrove, 1970
LaVerne G. Milunovich • Management Information System ......................... p. 23
A planning and control system for the enterprise as a whole, based on the principles of responsibility accounting, which measures the performance of management at all levels of an organization—that is how this author defines a management information system. In this article he describes the MIS that is being developed for the First Wisconsin National Bank of Milwaukee.

Thomas S. Dudick • Diagnosing Company Weaknesses and Taking Corrective Action ... p. 28
Many executives dislike management meetings as time wasters and arenas for company politicking. But in the medium-size organization that has outgrown reliance on day-by-day face-to-face communication but cannot justify a computer system, meetings have a useful role to play. Here a hypothetical script for a cross-functional meeting illustrates some of the advantages.

Harris J. Nadley • An Accountant’s Role in Product Obsolescence .................... p. 37
In a period of general prosperity the fact that a product’s sales are rising may not be as reassuring as it seems. Because products become obsolete so rapidly, management should be watching not only the volume of sales and the direction of any change but also the rate of change. This article tells how to track a product’s life cycle to spot the first signs of obsolescence.

Edward L. Summers and Glenn A. Welsch • How Learning Curve Models Can Be Applied to Profit Planning ................................. p. 45
It is obvious that the oftener someone has performed a given task and the more familiar he is with it the faster and better he can do it—at least up to the point of diminishing returns. This common sense observa-

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management services  

a magazine of planning, systems, and controls

Fred M. Kirby • Variance Analysis—The 'Step-Through' Method ........................ p. 51

Variance analysis—to determine why actual profits were lower than those anticipated—is a major pre-requisite of profit improvement. The first step is to break the variance down into segments for analysis.

When this is done by means of the "step-through" method that is described in this article, the sum of the sub-variances will always be equal to the total variance.

David O. Jenkins • Cost-Volume-Profit Analysis ........................................................ p. 55

Cost-volume-profit analysis is a basic tool in making decisions on pricing, product mix, purchasing, and many other vital areas of management. Although these areas may seem diverse, this author has con-

cluded that all of them are determined by only five basic variables, and he has combined those variables into a generalized formula as an aid in systematic data collection.

DEPARTMENTS

Management Services Forum ............................................................ p. 1

People, events, techniques ............................................................... p. 9

What people are writing about ......................................................... p. 58

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March-April, 1970
and operating for a period of time.
2. That divisional and corporate objectives have been defined for EDP operations.
3. That significant problem areas have been isolated.
4. That the machinery has been set up to evaluate and assign project priorities.
5. That long range plans have been formulated and that feedback is generated to measure these plans against actual results.

If the above assumptions are correct they are then talking about making a “Post-implementation Review” and in that context I would answer the questions as follows:
1. No major manufacturers come immediately to mind although a great number must have conducted “Post-implementation Reviews.”
2. Instead of proven technique I would rather say what method is used to conduct the review.

Again the assumption is made that feasibility studies have been done that estimated the following:
A. areas to be processed
B. schedule of installation dates
C. the costs of the installation
D. estimated savings
E. other benefits
A review is then made to determine how the actual results compare with the estimates. The procedure is the same for applications added after installation of the computer but instead of a feasibility study you compare actual results against an application justification, which includes the costing of each new application.
3. a. Ensure that DP resources are directed toward attainment of divisional & corporate objectives.
b. That systems activities are aimed at helping management cope with significant problem areas.
c. That project priorities are assigned in an appropriate manner.
d. That systems projects are related to a long range plan that measures objectives.
4. See outline of talk (below).
5. As to operating efficiency, see the outline. As to sales and profits, don’t know.
6. Structure of report would depend on findings. Generally conclusions are stated first in order of their importance. This is followed by a description of work done and this is followed by some detail indicating the basis for the conclusions.

Conclusions should include not only the rating of performance to date but also recommendations for future action.

Post-implementation Computer Study

Outline
Many published surveys have noted the preponderance of unsuccessful computer installations made to date. Using the commonly accepted criterion for an unsuccessful installation, which is “an installation that has not fulfilled pre-installation objectives” whether these objectives were cost savings, improved operations, intangible benefits or any combination thereof, we are inclined to agree with the results of these surveys. In spite of this it has been our experience, among our many clients that utilize computers in their data processing operations, that a large portion of these are, to varying degrees, successful. However we have found that almost without exception significant improvements can be made in existing installations that will save money, speed up reporting and improve operations.

The installation of a computer, for those of you who have not had the experience, can be a time of trial and tribulation. You are very often working against unrealistic deadlines, over-optimism and unreality. The original work done on systems and programming was probably done under enormous pressure and by people who were at that time unsophisticated in the areas in which they were working. When it is found that 50 to 75% of the present computer load is work that was done in the atmosphere of a pre-installation period the advantages to going back and reviewing the results of that work can readily be seen.

Introduction
A. Basis for making study.
1. Computer has been installed and in operation long enough to evaluate results.
2. Preferably a feasibility study had been done prior to installation and the results of that study presented to management as justification for installing the computer.
3. The feasibility study outlined.
   (A) Areas to be processed.
   (B) Schedule of installation dates.
   (C) The cost of the installation.
   1. Cost of computer.
   2. Cost of systems design and programming.
   3. One-time costs.
   4. Recurring cost for
C. Published by eGrove, 1970

Study

Mar-April, 1970

B. Review results of computer operation to determine how closely pre-installation estimates compare with actual results.

C. Definition of “Post-implementation Computer Study.”

Criteria for Conducting Study

A. Background of computer installations.
   1. Very few have obtained objectives.
   2. Examples of clients-The reason that consultants are called in.
      (A) Costs are increasing.
      (B) Time schedules not being met.
      (C) Additional equipment needed.

B. Criteria used by consultants prior to recommending study.
   1. Management’s role in planning and control of computer operations?
   2. Was proper feasibility study conducted and reviewed against actual results?
   3. Applications costed out?
   4. Is computer department operated properly?
      (A) Documentation.
      (B) Scheduling.
      (C) Controls.
      (D) Machine logs—work logs.
      (E) Housekeeping.

C. On basis of preliminary study make recommendation to general management for full study.

Study

A. If study has been preplanned—Figures should be available.

B. If not preplanned—accumulate pertinent information.

1. Cost of replaced operations.
2. Volumes.
3. Cost of computer operations—include amortization for one-time costs.

C. Review results of B against feasibility study or other estimates used to justify installation.

D. Evaluate study.
   1. Cost comparison.
   2. Offsetting advantages of computer operation.
      (A) Faster reporting.
      (B) Reduction of inventories.
      (C) Improved customer service.

Recommendations to Management

A. If study was favorable toward computer limit recommendations to improvement of computer operations.

B. If unfavorable—costs are greater, intangible benefits did not accrue, implementation estimates missed.
   1. Return to former systems—pro, con.
   2. Improve present systems.
      (A) Top management participation.
      (B) Costing of applications.
      (C) Operation of computer department.

C. Top Management Participation.
   1. Must be active rather than passive.
   2. Examples of clients—what we found, what we recommended.

3. Reasons necessary.
   (A) Investments.
      (1) Start up costs $250,000 - $500,000.
      (2) Operation (medium) $300,000 - $500,000.
   (B) Computer company-wide operation.
   (C) Realize potential—not only routine jobs.

D. Costing Applications, Reasons for—Examples of clients calling us in because
   1. Computer bogged down.
   2. Cannot produce results in specified time.
   3. Need more equipment.
   4. Need faster equipment.

Our findings:
Fill in jobs that do not belong on computer—why they were put on.
Would not have happened if jobs were costed and needed management approval.

E. Computer operations—most fertile area for improvement.
   1. Documentation—stress importance to company.
   2. Scheduling—discuss importance.
   3. Controls—discuss importance.

4. Optimization of programs.
   (A) What is it?
   (B) Why is it necessary?
      (1) To save operating time.
      (2) To condense reports.
   (C) What types of programs should be reviewed?
      (1) Long running programs that consume hours of computer time.
      (2) Frequently used programs.
      (3) Conversion to higher type of equipment.

(D) Results
   (1) Reduction of shift time.
      a. Saves rental.
      b. Saves personnel cost.
   (2) May eliminate necessity of converting to more expensive equipment or adding to configuration.
   (3) Gets work on a current basis.
   (4) Produces action reports faster.

The second firm’s reply also gave an outline of “key action items” to be performed:

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1. No knowledge of other manufacturers having done this type of internal review.
2. The techniques for accomplishing an internal review of data processing operating efficiencies and practices are established. The general technique is referred to as an Internal Facilities Management Review. These reviews are very often done by outside organizations.

3 & 4. A data processing facilities review should be done with a fully defined work program, set up to cover all elements relating to the objectives of the study. These objectives should be established by the project leader and should contain the intermediate goals for improvement as well as the ultimate aim of the study. Such intermediate goals would include getting rid of inefficiencies in the operations and tightening and improving the existing systems. Recommendations should be implemented as soon as possible.

The study should be staffed to allow each staff member to concentrate his energy on specific related areas of the data processing department rather than doing one or two specific tasks (e.g., timing, interviewing or report analysis) throughout all the areas of investigation. Staff members should report their findings to the project leader as soon as possible. The project leader should, on the basis of these findings, decide when and where deeper investigation is required.

Frequent meetings between the staff and project leader are helpful for amplification of information and for reducing instances of more than one person trying to collect the same information.

The project leader should be responsible for knowing where to get information and should oversee the data gathering described in the work activities mentioned in the following section.

The key action items to be performed are as follows:

Data Gathering by Divisional Personnel (Prior to On-Site Survey)
A. Obtain system and cost information for all hardware used and on order.
B. Obtain organization charts for each EDP department and cross reference to functional duties and policies.
C. Obtain copies of present utilization reports from each EDP department.
D. Obtain systems designs, both present and future.

EDP Operations
A. Review activities of the Data Processing Operations Department
   - Review, observe, time and document computer room operations
   - Review processing sequence of applications and their I/O requirements
   - Review adequacy of tape library procedures
   - Review operator instructions for adequacy and being up-to-date
   - Document all reruns
   - Review program control and maintenance
   - Review program assembly and testing procedures
   - Review utilization logging procedures.
B. Analyze computer utilization logs for an appropriate previous period
   - Check for accuracy, noting significant variances and periods of unlogged time
   - Review usefulness with users
C. Categorize utilization by major applications
   - Determine cost of each application
   - Break down applications by:
     Processing Time
     Set Up Time
     Sort/Merge Time
     Validation Time
     Print Time
   and determine the relationship between these categories.
D. Review data processing schedules and techniques, both overall and by application
   - Determine operating efficiency
   - Determine input availability
   and output deadlines

Staff members should report their findings to the project leader as soon as possible. The project leader should, on the basis of these findings, decide when and where deeper investigation is required.
EDP Related Operations

A. Review input preparation section
   - Determine volumes and productivity by application
   - Analyze input preparation scheduling.
B. Review control section for adequacy and duplication of work.
C. Review output distribution section for control.

System Design

A. Review the quality of the systems design technique to determine
   - Process efficiency and machine utilization
   - Processing schedules, controls and error deduction
   - Difficulty in program maintenance.
B. Review quality of reports with users
   - Document problems, comments and checking procedures
   - Determine inadequate or excess reports.
C. Review plans for projects under development or proposed development for a significant period
   - Determine or review timing estimates for these projects
   - Determine effects on all schedules and existing equipment
   - Determine if faults found in Parts A & B exist in these new designs
   - Determine rate of progress in systems effort.
D. Evaluate the competence of the staff
   - Determine ability to design a quality system
   - Evaluate working knowledge of new developments in data processing hardware and software
   - Evaluate ability to program efficiently.

Completion of Observation Activities

A. Analyze findings from above sections.
B. Prepare, with all of staff involved in study, a discussion outline and discuss conclusions with supervisory personnel.

5. A method for measuring the data processing function’s contributions to sales or profit is to attempt to cost justify each project as it is proposed and to charge back the costs to the using department. In addition to the initial cost justification, a post installation review should be performed to insure that projections were accurate. Periodic reviews, such as the one described here, should indicate departures from the original economics of various segments of the company’s data processing systems.

6. The report to management should be structured as follows:

   A. Summary
      a. Review scope and purpose of study
      b. Indicate briefly how the study was conducted
      c. General comments on overall company EDP operation and personnel
      d. Specific recommendations by division
         (1) Short-range operating efficiencies
         (2) Long-range planning and design considerations
         (3) Organizational considerations
         (4) Comments on adherence to standards and procedures
         (5) Use of output
         (6) Comments on personnel
      e. Indication of corporate and divisional personnel who participated in study and views on results.

B. Detail for each division
   a. Amplify findings and recommendations as briefly stated in Summary
   b. Include supporting volumes, timings, costs, etc.
   c. Diagrams or tables of figures should be included in appendix and referenced from body of report.

A method for measuring the data processing function’s contribution to sales or profit is to attempt to cost justify each project as it is proposed, and to charge back the costs to the using department.
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Human Factors in Mergers, Manpower Shortage, and Systems Innovations Covered at NICB Meeting in New York

The human aspects of three major business problems—those arising from mergers, from manpower shortages, and from systems innovations—were the main focuses of a three-day seminar on managing changes held by the National Industrial Conference Board in New York in late January.

Three sessions dealing with each major field were held concurrently on each day of the meeting, so those attending could visit at least one presentation in each of the fields.

Thomas Amatucci, president of Amatucci Rambler, Inc., speaking at a session on "Increasing the Supply (Manpower) to Meet the Demand," warmly endorsed the manpower training programs sponsored by the U.S. Department of Labor. He said such programs could produce workers who were a real asset to their companies and "citizens ready and able to assume a respected role in society."

**Manpower training program**

Companies planning to participate in a manpower training program under contract with the Labor Department should be extremely careful about the proposals they make, he advised, although such proposals do not have to be either elaborate or costly.

"I would suggest that you allow ample time to plan your individual program in detail before starting on your proposal," he told the audience, "so as not to omit some phase or component which could prove vital to its ultimate success."

Expenses of the program should be computed just as carefully, he pointed out, although recruiting, selection, remedial education, motivation training, and counseling phases of the program can be safely left to organizations such as the Opportunities Industrialization Center or the Concentrated Employment Program.

In his own company, he said it had been found that four hours of classroom training per day and four hours of on-the-job training alongside regular Rambler mechanics had worked out well. Each trainee is furnished with his own set of basic auto mechanic tools and
Sometimes systems within a company tend to confuse the decision making process

made responsible for them as well as furnished with company uniforms identical to those issued to regular employees to make the men identify with the company.

Retention rate was extremely good, Mr. Amatuucci said; only three of those originally recruited by the Opportunities Industrialization Center were lost. Difficulties that arose during the training period were resolved through face-to-face discussion with the trainees.

Communications vital

"In looking back over these past weeks with the men, I would say that the key to our high rate of retention was communication," Mr. Amatuucci declared. "It became increasingly clear to me each day that personal communication with the employer was especially important to these men."

Although manpower planning itself is not a new concept, the idea that manpower is an economic resource that must be managed as carefully as any other asset is, K. R. Kidoo, corporate manpower administrator, Lockheed Aircraft Corporation, said. Increased emphasis on planning in every phase of a business and increased dependence on computer techniques have also advanced the concept of manpower planning. Still, manpower planning is largely oriented to occupations where shortages of workers exist and preparation time for each worker is comparatively long.

The primary emphasis has been on projecting requirements, with lesser emphasis on developing complementary programs, trade-offs, and controls," he said.

Lockheed's corporate offices furnish to each of its nine divisions objectives, environmental premises, format, and schedule, he said. Each division then provides a definition of its function, current posture and operating environment, the critical developments it expects during the next three years, its long-range (ten years) and short-range (three years) objectives, the alternative actions it might take, strategy, assessment of its plan, and data. Data include statistics on present and projected work force, including payroll, function, occupation, skill, location, line of business, and program.

Each division's plans are reviewed by the appropriate corporate functional offices and a Corporate Long-Range Planning Council. A consolidated corporation plan is then prepared which serves as the basis for an annual long-range planning meeting.

Areas that need further exploration lie in the area of finding how the labor market actually operates, how it serves to correct imbalances, and how trade-offs between areas with an overage of one skill and areas where that skill is in short supply might be developed.

Many systems within a company tend to confuse rather than clarify the decision making process, Grant A. Dove, vice president, corporate development, Texas Instruments Inc., told the conference group. For this reason, his company has found it wise to express specific goals at various organization levels, so that all elements work together for the common goal. The resulting "goal structure" is the nucleus of an organizational model.

"This structure has been formalized at Texas Instruments in a hierarchy of goals called OST, an acronym for Objectives, Strategies, and Tactics," Mr. Dove said.

Within the hierarchy, objectives define the broadly stated economic, market, and technological goals to be achieved by each business or corporation-wide activity within a specified time period. Strategies define the general courses of action to be pursued in attaining these goals, in addition to identifying required innovations and appropriate milestones for measurement of progress. Tactics finally are the specific programs to be carried out in support of a strategy; distinct steps are established together with detailed schedules and assignment of individual responsibilities.

OST was conceived, Mr. Dove said, as an attempt to institutionalize change, to create the conditions leading to repeated innovative actions by individuals, throughout the organization.

"One way this is accomplished is through the confrontation of really challenging goals," Mr. Dove went on. "To be effective in generating innovative thinking, the goals must be ambitious beyond the limits of normal extrapolation. Another way is through the deliberate separation of long- and short-term goals so that both can be properly emphasized. Tendencies of money and effort to gravitate toward today's problems are countered and allocation of resources to long-range strategic activities becomes a reality, subject to deliberate decision making and performance measurement."

"One of the greatest practical values of OST at Texas Instruments has been in the coordination of intracompany efforts through use of objectives and strategies cutting across the operating organizations," the speaker continued. "Since the strategies are not restricted to operating organization boundaries, we have a way of utilizing resources throughout the company in true synergistic fashion, without restructuring the operating organization established for today's business. As this mode of organization permeates the organization, we are developing on the part of individual managers a recognition that their span of responsibility nearly
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Survey of Accountants Shows Majority Feel Tradition, Inertia Block Calendar Reform

Do accountants feel the calendar should be revised to conform to reporting periods? Professor Doris Marie Cook of the College of Business Administration, University of Arkansas, sent out a questionnaire to find out how many of her accounting colleagues think it is time for a change.

To her four-part questionnaire Professor Cook obtained responses from 51 CPAs and 59 accountants employed in private industry.

Her first question read, “What is the major problem you encounter in your work which is specifically the result of our present calendar?”

Unequal work days problem

Both groups of respondents cited most often the lack of comparability of operating results between months or quarters because of the unequal number of working days. Fourteen of the industrial accountants mentioned problems in scheduling various steps in the accounting process and in setting completion dates for various reports because of the uneven number of working days per month.

Professor Cook’s second question was, “What is the most satisfactory method which you have found in actual practice for alleviating calendar problems?”

Methods of compensating

Thirteen of the CPAs use the 13-period year while ten of them responded they have found no satisfactory method. Nine industrial accountants reported they use a 4-4-5 week series of periods for reporting financial information. Another eight of those in industry solve the problem by careful planning of work to be performed so that non-recurring work is scheduled in long months.

“What do you think would be the largest obstacle to obtaining adoption of a revised calendar?” Professor Cook asked.

Fifteen CPAs pointed to tradition, ten to inertia, and another ten to opposition to change. Nineteen industrial accountants also thought tradition would be the primary obstacle, but twelve cited resistance to change and seven inertia.

Finally Professor Cook asked, “Do you favor a revision of the calendar?”

Of the CPAs, 17 did not, and 34 did, though some said only on the condition that the new calendar, be easier to use than the present one. Thirty-four accountants in industry also favored revision, some with the same condition the CPAs made, and 25 were opposed to a change.

Universal Calendar advocated

Professor Cook advocates the adoption of the Universal Calendar proposed by Walter F. Rothé in 1965. It consists of 13 constant months. The extra month, Solarius, would fall between June and July. Every four years a holiday would fall following Solarius 14. The 365th day, following December 28, would also be a holiday. Rothé’s system would permit most other holidays to be arranged consistently on Monday or Friday. (See M/S, Sept.-Oct. ’66, pp. 35-42.)

“Adoption of the Universal Calendar would solve most of the problems which are encountered with the present calendar,” Professor Cook says. “Each month is exactly equal and each quarter has 13 equal weeks. The end of each month or quarter coincides exactly with the end of the week.

“No accountant or manager can fail to realize the advantages this arrangement provides for planning, scheduling, preparing financial reports, and analyzing the result of operations,” Professor Cook says.
Congressman Gallagher Asks Certification for Computer Programers

A computer programer certification procedure similar to the one used for CPAs has been suggested by U.S. Representative Cornelius Gallagher (Dem., N.J.) as a way "to make sure computerization is really beneficial to all of society."

Representative Gallagher, a leading opponent of the proposed National Data Bank, spoke at a recent seminar conducted by International Computer Programs, Inc., publisher of the ICP Quarterly.

"Computerization can dehumanize experience by funneling all the events of a life into one context or by underemphasizing the subtle differences between men," he said.

"As long as one is not under suspicion for a specific crime, he must have the absolute right to control access to records of the events of his life," Representative Gallagher said.

Technical requirements and professional standards could be established for programers through certification, Representative Gallagher said. He also advocates the formation of a Federal regulatory agency to oversee all aspects of data processing.

International Pay Seminar Calls for Recognition of 'Management' Profession

The establishment of management as an internationally recognized profession was called for at the first International Seminar on Executive Remuneration, recently held in Italy at the Turin International Center for Advanced Technical and Vocational Training.

Moderator Ernst K. L. Rogowski, professor in charge of general management programs at the Center, observed that the need for large numbers of managers necessitates looking for management talent throughout staff ranks as well as throughout the world.

Governor Roland Pré, of the European Center for Industrial Development and Improvement of Resources Overseas, said that the seniority system which still prevails in some southern European countries is no longer adequate for industrial growth. Pay scales based on seniority are also obsolete, and he recommended rational criteria be developed instead.

Yale University Professor Edward Lawler said executive pay could be a motivator for people to work harder if a portion of the pay package was tied to performance. Promotion programs also provide incentive, he said.
A new national service offering data processing to accountants is shown by Transcontinental Data Processing Service, Los Angeles. A special NCR adding machine in the accountant's office produces duplicate paper tapes that can be optically scanned. One tape remains in the accountant's office; one is sent to Transcontinental, where the figures are processed by computer.

Key to Personnel Managers' Future Success: Ability To Work With Both Underqualified and Overqualified

Personnel managers of the future will find their success dependent on their ability to adapt to underqualified and overqualified people, said Willard W. Peck, international president of the Administrative Management Society, recently.

Mr. Peck, vice president in charge of personnel for the Metropolitan Life Insurance Company, made his remarks at a meeting of the Atlanta chapter of the Administrative Management Society.

Underqualified people, according to Mr. Peck, will come into business from the ranks of the underprivileged. He predicts the manpower pinch in the larger cities will necessitate drawing these people into expanding companies.

"This group will pose a real challenge to all administrative managers," Mr. Peck said, "and I would suggest that the manager will need to be particularly on his guard against preconceptions as to how certain types of individuals will perform on the job.

"Specifically, there is a world of difference between 'underqualified,' which may be the result of environmental influences, and 'incompetence,' which results from inherent deficiencies."

The overqualified class of workers Mr. Peck foresees will be composed of the increasing number of college graduates. He believes they will bring some of their campus attitudes with them into the country's business organizations.

Business still goal

"In spite of all the ‘business is for the birds’ publicity, they still see the business world as the place where the action is—where there is an opportunity to actually have an impact on society," he said.

To keep these graduates in business organizations Mr. Peck says managers must remember this generation feels sure of their ability to adjust to change.

"They have grown accustomed to this breakneck rate of change. As a result, they feel they are more

Honeywell Anticipates Sharp Rise in Sales Of Small Computers

The small-computer and time-sharing computing markets are expected to give Honeywell's Computer Control Division a 50 per cent growth in sales in 1970 over 1969, the company says.

Honeywell entered the data-communications market in 1969 with the introduction of computing equipment selling for less than $10,000. Company figures show one out of five data-processing installations currently are part of the data-communications market. This market is doubling every two years.

By 1975, Honeywell predicts, computers used for remote communications purposes will account for about half of the $12 billion worth installed.

Honeywell studies show that by 1972 the small computer market will be worth nearly $500 million.

The company recently announced it has strengthened its mini-computer line, Series 16, by doubling the maximum memory capacity of all models and adding nine new peripheral devices with complementing software.

Available with second-quarter computer deliveries will be memory extensions to 32,000 16-bit-word-length capacities.

Honeywell's new peripherals include three moving-head disk drives with controllers, four low- to high-speed buffered printers, a magnetic tape drive and control, and a data acquisition and control subsystem.

Since Honeywell started its Se-
Pitney-Bowes, Computer Concern, Will Make Cash Register Input Devices

Pitney-Bowes, Inc., and Alpex Computer Corp. have joined to form a company for the manufacture and sale of computerized point-of-sale register systems.

Pitney-Bowes, Inc., and Alpex headquarters in Danbury, Conn. Alpex has contributed all of its assets, including rights, patents, designs, models, and know-how, to the new company. Pitney-Bowes has supplied $9,500,000 in cash. Each company will hold 50 percent of the interest in the new corporation.

Alpex has started to produce and store test its SPICE system (Sales Point Information Computing Equipment). It includes an electronic cash register terminal which enters merchandise and accounting information according to a programmed sequence.

The sequence is determined by a small computer-controller located in the store. The controller can have up to 32 terminals connected to it. It can perform calculations and accumulate totals.

Gathered transaction data can be stored in a magnetic tape cassette for subsequent mailing to a data processing center or it can be polled over telephone lines by a central computer.

The SPICE system also offers a configuration in which terminals are connected directly to a central computer affording on-line real time operation.

Alpex’s SPICE system can also read credit cards and merchandise tags, print sales checks, and through peripheral devices store and retrieve credit authorization and price information, its developers claim.

Pitney-Bowes operates 14 manufacturing plants and directs the sale, rental, and servicing of its equipment through 144 branch offices in the United States and 121 other countries.

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March-April, 1970
Published by eGrove, 1970
The lightweight computer terminals that were only promised a year or so ago have now become so completely portable that IBM has produced one that can be used to communicate with a computer from a pay telephone booth. The terminal will accept both written and numeric information; responses from the computer are machine-compiled spoken answers to the questions posed.

Commonwealth Computing, IBM Offer ‘Solutions’ To Paperwork Snarls in Brokerage Back Offices

A proposed solution to brokerage firm "back office" paperwork problems is being offered by Commonwealth Computing, Inc., of Lexington, Massachusetts.

Commonwealth’s LIBRA system, designed originally for a mutual fund transfer agent, depends on what the company refers to as a "revival of the purest form of accounting," the ledger card.

The ledger card in this instance is not really a ledger card. Rather it is an individual shareholder account record, stored in a computer memory and displayed on a cathode ray display screen whenever any question or transaction concerning the individual account arises.

The display screens in a transfer agent’s office are tied into a central time sharing computer so that several hundred analysts can be sharing the central record "file" simultaneously. Since any aspect of the individual’s investment record with the mutual fund can be displayed and any changes of any sort except actual funds invested can be keyed in by the terminal operator to update the central records, central records are automatically brought completely up to date with each transaction.

The number of shares held can be altered through the keyboard to reflect a sale or purchase of shares. Then the total sum invested is calculated by the computer housing the central records. Because each transaction is dated in the records and is stored sequentially, the system provides an adequate audit trail, Commonwealth states.

Individual conditions flagged

Particular conditions affecting any individual account, such as escrow (a condition that is imposed when a certain discount is given if the purchaser agrees to buy a certain number of shares within a given time), or when shares are pledged as collateral, are flashed on the display screen to alert the operator whenever a "sell" order comes through.

According to Richard L. Trexler, Commonwealth president, the new system, by giving operators all pertinent information on the account they are dealing with, eliminates "blind" posting to a central file and allows each operator to act as an analyst, examining the validity of an account before completing whatever transaction is called for.

Customer accounts are numbered in the computer file, but there is a cross reference feature so that if a customer writes in giving only his name and city, the display screen will show all customers with that surname in that city. Then by a process of elimination the individual customer is identified with his code number. The code number, when flashed to the computer, will call out his entire record with the fund.
Although developed for a mutual fund and marketed principally to banks, which are the major transfer agents for mutual funds, the system is equally applicable to brokerage house transactions, according to Mr. Trexler.

He said that although banks usually lose money on their transactions as transfer agents and perform this duty only to gain custodianship of mutual fund assets, use of the LIBRA system permits them to pare clerical staffs to the point where it is possible to make a slight profit on these activities.

But the main advantage is the great increase in speed in handling transactions, he asserted. He said that the system was originally developed to meet a single major goal, to make it possible for the agent to handle all transactions of any type involving individual accounts within four working hours. That goal was met and the LIBRA system has now progressed to the point where about 1,000 transactions (the average daily volume generated by 250,000 customer accounts) can be processed in four minutes of computer time and about half an hour of throughput time, the time required by the operators to key in their requests and get their responses.

The LIBRA system, which is sold solely as software, is custom adapted to meet the accounting needs of an individual client, Mr. Trexler said. The system employs Sanders display units and is geared to employ IBM model 360/50's or more powerful IBM machines as the computers. If a customer does not have an IBM unit, he may either tie into another firm's 360 or use a time sharing computer owned by Commonwealth.

IBM shows system

IBM has decided to join in the effort to help clear away Wall Street's paperwork logjam. Its resulting program, called the Active Certificate Information Program, replaces manual processing of stock certificates with an on line, visual recording and information system using IBM 2260 television-like display stations linked to a System/360.

Many of the bookkeeping chores associated with securities the firm owns or controls itself, "free" certificates, can be taken care of by the Active Certificate Information Program, IBM says.

With the new program clerks in the cashier's department of a brokerage house still retain physical custody of stock certificates, but they do not do any writing or looking up of records. The clerks key codes into video display terminals which query the computer about the availability of a security. Information about the receipt or delivery of a certificate can also be entered by them.

As each transaction is completed both the inventory of active certificates and the file of pending delivery instructions can be posted by the clerks.

The Active Certificate Information Program was designed by a securities industry development department established by IBM last year. It runs under a disk operating system and can be used with IBM System/360 or any of the company's larger units having at least 64,000 bytes of core storage.

IBM plans to have the program available next December at a monthly charge of $300, under a license agreement.

Data Transmission Could Overload Phone Wires, Manufacturer Warns

The telephone company may lose its monopoly powers if it continues to fail to meet the business community's service demands, said Richard W. Sonnenfeldt, president of Digitronics Corporation, recently.

Digitronics, located in Albertson, New York, is a manufacturer of data acquisition and transmission equipment. Mr. Sonnenfeldt's re-
Labor Shortage Seen
With Productivity Drop, Shortened Work Week

A “personnel crunch” will be felt in offices throughout the 70’s because of the white collar worker’s reduced productivity, increased paperwork, short work week, ease of getting another job, and the mounting cost of his absenteeism, reports Elmer L. Winter.

Mr. Winter, president of Manpower, Inc., an office temporaries employment agency, issued an employment forecast for the decade in mid-January.

Based on a confidential survey conducted last year, Mr. Winter reports that the average worker is only 55 per cent productive while his work load is geared for 80 per cent productivity. Thus for every two hours the worker is on his job he actually works only about one.

Recently there has been an increase in job disloyalty. This is the result of the ease with which an employee can find another similar position if he is displeased with his present boss. Mr. Winter says a slowdown in the nation’s economy may cut the number of job openings and change this attitude.

During the last five years the toll of absenteeism, particularly on Mondays and Fridays, has become significant, Mr. Winter says.

He predicts that in the future more employers will work harder to match work force and work load. They will keep permanent staff to a minimum and employ temporary personnel for peak work periods.
Mr. Winter also believes management will have to try to make work more interesting for its personnel. To keep employees, enrichment programs will have to accompany paychecks and fringe benefits, he says.

"As we move deeper into the 70’s, we will be moving in the direction of jobs being a means to an end, rather than jobs as an end," Mr. Winter writes.

"Work satisfaction and work enrichment, as well as work planning and performance standards, will be priority items for management during the decade. Smart management will recognize that in the 70’s, despite computers, people problems must be considered foremost in the planning for the future," Mr. Winter concludes.

Typewriter Terminal Tax Data Input Service Shown by Multicomp

A computerized system for the preparation of state and federal income tax returns has been developed by Multicomp, Inc., a subsidiary of W. R. Grace & Co.

A typewriter communications terminal attached to a subscriber’s office phone relates the tax data to the Multicomp tax system. If an incorrect entry is made the computer responds with an appropriate error message immediately.

After the data are completely entered the computer analyzes them and prints a diagnostic report. This report calls the preparer’s attention to apparent violations of statutory requirements, inconsistent data, and overlooked deductions. Once these errors are corrected the computer figures out the return and prints out the results.

The subscriber pays a monthly rental for the terminal, from $65 to $125 depending upon the manufacturer, kind, and size of the equipment selected, and from $1.50 to $25 per return depending upon its complexity.

The time it takes from entry of the data to the completion of the return varies from a few minutes for a simple return to 90 minutes for an extremely complex one, Multicomp claims.

Computax Adds Six New State Tax Returns To Its Roster

Computer-prepared state tax returns for Massachusetts, Virginia, Kentucky, Oregon, Indiana, and Illinois have been added for the first time for 1969 returns to the services of Computax Corporation, Chicago, Illinois.

Computax also prepares returns for Maryland, Wisconsin, Michigan, Colorado, Arizona, California, New York, and New York City. In addition Federal forms 1040 and 2950SE are completed with the Computax system.

Acronyms Unlimited: ESP Offers HAL (Highly Automated Logic)

HAL, the omniscient computer of Sir Arthur Clarke’s and Metro-Goldwyn-Mayer’s “2001: A Space Odyssey,” now has a namesake developed by Exact Systems and Programming Corporation, Thornwood, N. Y.

According to ESP, HAL (Highly Automated Logic) "is an executive control supervisor that assumes full control of a System/360 and supplies functions normally performed by a human operator." It seems Sir Arthur should have patented his idea.

"HAL’s function is to substantially reduce operator intervention and human error and increase efficiency in operation of multi-job step programing systems," ESP says. Clarke’s HAL was designed to operate free from human error too.

ESP’s HAL is available in four forms: JCL Deck Storage/Execution Package, which is used to execute control decks for a single multi-program system, such as payroll; Installation Standard Procedure Supervisor, for such functions as compile and execute, compile and catalog, etc.; a combination of the two packages; and Full Operating Supervisor, which controls the total operation and uses a simple command language.

But can it sing "A Bicycle Built for Two?"

Direct Communications To Process Control Machine Developed

Engineers, laboratory technicians, or supervisory personnel can use simple declarative sentences to communicate directly with COMPAS, the computer acquisition system developed by Systems Engineering Laboratories, Ft. Lauderdale, Florida.

COMPAS monitors such physical information as temperatures, pressures, production measurements, and gas flow rates.

COIL, (COMPAS On-Line Interactive Language), enables the nonprogramer to communicate with the system in sentences like, "Scan length 8 channels" or "Log period 2 hours." Once the operator is familiar with the language he can use the shorthand form of only giving the first two letters in each command word, such as "Sc Le 8 Ch" or "Lo Pe 2 Ho."

"With COIL, the new COMPAS system spans modular, real-time computer applications that include process control, high-speed data acquisition (data collection), laboratory analysis, and automated production-line testing," the Systems engineers say.

The COMPAS system, including COIL, is available at a purchase price of $55,000 or can be rented for $1,900 a month.
Picture Aptitude Test, Used to Identify Similar Groups, Is Basis of New Employee Testing Service

A substantial reduction in personnel turnover is guaranteed by Success Prediction Systems, Inc., to companies that use its employee evaluation service.

The service utilizes a computer to give objective evaluations of a candidate's potential ability to do a given job through evaluation of a picture arrangement test and sentence completion test. His scores are compared with those of successful possessors of equivalent jobs in the same company to which he is applying. SPS' predictions for success in specific corporate environments have been from 90 to 95 per cent accurate, the company claims.

For approximately $20,000 SPS will study a category of employees, one group of successful ones and one of unsatisfactory ones. Management decides who belongs in each group.

SPS then selects with a computer the most important biographical, attitudinal, and psychological factors that differentiate the two types of workers. It will then develop a weighted application blank and a manual for hiring.

Then SPS will report back to management what the computer has found the company's actual criteria for success are. In some cases, SPS spokesmen report, management has found that a change in its hiring policies or personnel is needed.

SPS stresses that its system is tailored to a specific company's job environment. Success in a post in one company does not guarantee success in another. Using its service, SPS says, a company can tell a prospective employee that he can be successful in their organization and mean it.

The service is most suitable for companies that have a minimum of at least 30 employees in the same job category. SPS claims it has accurately predicted the success not only of salesmen, sales managers, and public school administrators but also of more task-oriented workers, such as tabulating machine operators.

SPS will perform an annual review of its work by selecting a small group of successful and unsatisfactory employees and seeing how well their test scores match with SPS's criteria. A fee of $5,000 is charged for the review.

After the SPS testing system has been put into service, applicants' tests can be scored by the computer for between $60 and $100 each.

Within six months SPS claims to have reduced a firm's turnover rate by one-third, for a saving of $350,000.

Success Prediction Systems is based in Philadelphia. It is headed by Warren J. Wittreich, Ph.D., a Pennsylvania psychologist and former president of Daniel Yankelovich, Inc., a Pennsylvania marketing research and consulting firm.

Dr. John B. Miner, chairman of the behavioral science division of the University of Maryland's college of business and public administration, developed the method of scoring the Tomkins-Horn Picture Arrangement Test that enabled Dr. Wittreich to write a computer program for it.

Individual, Low-Cost EDP Education Series Developed by N.E. Firm

A new customized education service which could potentially bring down the cost of in-house computer training courses is being offered by Cybernetics International Corp., Newton, Mass.

The service, called Team-Up, allows CIC to resell the core curriculum it develops for a company's EDP needs. A percentage of the resale price would go back to the company.

George B. Whelton, Jr., vice president of the training and education division of CIC, said, "In cases where a curriculum was particularly applicable to a large number of users, an originating user could actually underwrite the entire cost of his internal training program."

A CIC education specialist would work with a client's EDP management to analyze and define its training needs. Then CIC would develop a core curriculum "custom tailored" for the client's particular requirements.

The complete course includes instructor guidelines, course outlines, training materials and literature, audio-visual aids, and testing materials.

TWO New Universal EDP Languages Reported By CODASYL

Data bases not tied to any specific processing languages could be the result of a report published by the CODASYL Data Base Task Group.

CODASYL, the Conference on Data Systems Languages, is a voluntary organization dedicated to the design and development of techniques and languages to assist in data systems analysis, design, and implementation. It is the organization responsible for the development of COBOL.

Specialists in data management from computer suppliers and major computer users, including Bell Laboratories, General Motors, and United States Steel Corporation, composed the Data Base Task Group. Their report was completed in October after several years of work. It contains proposals and detailed specifications for two new languages that would be used in coordination with existing languages.
The Data Description Language they have worked out contains appropriate declaratives for describing a data base.

The second language they propose, the Data Manipulation Language, is a language that would be used in association with a host language to manipulate the information described by the Data Description Language. Typical host languages would be COBOL, PL/1, ALGOL, JOVIAL, or FORTRAN.

Among the objectives of the Data Base Task Group in developing its proposals were to allow data to be structured in the way most suitable to each application regardless of the number of applications the data may be used for; protect the data base against unauthorized access; and provide for the use of a variety of access methods on the whole or parts of a data base.

The 200-page Data Base Task Group report is available at $4.00 per prepaid copy from the Association for Computing Machinery, 1133 Avenue of the Americas, New York, New York 10036.

NCR Education, Software Costs to Be 'Unbundled' From Machine Prices

All NCR educational services are now to be priced separately from its Century Series computers, the company has announced.

NCR computer users will now receive a basic educational allowance as part of the rental or purchase price of their systems. Customers pay extra for educational services above the allowance.

Users of the NCR Century basic system will have an educational allowance of $2,250, and users of the Century 200 basic system are allotted $3,150 for courses.

For each $1,000 above the basic system’s monthly rental and for each $50,000 over the basic system’s purchase price NCR increases the educational allowance by $450.

NCR Marketing Vice President Charles L. Keenoy said, "This new policy offers a decided advantage to the customer in that he can determine in advance precisely how much educational assistance he will receive without extra cost."

NCR has announced that in the future it plans to price selected software separately.

Western Union Will Permit Private Equipment Tie-Ins if It Gets TWX

Western Union, in what was seen as a bid to win a favorable FCC decision on the company’s bid to acquire the Bell System’s Teletypewriter Exchange Service, has announced that it will permit connection of customer-provided terminal equipment to TWX networks if and when Western Union acquires TWX.

The announcement was made in a statement to the FCC by Thomas F. McMains, vice president and special assistant to the chairman of Western Union.

Equipment must be approved

The company’s position would apply both to private TWX communications networks and the public Teletypewriter Exchange Service of TWX, Mr. McMains said, as long as the type of terminal equipment used by the customer is approved by Western Union. Line connections for both public and private service would have to be made through a TWX network control and protective device provided by the telephone company.

If the FCC approves Western Union’s purchase of TWX, the company would have a total of more than 75,000 communications terminals in its own Telex system and its acquired TWX system by 1971.

Estate Analysis by Computer Offered By Boston Firm

A computerized estate analysis service is being offered by Capital Formation Corporation, Boston. Estimated cost for an average client’s estate survey over ten to fifteen years is $300.

The service uses a balance sheet approach, separating assets by ownership classification. It breaks down assets into liquid and non-liquid, computes estate settlement costs with and without marital deduction, and summarizes the income-producing capability of the remaining assets.

CFC’s computers also prepare an asset-flow chart which breaks down the transference of properties with various ownership characteristics and points out the savings of a marital deduction trust.

The service provides two estate reports. The client’s report is the same as the estate planner’s but does not include the notations the planner has for making beneficial changes.

Among the analyses included in the estate survey are: life insurance progress report, section showing estate liquidity needs and resulting trust income, and analysis of disability income plans.

The Sixth Annual AICPA Conference on Computers and Information Systems will be held at the Jack Tar Hotel in San Francisco from May 18 to 20, 1970. Formerly called the AICPA Conference of Computer Users, the meeting’s scope has been broadened to include CPAs contemplating all aspects of EDP involvement as well as those already utilizing computers. The conference will include panel discussions and talks on EDP-related topics, plus informal evening presentations by software suppliers.
TRAINING THE UNSKILLED MINORITIES ISN’T JUST FOR GIANTS

Kendall Manufacturing Co. learned that it is easier for a small company to teach the unskilled than a large manufacturer. In a small plant, says President Lowell Kendall, the unskilled trainee has the opportunity to work alongside an experienced worker. In a large plant, classroom instruction is mandatory.

The Crouse-Hinds Co. offers “off-the-job” training to employees so that they can qualify for better positions as openings occur.

Oxford Chemicals feels a smaller firm like itself is in a better position to attract and train hard-core unemployables because they feel it is hard to compete within a large corporation. Oxford finances its own training program, sending employees to school at night. Each trainee is assigned to a trainer of the same ethnic group.

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MANAGEMENT INFORMATION SYSTEM

by LaVerne G. Milunovich

First Wisconsin National Bank of Milwaukee

MANAGEMENT information systems have been alternately criticized and praised in recent years, with much of the praise coming from academicians and much of the condemnation from business people who had experimented with them and found them far short of their expectations.

We think this is largely true because of confusion on the part of both groups as to what a management information system actually is, what is involved in developing it, and what its true benefits are.

In the first place, let's define our terms. There is a broad hierarchy of information systems that can exist in any organization. They range from detailed, highly structured production systems to broad, poorly defined environmental study systems.

It is not easy to classify such a spectrum of information systems. One approach to such classification, beginning with the highest level and working down to the lowest, is as follows:

1. Long-range, future, external, environmental analysis "systems." This could involve a study of fundamental forces—technological, sociological, demographic, political, economic, and philosophical—out, for example, to the year 2000.

2. Long-range, strategic, directional study "systems." Based on analyses of the fundamental direction of environmental forces, a pattern of strategic maneuvers can be developed so that the enterprise can capitalize on the trend of those forces. This system—if, in fact, it can truly be termed a system—is very broad and ill-structured in nature, as is the first system.

3. Intermediate-range cyclical planning systems. This is a rhythmic process, such as the five-year plan so frequently employed, whereby areas of an enterprise plan their growth into the future in a fairly coarse manner.

4. Short-term, external, environmental forecasting and monitoring systems. This involves a study of economic factors and trends in considerable detail and projections about one year into the future. The one-year economic forecast that

Here's the story of what one organization has done—and is doing—to provide itself with a workable and still an all-encompassing—

This article is adapted from a speech given by the author late last year before a meeting of the Bank Administrative Institute in Cleveland.
The key concepts toward which any good management information system . . .

precedes sales forecasting and budgeting in manufacturing is an example of this. In addition, it can involve competitor surveillance.

5. Program systems. These are special development programs, such as construction of a new building or development of a comprehensive Management Information System. This basically refers to capital expenditure and research and development programs. Such programs can require as much as five years, or so, for completion.

6. One-year cyclical or rhythmical planning and control systems. Income, expense, and various resources are budgeted, on a month-by-month basis, by all areas of the business for the coming calendar or fiscal year.

7. Day-to-day tactical decision systems, such as bond trade analysis or investment selection programs.

8. Historical, corporate-level, custodial reporting systems. This involves reporting of the corporate income statement and balance sheet.

9. Special subsidiary systems, such as personnel and customer information systems. These systems provide detail by individual employee and customer. Considerable descriptive, as well as quantitative, data are included in these systems.

10. Daily production, posting, and proof systems, such as demand deposit accounting, transit, and installment loan processing systems.

Many of these are basically general ledger subsidiary systems.

Now in several of these systems simulation and optimization models and many of the newer quantitative techniques can be employed profitably. This does not give them the characteristics of a management information system; these are simply tools that can be utilized successfully at any level of planning.

What is an MIS system? An MIS system, fundamentally, is a financial control system, which is the principal basis of a good planning system. The key concepts toward which any good management information system must be geared, then, are planning and control over the enterprise as a whole, not just one aspect of it. This is certainly not a new idea; many of the key concepts were formulated by DuPont and refined at General Motors many years ago. It is an idea that is not completely understood or implemented by too many businesses, however.

The planning and control system must be based on the principles of responsibility accounting.

This relates primarily to point six in the list of information systems, although it generally includes several of the other categories, too, such as points four, five, and eight. The resources: people, machines, earning assets, deposits, etc., under the control of each manager are planned, on a month-by-month basis, one year into the future. Actual performance, periodically, is measured against goals, and accountability, or control, is provided by monthly variance reporting. It is a system for measuring the performance of management at all levels of an organization. It basically measures administrative effectiveness. This is why it logically can be called a Management Information System.

To provide a better idea of what MIS is, I would like to outline what we have been doing at the First Wisconsin National Bank of Milwaukee to achieve an MIS Program. The principal reason why, the First Wisconsin embarked on a large-scale MIS development program was to improve its earning power by providing rather complete information to managers about many segments of the business. In particular, it was considered desirable to be able to measure profit contribution of different aspects or elements of the enterprise. The program is very comprehensive and will take four years, overall, to complete. A listing of the major concepts being employed is as follows:

1. The entire system begins with the corporate-level income statement and balance sheet—the general ledger—and is exploded down from that point. Everything must relate properly to, and integrate well with, the fundamental statements of the business.

2. The principal categories of coding are:
   a.) Responsibility area
   b.) Chart of accounts
   c.) Service line
   d.) Program and project.

Considerable effort was expended in developing sound, imaginative, and basic coding systems.

3. The organization structure was precisely defined, since the reporting system is to follow, or roll up, the "chain of command." This is a basic feature of the system. There must be sound control by responsibility, which means by manager.

4. Cost is to be measured in three fundamental, mutually exclusive segments:
   a.) Standards will be developed for production costs, employing work measurement techniques, and flexible budgeting will
...must be geared, then, are planning and control over the enterprise as a whole...

be used for controlling these costs.

b.) Program and project costs will be controlled as an integral segment of the reporting system. These costs will be controlled directly on an occurrence or responsibility basis as well as be summarized for evaluation on a program management basis.

c.) Administrative costs encompass those expenses not included in the other two major categories. These costs tend to have an overhead orientation. We are treating each of the various broad categories of cost in a different manner, based on significant differences in their behavioral characteristics.

5. Profit will be measured in several ways:

a.) By responsibility, or profit center (sales manager)

b.) By service line (product line manager)

c.) Eventually, by individual customer.

Profit centers will be stated on a contribution basis; that is, no higher-level overheads will be allocated to profit centers. There will be two profit levels reported in profit centers—marginal profit contribution and contribution to profit and higher-level overhead. We are making provision for incremental analysis. Service line income statements will have two levels of profit—marginal profit contribution and full absorption net profit (principally for major pricing decisions). In general, we will allocate costs only where absolutely necessary.

6. Standard costs, which are controlled for efficiency purposes by flexible budgeting in production areas, will be charged out at standard, on a service line basis, to profit centers and service lines to provide a better measure of profit contribution.

7. Transfer rates will be developed to apply to excesses and deficiencies of investable funds of all fund-oriented areas.

8. An automated variance reporting system will be developed which will highlight material variances requiring explanation. By this means, the management by exception principle will be incorporated into the system.

9. Balance sheet and a variety of statistical elements will be reported by responsibility, as well as income, cost, and profit.

10. The general ledger will be fully automated.

11. A bill of materials processor will be employed to assemble cost components by service line.

12. Not only will after-the-fact reporting of actual against plan data be fully automated, but also the assembly of the plan itself. This is a major task that is frequently overlooked.

13. The entire system will be fully integrated. All segments of the system will work from the same data base, and there will be no inconsistencies in the data.

14. Very attractive reports will be developed. Esthetics will be given considerable attention.

The program will be completed near the end of 1970 and is progressing quite well. This represents one of the largest and most comprehensive undertakings of this type being attempted by a bank in this country. A sizable staff has been committed to the effort.

Risks to watch

There are many risks involved in embarking on a large-scale information system of any kind. The major pitfall is that of suboptimization—development of a segment without possessing a good appreciation of the overall whole and of how the segment should relate to the whole.

This has been one of the principal mistakes made by many companies. Few organizations have devised a broad, high-level concept of the hierarchy of information needs, similar to that previously discussed, and the related systems required for an imaginative organization. It is very important to try to do so, difficult though it be. The whole must be well conceived before developing any of the components. The design of every segment must fit properly into a high-grade master plan. Many banks have failed to take a broad approach to the design of information systems. Random systems development sometimes has resulted from inadequate planning. Some of the major problems that have impeded banks seriously in their efforts are the following:

1. Top management may not have participated actively in the formulation, design, and control of implementation of information systems. There may be a lack of understanding in regard to the value and use of such systems and a lack of appreciation for employing computers in the process. In many cases, information development programs are sold from levels well down in the organization. Top management approval for initiation may be obtained, but utilization of the system after implementation may be somewhat ineffective.

2. Very few banks can muster a development group of sufficient breadth and conceptual power to do a truly effective job. Generally, systems are designed by computer specialists or systems analysts who know computer capabilities rather well. However, they may not have a broad knowledge of the business, may have not served in a line management or staff analytical role, and they may not have used information actively for making deci-
sions. They often may have highly specialized backgrounds and little corporate exposure. They have tended to view computers as production machines, rather than as engines of information analysis. Designing or creating a new decision making system is a much more difficult task than automating an existing processing system. The approach, many times, has been one of achieving cost savings in processing systems, rather than entrepreneurial in formulating analytical and decision systems. A demand deposit accounting system is a very low order of information system. Reports designed by computer staffs sometimes are cluttered and unreadable. Readability is as important as content. There may be a serious lack of appreciation for a sales or public relations attitude toward users and for display esthetics or good “packaging” in exhibiting information.

Many accountants have suffered from the same sort of myopia. They have been too concerned with handling of transactions and book-keeping entries, rather than with analyzing and interpreting decision information. There has prevailed a processing orientation, rather than a user orientation.

Finally, line people—the basic users of information—frequently have not provided a strong contribution, partially due to lack of interest and dedicated participation, but mostly because they have not taken the time to really think deeply about their aspects of the business in fundamental and conceptual terms. They, of necessity, perhaps, have a pronounced, day-to-day, current, problem-solving orientation. Some may view information systems as an impediment to their work, rather than as a favorable aid.

Thus, there is a great void in requisite capability to perform an exceedingly difficult task. The necessary attributes are a strong entrepreneurial posture, user attitude, and a high-level, deep, conceptual understanding of the business. Technical knowledge and computer comprehension are secondary in importance. The “make or break” aspect does not lie mainly in the technical area. The information design group should be placed at a high level in the organization and be staffed with the best conceptual brains available. The members should have had broad and diverse experience in the business. Then they should read heavily in the literature to educate themselves in the new disciplines of managerial accounting, managerial economics, information theory, and information systems. There is little formal education or work experience that provides a respectable background in this field today.

Establishing a competent group of this sort is the most difficult aspect of the entire program. This design group should be fully segregated from the computer operations area, which represents a production function.

3. Many enterprises have the function of systems development fragmented throughout the organization in an array of staff groups, having ill defined and conflicting responsibilities. Conflict, lack of progress, and production of unrelated systems components can be the result.

4. The control of the entire staff and all the other resources required to develop the system should be fully centralized in one individual if effective performance is sought. Organizationally, this individual should report directly to executive management. The approach involving participation of members, from various areas, reporting to different superiors, and under the guidance of a “coordinator,” can all too often be quite inefficient and costly and may result in poor-quality systems.

5. The successful development and implementation of information systems represents a gigantic, complex, and costly effort and is not to be undertaken lightly. Yet, dealing with lesser subsystems will not provide the real payoff to an organization. Many banks may not have the caliber of talent to do the job. Competent individuals may have to be recruited from other more experienced industries, or a consulting firm may have to be retained. In dealing with a consulting firm, choosing the lead representative to be assigned to the job is at least as significant as selecting the firm itself.

The First Wisconsin National Bank of Milwaukee retained a prominent national public accounting firm to work with the bank staff on the MIS Program. The accounting background was considered to be quite important, since an MIS system is steeped in managerial accounting theory and is heavily founded on accounting systems. Banks, essentially, are large accounting machines.

Most banks are engaged in thinking about information systems, in one manner or another. Many, however, may be having difficulty in precisely defining problems and, specifically, what they want to do.

Perhaps a highly competent consulting firm could provide direction to general problem definition and planning, as well as guidance in systems design and implementation.

Possible future developments

Some of the developments which may occur in the near-term to intermediate-term future in the general field of information systems should be mentioned:

I. Control of information—basic coding, reporting, or other display methods, systems design, and very possibly analysis and interpretation of information—probably will be centralized in a highly placed staff group in organizations. The totally integrated systems of the future can be produced effectively only on a centralized basis. One cannot obtain integrated systems from fragmented systems groups. Each group will tend to go its own way. Information management, not equipment management, is the key to success.
Few people recognize that the computer is easily the most important invention of mankind

2. Information systems will become more sophisticated as business becomes more complex and the competitive pace quickens. There will be no return to simplicity, for the world inexorably is becoming more complex.

3. Banks will employ computers as an extension of the thinking process, rather than primarily as arithmetic posting and trial balance printing machines. In the past, banks have tended to concentrate their efforts on the more mundane applications and may not have recognized, adequately and imaginatively, the potential of high-order applications. The information retrieval capability of computers will become fully as important as their computational features.

4. A data librarian will be placed in charge of a single, centralized, corporate data bank, containing all internal and external data. Duplication and inconsistencies of data will be avoided. All data will be well classified, coded, and readily addressable. Today, each systems analyst, working with users, establishes his own data requirements and reports, but there may be insufficient control over achieving consistency, uniformity, and full integration among systems. Fragmented systems, inconsistent data, and nonuniform report format and content can be the result of this uncoordinated process.

5. Mass, on-line, storage capability soon will become quite economical and will tend to displace sequential storage. Transactions will be posted automatically as they occur, not only within an organization, but among organizations on a global basis. Computers will be interconnected completely among enterprises, as the telephone system is today. Paper will become less important as a medium for storing and transporting of information. Electronic transmission will tend to displace paper flow.

6. One person in an organization will be responsible for the format and structuring of all formal reporting and display of information. Centralized control provides full integration and a high level of consistency. The importance of aesthetics and appearance in the display and comprehension of information will be recognized more fully. Total integration of all systems will be achieved.

7. Centralized, large-screen display and decentralized, tube, or other types of display units will be more heavily employed to access data and charts, in many areas of companies and for a great variety of purposes. The First Wisconsin National Bank has had an operational Management Information Center since the autumn of 1966.

8. Interaction of user—salesman, analyst, or anyone else—and the computer will become commonplace. Employing terminals, users can access an index of the complete data library, unrestricted data, and a great array of statistical and analytical programs. Information will be available precisely when it is needed. Alternative solutions to a variety of problems easily can be explored. Mathematical models will be used extensively. Users and computers will come closer together. More flexible machines and systems technology will tend to reduce the relative number of technical people required to develop information systems, in time. We must remember that computers are still in a relatively early, crude state of development.

9. Banks are basically giant information processing machines and will become very heavily automated. Few people recognize that the computer is easily the most important invention of mankind. The potential is unbelievable, and all projections in this field will represent vast underestimates. Fifty-year projections are virtually impossible to make and are incomprehensible, if made. Yet, we must attempt to make such projections. The computer will expand the use and efficiency of the mind, rather than serve merely as another piece of production equipment, as has been too frequently the situation in the past.

10. Organization structures will change significantly in many ways. For example, analytical staff—“think groups”—will become increasingly centralized. Much staff work is too fragmented and of relatively low quality today. It is easier to waste money in splintered, ineffective staff work than in nearly any other manner. The difficulty of fairly accurate measurement complicates the problem.

11. Knowledge will become our most important resource. We will sell an increasingly broad range of advice to customers, rather than mainly process their transactions. The word “bank” may become obsolete in two decades, as we become more deeply involved in consultative activities.

12. Enterprise and individual obsolescence rates may increase substantially, because competition will move increasingly into the arena of competing ideas and philosophies. Ideas can become obsolete quickly. The pace will be intense, and the rich innovational rewards will go to the swift and highly competent. The day of comfortable and complacent banking decidedly is over. The competition for high talent will become fierce, for such talent is quite rare in the population. But there will be considerable challenge available for those who actively seek it and have the courage to promote their beliefs and concepts.
Many medium-sized companies, too large for direct face-to-face communication, too small for elaborate information systems, can benefit enormously from well planned, well guided management meetings—

**DIAGNOSING COMPANY WEAKNESSES AND TAKING CORRECTIVE ACTION**

by Thomas S. Dudick
Ernst & Ernst

Each of us is constantly exposed at seminars, through articles, by directives from our management to the importance of information in our business lives. We hear learned discourses on management information systems; we read detailed criticisms demonstrating that they have not yet been achieved.

Actually, though, information of any type is simply a matter of communication between entities. In a highly structured company, this might best be achieved by an elaborate system, based on almost mechanical precision, that ensures that each individual receives the information he needs about other departments or parts of the concern in time to take effective responsive action, in a form that will make it possible for him to take the correct action.

In a less highly structured environment, an information system can exist—and be equally effective—in a much less elaborate setting. The extreme case would be two individuals—a lawyer, say, and his secretary. He tells her what she needs to know, or she asks him what she needs to know. In any event, there is a two-way flow of information, and the office gets its business done.

Falling in the middle of this range is the company of medium size, large enough so that no one man can carry all necessary information in his head any more than he can carry out all the responsibilities of directing the company, but not so big that it requires an automatic or automated information system. And here the periodic face-to-face meeting of department heads offers a great deal. It does not have the split-second timeliness that a management information system should ideally be able to offer. On the other hand, it does have one tremendous advantage: spontaneity, the challenge and response of face-to-face discussion among individuals.

Let’s review how a group of
managers, meeting in a fronton, can bring their own knowledge of their departments' problems to bear on their company's operating statement and see how in the process they can make comparisons of their company's record with their industry's average and attempt to discover how—and why—their company falls short of that industry average.

Scene: Board room of a medium-sized manufacturer of TV sets. The ABC Company general manager, Don, is equipped with a financial ratio study showing industry average figures for the past five years compared with his company's record for the past year. The *dramatis personae* are:

Don—General Manager
Joe—Manufacturing Manager
Jack—Controller
Bob—Personnel Manager
Harry—Sales Manager.

*Don:* "Gentlemen, I have called you together so we can look at ourselves introspectively by comparing the results shown on our financial statement with the results for our industry as shown on the exhibit (page 30) that was previously distributed to you.

"Through periodic meetings such as this, I hope to promulgate free and open discussion among ourselves as to:

- where our weak points are in relation to our competitors
- what we can do to correct these weaknesses.

"Let's begin by looking at the pre-tax profit. You will notice that this figure is 8.2 per cent of sales as compared with 12.2 per cent for the industry. Prior to the time we began receiving the industry statistical reports we thought this was reasonably good—we had some feeling of satisfaction with our performance as managers. The comparison in the exhibit I referred to earlier points up the fact that we are not quite as good as we have led ourselves to believe. With this as background, let us look at the other items, a line at a time, in an effort to pinpoint some of our problems and possibly reach some

"The next item to look at is returns and allowances. This seems to be the customary medium of stating the amount of reduction of sales through rebates, defective products, and other reasons for which we give credit to customers.

"Joe, as a manufacturing man, I am asking you this question: We, at the ABC Company, show that 4.8 per cent of our sales are returns and allowances—compared with the industry average of 4.0 per cent. The .8 per cent may not sound like much, but it is 80 cents out of every $100 multiplied by the dollars of gross sales. This does become a significant number of dollars over the period of a year."

*Jack, Controller:* "Let me come to the defense of Joe. This is not quite as bad as it appears. If we inadvertently make a double billing or if we send out two shipments in error, we correct this in the returns and allowances account. Gross sales are thereby automatically reduced through this process. We have recently changed this practice. In the future, gross sales will be reduced directly rather than indirectly, and the items shown in returns and allowances will reflect only true allowances and returns."

*Don:* "I'm certainly glad you have changed the practice. I'd hate to think that a financial statement was being used as an accounting worksheet. If any other kinds of adjustments are being made in the same way, let's clean them up too."

*Joe, Manufacturing Manager:* "Some of the returns and allowances can be blamed on 'dirty orders.'"

*Harry, Sales Manager:* "What do you mean by dirty orders?"

*Joe:* "When an order comes in from the Sales Department marked 'same as last time,' we pull the order, and it frequently turns out that it was not the same as last time but two times ago. I suggest we get some instructions out and do a better job of coordinating between Sales and Manufacturing so we know exactly what to make."
FINANCIAL RATIO STUDY

ABC COMPANY COMPARED TO THE INDUSTRY

<table>
<thead>
<tr>
<th>INDUSTRY STATISTICS</th>
<th>ABC Company This Year</th>
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<tr>
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<td>Last Year</td>
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<td>Ago</td>
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<td>4 Years Ago</td>
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| Gross Sales          | 103.7%                | 103.8%       |
| Less Returns and Allowances | 3.7                  | 3.8          |
| Net Sales            | 100.0%                | 100.0%       |

<table>
<thead>
<tr>
<th>Cost of Goods Sold</th>
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<tbody>
<tr>
<td>Material</td>
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<tr>
<td>Factory Labor</td>
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<tr>
<td>Factory Overhead</td>
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<td>Total</td>
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| Gross Profit        | 37.2%                  | 35.9%        |

<table>
<thead>
<tr>
<th>Selling Expenses</th>
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<tbody>
<tr>
<td>Sales Salaries and Commissions</td>
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<tr>
<td>Travel Expenses</td>
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<tr>
<td>Executive and Office Salaries</td>
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<tr>
<td>Advertising</td>
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<td>Special Promotions</td>
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<td>Total</td>
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<table>
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<th>Product Development</th>
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<td>0.6%</td>
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<table>
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<tr>
<th>Administrative Expenses</th>
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<tr>
<td>Executive Salaries</td>
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<tr>
<td>Office Salaries</td>
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<tr>
<td>Non-labor Expenses</td>
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<tr>
<td>Total</td>
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<tr>
<th>Other Income</th>
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<tr>
<td>(1.2%)</td>
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<tr>
<td>Other Expenses</td>
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<tr>
<td>Pre-Tax Profit</td>
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<th>Finished Goods—Days of Inventory</th>
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<tbody>
<tr>
<td>19</td>
</tr>
<tr>
<td>Accounts Receivable—Days' Turnover</td>
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1. Clean up the "dirty" orders.
2. Automate!
3. Establish budgets.
4. Standardize sales compensation methods.
5. Over-sophistication of computer operations.
6. This is where the buck stops.
7. Stop overruns—stick to the schedule.
8. Issue credits promptly.
This will also help our inventory turnover.”

Harry: “As far as asking you to make the order the same as last time, I am sure that is the best thing we can do because that is what the customer tells us. However, if we have problems in writing orders, I think we can specify what goes on them. It’s only a matter of altering our approach.”

Joe: “Suppose I do this, Harry. I’ll have a list made up of all orders that are giving us problems. I’ll have this for our next meeting so we can all work this out together.”

Don: “We can do better than that. Would you make a photocopy as the order goes through Production Control? Bring these photocopies of all dirty orders to the next meeting so we can deal with specifics. Harry can’t just write a memo to his salesmen asking them to write better orders—that’s just too general an approach and it will accomplish little.

“So much for dirty orders. Let’s move on to cost of goods sold. This is segregated by material, factory labor, and factory overhead. We don’t usually have too many bouquets to pass out, but I think you are due one for material. Our material cost is lower than the average for the industry—33.9 per cent of sales as compared with 36.9 per cent for the industry.”

Jack: “There is another factor to be considered before we hand out any bouquets. Our material costs line is concentrated more heavily on black and white table models and portables, which have a relatively low material content in relation to sales value. Our competitors have more of the stylized, expensive wood cabinets in their lines, which have a greater percentage of combination stereo-TV color sets. These have a larger material content and are, incidentally, more profitable. If Harry’s salesmen would sell more of these we could increase that profit figure.”

Bob, Personnel Manager: “I’m a little confused. Even if the table models and portables are less profitable, the material in these is less costly so wouldn’t that compensate for the lower price? We sell a lot of these and we put out a good set.”

Jack: “The mark-up on table models and portables is very low. Even though the material in a color TV-stereo combination is a larger percentage of the selling price, the mark-up is even greater—so if we could sell more of these, we would come out with a better profit.”

Harry: “I’d love to sell more of the higher-priced line, but every time I send an order into the factory they goof it up. I got a complaint from a customer only last week that when he switched on the TV the stereo unit began to play. Apparently our factory is geared up to make the simpler sets—and they do a good job on these—don’t get me wrong. I just don’t think the more exotic lines are our cup of tea.”

Joe: “Now just a minute, Harry. Your salesmen send in a small order for combinations about once a month. We can’t afford to keep together a group of people familiar with the intricacies of the more exotic items in our line—we have to use people from the lines we run day in and day out.

“If your department would go out and get some decent-sized orders I’d set up a special line and train people who would put out a quality product that you’d have no
problem at all in selling, I'm sure."

Harry: "This is the old story of which came first. We can't sell the product if you can't produce it and you can't produce it unless we can sell it."

Don: "Maybe we should do some soul searching in this area and develop a marketing program. Harry, why don't you give Joe an idea of the potential so he can develop some firm plans?"

Joe: "Do you have any idea of what this potential really is? It's all well and good to say that we'll try to tap the potential, but I've been stung before. A few years ago I set up a special line in anticipation of heavy tape recorder business, but it never materialized, and I was left holding the bag."

Don: "I remember the tape recorder problem—I was a party to it when I was sales manager. If you recall, that was about the time the cartridge-type recorders became very popular. As a result, the conventional product we made took it on the chin. The same thing happened when tape took the place of wire recorders. We profited by that change; in fact, that's how we got into the business."

"This is one of the things I hoped would come out of such meetings as this one. It's obvious that we need to do a better job of forward planning and try not to repeat errors of the past. I see Joe's problem—he just can't have specially trained people available to run every small order that comes in the house. We need a plan; we need product selectivity so we can push more of the high-profit items rather than just the highly competitive items. The three of us will have to get together in some extended sessions. We'll get some commitment on the part of the sales department in terms of units by product line as well as by dollars and gross margin."

"Then, armed with that type of information, we can get the opinion of the manufacturing department as to needs in terms of people, technology, equipment, and investment in inventory. We can't continue drifting in and out of product lines in a haphazard fashion."

"The next item I want to talk about, gentlemen, is factory labor. I'd like to hear about this from you as personnel manager, Bob. As you can see, factory labor costs are running 14 per cent of sales compared with 9 per cent for the industry. This is five points higher than our competitors. What is the story?"

Bob: "I'm going to sound a little like a broken record. As you know, we're in an awfully tight labor market—the likes of which we haven't seen since World War II. Another factor is turnover. It isn't only a matter of losing experienced people and hiring green replacements—we almost always have to hire these new people at higher rates than were paid to the ones we lost."

...is often handicapped when it tries to manufacture more exotic products.
Don: “But we’re in a distress area with a very high percentage of unemployed.”

Bob: “True, but the labor pool isn’t made up of the type of employees we need. It’s the male population that is largely in the ranks of unemployed. But, as you know, we need women in our assembly operations for their manual dexterity—and we need inspectors who have a fairly good comprehension of the written word. These types are not available in the quantities that we need.

“I do have one suggestion regarding turnover. We have to get closer to our employees so we can become aware of dissatisfactions before they look for another job. By the time we find out an employee is looking, it’s too late.”

Joe: “Who could disagree that we should get closer to our employees? We could spend all our time wet-nursing 400 employees. There’s always going to be some petty bickering that we could never resolve because of personality differences. Arbitrating these differences would take up too much time and accomplish little.

“The way you can make real inroads in the cost of factory labor—and I’ve been saying this for three years—is to automate the assembly operations. That’s where a good deal of cost is.”

Jack: “That will require a good deal of investment, though.”

Joe: “Of course it will. But no one seemed to be too concerned about investment when we built that new office building just to house your new computer—air conditioning and all—while my people sweat. There’s a way to eliminate a good deal of employee dissatisfaction, Bob. Air condition the factory like our competitors are doing.”

Jack: “But we were able to come up with some savings.”

Joe: “You’ll have to convince me of that. All I see is a lot more reports that I don’t have time to read because of all the unnecessary detail they show. I want the big picture, but your computer gives me all the nitpicking detail that I can do without.”

Don: “Joe and Jack, let’s make the discussion of reports the subject of a separate meeting. Joe, suppose you get together copies of the reports you’re talking about and we’ll go into them in greater depth.

“Regarding your recommendation for automation, I recall that
Joe: "OK, I'll write something up and turn it over to Jack. I know that if I put in an automated line for $100,000, I can eliminate 10 people at a cost of $4,000 per year. After deducting depreciation and maintenance, there will be a net saving of $30,000 per year, or a payback of 3½ years. If this isn't convincing enough and they want to use the discounted cash flow method, I don't understand it—let Jack's computer do it."

Don: "I'm sure Jack will be glad to help you once you give him the basic information. Let's move on to factory overhead. You may be able to throw some light on this one, Jack. Why is our overhead 16 per cent of sales when the industry figure is only 14.6 per cent?"

Jack: "I believe the major part of this difference is due to the way we handle depreciation. As you know, our equipment is quite new, and we use accelerated depreciation in our costing. As far as I can tell, most of our larger competitors have equipment purchased 12 to 15 years ago when prices were lower."

Don: "You're probably right. I have no doubt that you are right. However, as you know, the corporate office requires us to submit a request for appropriation with a calculation of payback—using the discounted cash flow method. I know how you despise paperwork, but we'll have to do it."

Jack: "By the way, Joe, when we justified purchase of the new equipment, one of the potential savings was a reduction in the number of maintenance men. We still have as many as we ever did. This is another reason the overhead is up."

Joe: "Well, it just seems that everything has been going wrong. We had to use our maintenance crew to make a lot of building repairs."

Don: "I do recall that you were to reduce your crew by five men if we purchased the new equipment. By the way, Jack, your departmental reports don't show budget figures by which we can compare the actual costs to see if they're in line. If you did include a budget based on the annual plan we could spot these things before too much time gets by us. This is a subject we might discuss after the meeting.

"Let's move into Harry's area now. You'll note that salesmen's salaries and commissions for the industry—for the entire five years—fall within a single percentage point. There is not a figure below 7 per cent nor one above 8 per cent—which is surprising. In our case, this cost is running at 8 per cent. Are we paying the men too much? What's the story?"

Harry, Sales Manager: "Well, in 1969, the year I inherited the sales organization. Some of our men are on compensation plans that include straight commission, some are on salary and commission, some on salary and bonus, and others on salary only. One of my goals is to have the entire compensation plan uniform by next year.

"Along with this, you will notice that our executive office salaries are lower than industry. With the standardization of method of payment I would like to restructure the sales organization to put more management into the field. The combined figure will probably not change, but we will look better under the salesmen's salaries and commissions and will be a bit higher under sales executives' and office salaries."

Don: "What you are saying then is that through reorganization of our sales compensation plan we will save money and this will be used for the sales executive compensation. This should make the whole organization more effective.

"Let's focus on advertising next. We have spent about 1 per cent of our sales dollar on this item—which is about 30 per cent less than the rest of the industry. Would an increase in this figure result in added volume?"

Harry: "I don't believe so. We haven't done too much in the way of advertising because we have no new product to advertise."

![Cartoon image of labor surplus with text: Labor surplus, made up largely of male, unskilled employees, isn't too meaningful when women and literate inspectors are needed.]
Don: “Other companies are streamlining their products through national magazines.”

Harry: “That’s because they have something new. You will see that we’re spending a lot of money under special promotions. This is principally sales contests to motivate the salesmen. We do this because our product is at the cheaper end of the line and our men get bored with this sort of thing in a market where others are selling a broader line and glamorizing a variety of models.

“What I would like to do is take the money I am spending on sales contests and put it into product development, where we are spending virtually no money. This will be a greater motivation for our sales force. Of course this program will have to be long-range. We have to plan on new products, techniques, and new designs for existing products.”

Don: “This excites me because it fits into the pattern. We have been talking about the fact that we are drifting into new products on a casual basis and not doing a good job because of lack of proper planning and coordination. What you are saying is that we need some specific product development. We can’t tell what the outcome will be, but I can see the benefits of closer liaison among sales, product development, and manufacturing.”

Harry: “We cannot do this this year and next year—and then drop it—the program must go on according to a definite long-range program.”

Don: “We have already covered product development so let’s skip down to administrative expenses. Jack, I see that we are in good shape on executive salaries and office salaries but we’re high on non-labor expenses. We show 5.6 per cent of sales—which is higher than industry averages in any of the five years. What are we doing here that puts us out of line?”

Jack: “I guess this is mostly our computer rental. As you know, we’re now putting out reports on sales by customer, by territory, by commissions by salesmen, which we used to do manually. We’re also giving the foremen a daily efficiency report by individual operator so they can nail down inefficiency by operator and by the operation.”

Joe: “We can do without these daily efficiency reports. Each of my foremen gets a stack of paper one inch high showing this mass of detail. We receive the report two days late, but even if we received it the next morning it would take each foreman an hour to review this. Even then, it’s too late to take action on something the operator has long since forgotten.

“I can tell how efficient my people are by the number of TV sets that come off the end of the line each hour. I can also control poor workmanship by the number of reworks we get at the end of the line. As soon as we find that a girl is doing a poor solder job, we know the position on the line and we take care of the matter immediately—without a stack of paper to tell us. As far as I am concerned, you can cut out these reports and save the money.”

Don: “Jack, I know that you and I went into this computer program with high hopes of improving efficiency and saving money. I’m wondering if we might not have been sold a bill of goods by computer salesmen who would have us spend a dollar to get ten cents worth of information. Let’s take a good look at this.

“The next item is finished goods. I notice that we have an 18 days’ supply compared with 16 days’ for the industry. As you know, this is money. What is the story on getting this under better control, Harry?”

Harry: “My records show that the factory is overrunning production schedules. If they stuck to the schedule I requested, we would be slightly under the industry.”

Don: “Is that true, Joe?”

Joe: “Well, you know when a line is running well—with very low defects—it’s much cheaper to keep running because when we stop and start up again later, costs go up considerably.”

Harry: “What good is low-cost inventory when you have to write off a couple hundred thousand dollars at the end of the model year?”

Don: “Joe, this only reinforces my point. I think that it’s imperative that you, Harry, and I get together as soon as possible to do some down-to-earth planning. Let’s set a definite date before the day is out.

“The last item I want to cover is accounts receivable. As you can see, we have 52 days of outstanding receivables. Again, we’re higher than industry averages. What can we do about it?”

Jack: “One of the reasons the receivables are so high is that it takes so long to process credits. I have one case where a customer won’t pay a $5,000 bill because he says he is entitled to a credit for $45 which hasn’t been received.

“I would suggest that the salesmen be allowed to approve credits for $50 or less. It still has to be processed, and we have to find out why the credit is being requested, but it would help our collections.”

Harry: “If, after the credit has been allowed and a study reveals that it really is the customer’s
fault, who is going to bear the cost of that credit? Will it be charged back to the sales department?

Jack: "I don't think that is going to happen very often. The $50 that we might lose occasionally would be offset by savings in phone calls, letter writing, and ill will."

Don: "I am a little concerned. I think we would have to institute a monitoring system to be sure that salesmen would not abuse this system."

Harry: "I'll work this out with Jack, and we'll talk it over with you before I issue instructions to my sales people."

Don: "I hope this meeting has been as helpful to you as it has been to me. Just by way of summation, our discussions have highlighted the following areas which require our attention: "We covered the subject of 'dirty orders,' which have undoubtedly been a source of confusion to our manufacturing people and have undoubtedly rankled some of our customers. This meeting permitted us to air the problem, which we will explore further with the view toward taking corrective steps. "We also talked about the problems of small orders and increasing our volume in the more profitable lines. Our approach will include a coordinated effort among Sales, Product Development, and Manufacturing to come up with a program for better selectivity in our product line. "The sales compensation plan will be standardized and organization shifts made in order to make our field sales effort more effective. "Automation, as a means for reducing factory costs and coping with the labor shortage problems, is a must. We'll have to prepare the request for appropriation without further delay. "It's obvious, also, that we have other incongruities in our procedures that require further investigation. I refer to the possibility of overly detailed reports, the question as to whether or not we have over-expanded our computer facilities, and the problem of issuing credits to customers on a timely basis. "Probably the biggest deficiency in our company that has been revealed to me is the need for a plan to improve profits. "I'm certain that future meetings of this type will put all these problems in proper focus and facilitate effective solutions. Thank you, gentlemen. I'll notify you of the date of our next meeting."

The foregoing describes a composite of actual happenings at meetings held by several companies. While use of meetings for problem solving is sometimes criticized because they can become a forum for the more vocal members of the group, a well controlled discussion with specific objectives can be highly productive. The following guidelines will assure greater success:

- Establish a definite agenda of the topics to be covered. In this case, the agenda consisted of explanations and solutions to specific out-of-line situations.
- Be alert to the opinions of those in other areas of responsibility who are in a position to flush out deficiencies that might not otherwise be revealed by those directly responsible for the activity.
- Make a definite decision to take certain action. If action cannot be taken, give specific reasons why it cannot. Should further investigation be required, make this known and set definite dates for accomplishment.

The ability to direct a group of executives in the pursuit of reasons for and solutions to problems is one of the marks of business leadership. Diagnosing a business through the team approach certainly calls for the exercise of such leadership.

And, as the example in this article demonstrates, one way such leadership can be achieved quite naturally and painlessly lies in framing the questions one wants the answers to first and then getting the benefit of all the best informed opinions simultaneously.
Approaching obsolescence of one of a client's product lines can often be predicted in an industry where conditions are stable and marketing practices are comparatively unimportant. Here's the story of—

AN ACCOUNTANT’S ROLE IN PRODUCT OBsolescence

by Harris J. Nadley
Michael Nadley Company

John Maynard Keynes, the eminent British economist, once said, "In the long run, we are all dead." While this happy truism may apply rather casually to large industries, and large firms within such industries, when tastes or technologies change, it has much more sudden impact on smaller firms. This article will deal with the latter problem, and necessarily be limited in scope to certain broad types of controllable situations and how the smaller accounting practitioner can assist in dealing with them.

There is no concrete indication that product obsolescence is increasing in frequency, but no one doubts that an acceleration has occurred. This has been provoked by two principal factors: cost cutting and product improvement, both by-products of an increasingly competitive economy.

The smaller firm, working on a thin equity traditionally, is adversely affected with alarming speed. Working capital disappears because of factors discussed later in the text, and since the "life blood" of the business is involved, it is procrastination to re-stock the firm with injections of additional funds. The type of firm most subject to this problem is typically the small manufacturing company, an independent or sub-contractor operation, dependent on one product line or several related lines. It is also the firm with a comfortable set of financial ratios and a history of modest earnings. The author cites five examples of product obsolescence in his experience, with similarities as mentioned above, that occurred in the past few years:

1. Four-ply automobile tires changing to two-ply tires, thus doing away with the recapping industry
2. Linen sanitary hats giving way to paper sanitary hats
3. Wool floor carpeting changing to synthetic carpeting
The sales figures for the past also showed that this particular client’s products seemed to show a five-year product cycle, so that was the basis on which we projected sales figures. Then a running projection of true sales figures with projected trends gave us a fairly close control over the firm’s profit figures.

Methods of detection

A. Statistical Observance

Almost all clients, with the help of figures prepared by their staff or accountants, watch sales records, or, more specifically, trends in sales. Larger firms devote whole departments to this job. It will be the purpose of this discussion to reduce this task to one of restricted application, so that an individual practitioner can feasibly and economically cope with it.

In the course of periodic reviews with their clients, all accountants include sales comparisons in their presentation, most surely. But the bare discussion of total volume is nothing but an interesting few minutes (if it is up over last year’s), if they are not dissected with a practiced eye. Basically, such figures should be broken up into two broad categories of treatment—average sale price per physical sales unit per item and comparisons of such compilations to periods for a month previous, a year previous, and three years previous (or a continuous moving average). These figures should then be graphed to visibly discern significant changes. Note that the “product mix,” or determination of what items make up the whole sale dollar, is extremely important. Logically, the sales of one item might be ascending while offset by a compensating decrease in another item, and remedial action should be directed accordingly.

The example we are dealing with in this article is that of the most stable of stable industries—one where advertising and marketing practices are irrelevant and where demand remains almost constant, as long as the automobile remains the nation’s most popular form of transportation. The company for which we worked out the analysis described in this article was a used tire processor. So obsolescence as a factor in its operations was almost entirely a factor of obsolescence of one of its product lines rather than the total line.

The sales figures for the past also showed that this particular client’s products seemed to show a five-year cycle, so that was the basis on which we projected sales figures. Then a running comparison of true sales figures with projected trends gave us a fairly close control over the firm’s profit figures.

In Figure 1 (A) on page 39, a typical pattern of a whole sales history is shown. This is the familiar “Gompertz” curve, or “life line” as termed in biological language. The sales start with a strong upsurge, grow at a steady rate, then decline with old age, and if carried to infinity, die away. Our
To get a really accurate projection, many similar cycles of a firm's sales should be charted and an "average" cycle derived; also, at the beginning and end of the aging cycle, the projections are in the most unpredictable range because the data are new.

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Rate of Change %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5.00</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>7.07</td>
<td>0.4140</td>
</tr>
<tr>
<td>2</td>
<td>8.41</td>
<td>0.1896</td>
</tr>
<tr>
<td>3</td>
<td>9.17</td>
<td>0.0904</td>
</tr>
<tr>
<td>4</td>
<td>9.58</td>
<td>0.0447</td>
</tr>
<tr>
<td>5</td>
<td>9.79</td>
<td>0.0215</td>
</tr>
</tbody>
</table>

interest is ascertaining the outlined area, the point of decline. This is presented better by reference to the semi log chart (Figure 1B on page 39). It shows the true mathematical perspective of an increase with a declining rate of increase.

The Figure 2 series (page 39) depict the effect of a firm making changes in its product or developing a new related line from its predecessor. For the purpose of this discussion, these will be called "modifications." Later on in the text, it will be seen how quickly an alert management recognizes this phenomenon. Figure 2(A) shows the approximate areas of "re-birth" in the life cycle arithmetically, and Figure 2(B) shows the same reaction much more dramatically.

Figures 3(A) and 3(B) on page 39 are extended mathematical models that involve projection, and, thus, the ultimate goal, prediction. In Figure 3(A), certain geometric ratios exist along the curve, as the dotted line configurations indicate. Therefore, if the firm's sales are at a given point, then by computation it is possible to foretell where they are going.

For example, the Gompertz curve mentioned previously can be expressed in the form of a graph (Table 1 above) with "X" representing years equally spaced and "Y" representing time in proportion to the product aging process. To determine values of projected sales from the starting year or period ("X-O"), take 0.4140 per cent of the first year's figure and add this answer to the first-year figure, and so on for the next year, etc. The rate of change slows down considerably, reflecting aging as the years go by. To get a really accurate projection, many similar cycles of a firm's sales should be charted and an "average" cycle derived; also, at the beginning and end of the aging cycle, the projections are in the most unpredictable range because the data are new. However, most firms with some years in business typically operate in the predictable areas.

Figure 3(B) represents a scant introduction to probability theory. This is really a three-dimensional graph; along the time axis, extending upward toward the reader, the dark line represents a nonlinear function line formulated by the use of simultaneous equations. The conclusion deduced is that modifications are critical to

1The Gompertz curve referred to above is mathematically expressed by the equation $Y = AB^e^x$. From this exponential equation, a typical growth curve bears the relationship between the X and Y axis: curve $Y = 10(0.5)^{0.5}$. For further elaboration, see A. C. Rosander, Elementary Principles of Statistics, D. Von Nostrand Company, N. Y., 1951, p.p. 887-894.
the growth of sales until a saturation level is attained; thereafter the cost of further improvement becomes prohibitive. Since this type of formulation is beyond the scope of many accountants, it will not be discussed but is drawn just to stimulate the reader a bit.

A case history using this analysis shows how interesting this technique is to an accountant in the course of reviewing periodic financial results with a client. In Table 2, on page 42, which represents an arithmetic graph (the "normal" kind of graph scaled equally 1-2-3-4-5 etc.), the sales of this scrap company looked moderately good in 1957 through 1959 in total form, but broken up into product lines and put on semi-log paper (Figure 4 above), the sales picture showed instead that there was no growth rate at all in most lines with the unexplained exception of product "14 CAS," and that in product "RE," the lead line that always foretold sales for the next five-year cycle, the rate was down at an increasing rate. (Product "RE" was resold without any processing and since this line came directly from the factory and was sold as "second-line" rejects, it represented the "fastest" merchandise to hit the market.)

Therefore in Cycle 1, which was the five-year period that ended in 1957-1958, the chart indicated a "bottoming-out" of the "RE" or "seconds" type of merchandise. Simultaneously, the charts indicated an increase at an increasing rate of the "14 CAS" sales. The client, on this presumption, immediately began to accumulate inventory of product "14 CAS," which showed the strongest rate of growth. This carried through nicely, representing the largest sales by far to 1961, and, even though dropping swiftly then, was already being replaced by accumulation and promotion of product "RE," now recognized again as the most profitable product line.

Of course, an understanding of how to read semi-log charts is the key to this type of analysis. Semi-log charts are scaled in linear proportion—lines 1, 2, 3, 4, etc., are in fact numbers 1, 2, 4, 8, 16, etc. Each number, therefore, is the result of the line before it times 2. Any number can be used as a multiplier, and the typical semi-log table is a decimal table, the numbers being in terms of 10 power logarithms. In actual fact,
while understanding the computations is useful, just interpreting the facts plotted on the graph is the meaningful object. What is being depicted is the "rate" of growth, and this rate is what is discussed as significant with the client. In Figures 5(A), (B), (C), (D) and (E) on page 43, a visual portrayal of all kinds of growth rates possible when reading semi-log charts is shown.

Returning to the case example (Figure 4), the trend line (heavy dash line) of the total sales volume now shows the growth as increasing with a "rate of decrease," and the sudden jumps called "discontinuities" are the decision changes that the management made to improve the sales potential. The important point seen here is that while sales fell during the various cycles, the total trend is always on a higher plane. The short dash lines are the projections made by the management and can be used at the next conference with the client to see how the results are working out.

Use of the Gompertz calculations—before outlined—on the total sales, for example, would produce the analysis in Table 3, page 44.

Observe that the projected sales, calculated originally in 1957, followed the trend of this five-year cycle fairly well, but also at the end failed to signal the sharp jolt as the product became thoroughly obsolete.

Discontinuities on the chart indicate a deliberate break on the client's part for some change in procedures to alter the particular line. Manufacturers of this type (used tire processing) must adapt their product occasionally because they are reprocessing scrap and the type of raw scrap may change appreciably over a period of time.

### Supporting Figures for Figure 4

<table>
<thead>
<tr>
<th>Years</th>
<th>Sales (000)</th>
<th>Re.</th>
<th>Vol. T.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15 Cas.</td>
<td>14 Cas.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1957</td>
<td>80</td>
<td>20</td>
<td>60</td>
<td>180</td>
</tr>
<tr>
<td>1958</td>
<td>80</td>
<td>50</td>
<td>20</td>
<td>200</td>
</tr>
<tr>
<td>1959</td>
<td>90</td>
<td>70</td>
<td>20</td>
<td>220</td>
</tr>
<tr>
<td>1960</td>
<td>80</td>
<td>200</td>
<td>20</td>
<td>350</td>
</tr>
<tr>
<td>1961</td>
<td>130</td>
<td>300</td>
<td>20</td>
<td>500</td>
</tr>
<tr>
<td>1962</td>
<td>110</td>
<td>80</td>
<td>30</td>
<td>280</td>
</tr>
<tr>
<td>1963</td>
<td>30</td>
<td>40</td>
<td>35</td>
<td>200</td>
</tr>
<tr>
<td>1964</td>
<td>20</td>
<td>70</td>
<td>40</td>
<td>250</td>
</tr>
<tr>
<td>1965 (PROJECTED)</td>
<td>20</td>
<td>70</td>
<td>160</td>
<td>300</td>
</tr>
</tbody>
</table>

### Table 2

Management Services
In other words, adaptations have to be made, according to the available supply of “raw material.”

Some mathematics essential

Again, it is obvious that use of these techniques involves a knowledge of higher mathematics, but this article hopes to encourage an understanding of these tools. And they should be used with proper professional advice, so that an accountant who is pursuing such a project is aware of the statistical confidence limits of such projections. Some awareness of this theoretical approach has already been imparted to the accounting profession.2

B. Other Factual Observance

The accountant can also develop a “feel” for this problem by examining other data available to him during the course of his routine audit. “Backlog” figures are an excellent example. Any sudden unexplained drop in the backlog often flashes a warning months in advance. An unexplained build-up in accounts receivable, not necessarily confined to the slow end of the aging schedule, reflects consumer resistance but is, naturally, a short-run indicator. Such intuitive observations make the client aware, at least, although there is no substitute for continual study.

Combating the problem

A. Discussion

The astute management develops a policy constantly improving its product technically. This is not done in spurts, but is programed to take place each year over a term of years—the best specimen of this being the automobile industry. All can observe the body

Even in smaller firms, research is invaluable, even though not assigned impressive titles such as "R. & D.," and it need not cost excessively. The constant reading of trade journals, liaison with other suppliers or beneficial larger competitors, perusal of overseas developments (as carried in business magazines and newspapers), and working with local organizations devoted to basic research are but a few measures utilized to keep abreast of product usage.

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Total Sales</th>
<th>Projected Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>1957</td>
<td>180</td>
<td></td>
</tr>
<tr>
<td>1958</td>
<td>200</td>
<td>235</td>
</tr>
<tr>
<td>1959</td>
<td>220</td>
<td>303</td>
</tr>
<tr>
<td>1960</td>
<td>350</td>
<td>330</td>
</tr>
<tr>
<td>1961</td>
<td>500</td>
<td>345</td>
</tr>
<tr>
<td>1962</td>
<td>280</td>
<td>352</td>
</tr>
</tbody>
</table>

The Franklin Institute, in Philadelphia, maintains a full-time staff to assist area firms to perform development—on a negotiated contract fee basis, philosophy may be suggested to the client in respect to this problem. Avoid the pitfalls of overexpansion, whether in bricks and machinery or in the luxury of expanded "staff" overhead. Keep a certain percentage of assets in liquid form for quick action (from cash to marketable securities)—in fact, one client insisted that 10 per cent of his total assets be in this form, despite its apparently nonproductive nature, for product generation. Another contradictory measure observed by the author was the signing of long-term fixed-price commitments, so that basic overhead would be covered while other products were "in the hopper"—ordinarily not done in these inflationary times.

Summary

The accountant has come to realize that management services have become a vital ingredient in his practice, and the author believes that recognizing product obsolescence is a significant part of this service. While the amount of service performed depends on the emphasis he or the client desires, and may range from brief discussion to an elaborate survey, it should be done nonetheless. The author is of the opinion that "sudden death" matches should be fought on the playing field, not in the economic sphere, where intelligent application should reduce blind chance to the absolute minimum.

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https://egrove.olemiss.edu/mgmtservices/vol7/iss2/10
The increase in efficiency caused by the learning effect in making new products is all too often ignored in budgeting and bidding. Yet it can make all the difference in gaining a contract or losing it—

HOW LEARNING CURVE MODELS CAN BE APPLIED TO PROFIT PLANNING

by Edward L. Summers and Glenn A. Welsch
University of Texas

Since World War II a substantial amount of literature has been devoted to a behavioral phenomenon known as the “learning effect.” The learning effect refers to the potential efficiency to be gained from repetition of a manufacturing procedure, process, or operation.

Learning-curve theory has particular relevance for accountants and others concerned with historical costs, projected costs, and budgets. It is an important factor to be considered in developing realistic cost estimates and profit projections where repetitive manufacturing or operational activities are involved.

A high degree of realism and accuracy in cost and profit forecasts enables management to develop competitive and economically sound pricing policies, particularly where price depends in large measure on costs. Other significant consequences include effective planning and control of cash flows, costs, and personnel requirements. This article reviews learning-effect theory and suggests some relevant applications in profit planning and control.

The learning effect is the relevant factor underlying what have come to be known as learning-curve manufacturing progress models. Development of the ballistic missile provided the basis for a widely cited illustration of the learning effect. During the early and middle 1950’s, when the research and development of ballistic missiles reached a payoff stage, cost projections for the first production models emerged. The cost of one ballistic missile from the first production line was in excess of the cost of a single strategic bomber. It could have been argued (aside from the fact that the bomber was manned and the missile was not) that, since bombers were less costly to produce, they should be produced in preference
to the apparently quite expensive missiles.

However, the decision was to produce missiles. The decision rested in part upon the knowledge of learning-curve models and significance of the learning effect gained from the experience of the aerospace industry. That experience had enabled planning and budget executives in the Department of Defense to forecast realistically that the production cost of a ballistic missile could be reduced to approximately one million dollars, far less than the “matured” cost of a strategic bomber. The expectation of substantial and dramatic reduction in cost was based on the explicit assumption that there would be significant learning efficiencies as more and more missiles were produced. With cumulative experience, less material waste, less labor, and less overhead should be incurred for each missile produced.

The learning curve

Practically all manufacturing experiences are subject to the learning effect in varying degrees. In particular, a production run of finite size and possessing some degree of complexity is susceptible to the learning effect. The learning effect may be described quantitatively by an exponential function which relates the resources required to produce one unit to the total number of units produced. One commonly observed learning-effect function has the resources required per unit produced decreasing by 20 per cent each time the production quantity is doubled. Thus, if the first unit produced required $10 million in resources, the second unit would require $8 million, the fourth unit $6,400,000, and so on. These costs, plotted on a vertical axis against total units produced on the horizontal axis, represent a learning curve.

The learning effect concept of cost measurement may be compared with the standard cost concept in managerial accounting. A standard cost normally is held constant in the short run, subject to the effects of discretionary management decisions and externally imposed price changes of specific resources. The learning model holds that the cost of resources included in a product in addition is affected by other variables that are controllable by the firm. The standard cost concept implicitly assumes that the learning effect (if it exists) has been realized; i.e., that the firm is operating on that segment of the learning curve that is asymptotic to the horizontal axis. To restate it another way, a standard cost is a “mature” cost; the assumption is that sufficient experience has been gained so that any further learning effect is negligible. In contrast, the learning-effect model explicitly states that many of the operations and resource commitments involved in a producing situation (particularly where the product involves complex operations and the production run is limited) are continuously subject to the learning effect as more and more units are produced. The learning-curve model does not assume a mature cost as the ongoing situation. If the conventional concept of standard cost is utilized in developing the cost budget for manufacturing in a situation where the learning effect is significant, the budget standards are apt to be excessively liberal and the resultant variances in performance reports misleading. The inclusion of learning-effect models in the development of manufacturing cost budgets in “immature” situations clearly should serve to improve managerial planning and control of operational costs.

Classifying activities

At any one point in time, not all activities of a firm are subject to the learning effect. Those activities which are subject to the learning effect should be identified and evaluated so that relevant cost concepts can be applied to them in the profit planning and control process. Activities that are subject to learning curve analyses are:

1. Those that have not been performed or have not been performed in their present operational mode. In contrast, any activity which has long been performed by the firm in a particular way is not subject to the learning effect.

2. Those which are being performed by new workmen, new employees, or others not familiar with the particular activity. In contrast, activities being performed by experienced workmen thoroughly familiar with those activities will not be subject to a learning effect.

3. Those involving utilization of raw materials which have never been used by the firm before, or never have been used in this particular fashion by the firm. In contrast, familiar and regularly used materials generally do not reflect the learning effect.

4. Those production runs which are of short duration, especially if there is a possibility of follow-on production runs (by short duration we mean perhaps less than 10,000 units although “short” is a relative concept).

Curves vary widely

From the control point of view the learning effects should be identified with responsibility and decision centers primarily associated with service or overhead operations. In general, one should not expect that normal service or overhead operations will be subject to a learning effect in a significant degree since they tend to be routine and to be continuously performed in essentially the same manner for long periods of time. However, exceptions should be anticipated such as the maintenance of new types of equipment; in such cases maintenance in the early periods is likely to be significantly less efficient than maintenance after a record of experience is attained. The supervisory function initially is apt to be subject to a learning curve effect; for example, when a
new plant is acquired supervision initially may be less efficient than after the plant has been in operation for a period of time.

In applying learning curve models it is important to recognize that not all learning effects can be described by the same quantitative formulas although some formulas do have wide application. For example, the "50 per cent learning effect" has been found to be widely applicable to a variety of simple manufacturing operations. It may be applicable in the aggregate to the assembly of a product that involves a large number of independent operations, each individually subject to a different learning effect. Yet there are a number of situations where the 50 per cent curve would be inappropriate.

Although there are many instances of complex mathematical analysis in the literature with respect to the learning effect, one of its pragmatic attractions is that it can be described simply and applied with a minimum of mathematical sophistication. The essential technique employed is to plot certain selected values on log-log paper (graph paper on which the scales are expressed in terms of logarithms rather than absolute values). The learning effect may be expressed as a straight line on log-log paper; therefore, only two points (or one point and a slope) are necessary for plotting. Each point plotted will represent values for a pair of variables: first, the dependent variable—the measure, in dollars or other units, of the resource used; second, the independent variable—the measure of output, usually the number of units produced. The terms "resource used" and "number of units produced" are generalizations and are used to suggest definitional requirements appropriate to each particular application. (As another example see Figure 1 on page 49.)

Two-cycle log-log paper generally is adequate for these purposes. Once the required initial data are obtained and plotted, the resource input for each individual unit in a production run can be read directly from the graph. Since direct reading is tedious it is generally preferable to employ a formula for estimating the total resource input for any given number of units produced.

**Formula for resource input**

The formula for the resource input (Y) of the xth unit in a production run is:

\[ Y_x = Y_1 \cdot x^n \]

where \( Y_1 \) = resource input for the first unit in the production run, and \( n \), the learning constant, is

\[ n = \frac{\ln (1-K)}{\ln 2} \]

where \( K = \) fractional reduction in resource required per unit for each 100 per cent increase in total units produced.

The cumulative resource input is:

\[ \Sigma Y = Y_1 + Y_2 + \ldots \text{ etc.} \]

If \( N \) units are to be produced, this expression may be integrated from \( x = 0.5 \) to \( x = N + 0.5 \) to give

\[ \Sigma Y = T_N \approx \frac{Y_1}{1-n} \left[ (N+0.5)^{1-n} - (0.5)^{1-n} \right] \]

which is the desired formula.

This formula can be modified to give the average cost per unit in a production run which is subject to the learning effect:

\[ \Sigma Y_0 = \frac{Y_N}{N} \approx \frac{Y_1}{N(1-n)} \left[ (N+0.5)^{1-n} - (0.5)^{1-n} \right] \]

Consider the following brief example which illustrates utilization of these formulas:

Let \( Y_1 = 962 \) direct labor hours (DLH)

\[ K = 0.18 \]

\[ x = 12 \text{th unit} \]

\[ N = 24 \text{ units of output} \]

\[ \ln (1 - 0.18) = \ln 2 \]

\[ = 0.198 \]

\[ = -0.286 \]

\[ = 0.694 \]

\[ Y_{12} = 962 \cdot 12^{-0.286} = 962 \cdot 0.49 \]

\[ Y_{12} = 471 \text{ DLH} \]

The total DLH requirement for 24 units is approximately

\[ T_0 \approx \frac{962}{0.18 - 0.286} \left[ (24 + 0.5)^{1 - 0.286} - 0.5^{1 - 0.286} \right] \]

\[ \approx 1350 \text{ (9.2)} \]

\[ \approx 12400 \cdot 11.14 \]

The average number of DLH in each of these first 24 units would be

\[ Y_{24} = \frac{12400}{24} = 517 \]

(\( 24 \) (compare this with the 962 DLH in the first unit))

The primary difficulty in measuring the learning effect is development of the initial data (values for \( Y_1 \) and \( K \)) that are required to formulate the relevant models.
Incorporation of the learning effect in the budgetary process introduces a complexity somewhat greater than when standard costs are utilized...effective use of the nonlinear cost function is a skill that the budget executive should acquire. The budget executive should be competent to select and apply relevant learning models to those costs which should reflect a significant learning effect and to incorporate them in a budget along with costs that do not involve a learning effect.

Cost projections frequently must be developed prior to the production of a single unit. In such circumstances, the resource input for the first unit, or the average cost in a production run, may be unreliable. There is little help that we can provide to resolve this rather sticky problem, except to note that through experience many firms have developed their own heuristics for estimating its significance.

For example, the quantity \( n \) in the preceding formulas is termed the “learning constant.” The learning constant tends to be stable within certain classes of activity; a repetitive activity such as “fitting” might justify a constant of .9; and for another activity such as “painting” the constant might be .75. As a consequence, when a new product is produced, these two learning constants should be appropriate for “fitting” and “painting” if these two activities are required to produce the new product. When a totally new operation is to be performed for the first time it may be possible to conduct pilot runs of the new operation—and from these runs useful estimates of the learning constant may be made.

Absolute precision impossible

With respect to the value of \( K \) in a given production run we must observe that it is practically impossible to develop absolutely precise estimates. However, the accountants, budget executives, and engineers who work cooperatively to prepare cost projections usually can specify \( K \) with sufficient precision to provide, on the average, a usable learning effect description.

Incorporation of the learning effect in the budgetary process introduces a complexity somewhat greater than when standard costs are utilized. The nonlinear relationships explicit in learning curve theory require some added sophistication; effective use of the nonlinear cost function is a skill that the budget executive should acquire. The budget executive should be competent to select and apply relevant learning models to those costs which should reflect a significant learning effect and to incorporate them in a budget along with costs that do not involve a learning effect.

How to budget

For example, consider the problem of budgeting by quarters. Let us assume that in each quarter 100 units of a particular new product will be produced. In the first quarter costs of production subject to the learning effect will be higher than they will be, say, in the fourth quarter. Assuming stable quarterly production, it would be unrealistic to allocate the total estimated manufacturing costs for the year in equal amounts to each quarter should some of those costs involve a learning effect. Rather, the learning-curve costs should be separately evaluated and projected by quarter and then combined with those costs not subject to the learning effect. Consequently, the resultant budget variances are apt to be more useful as instruments of effective managerial control. The same procedure should be applied by weeks if budget variances are reported in that time dimension. Budgeting learning-effect costs in this way serves to explain to management many mysteriously occurring variances whose causes are not suggested by the conventional variance analysis. It is also possible to compute a “learning-effect variance” to measure whether incurred costs subject to the learning effect reflect an acceptable level of improvement in the performance of the activity.

To appreciate the potential influence of the learning effect on managerial decisions, consider the implications in a situation where standard or budget costs have not incorporated the learning effect. Significant variations are apt to be reported, creating concern and misunderstanding by the management. The management might be
...provoked to unwise decisions (such as overpricing a new product) that application of learning-curve theory could have prevented. High costs during the early production period also may be accepted as representative and used as a basis for budget projections, thereby tending to deprive the firm of potential cost reductions due to the learning-curve effect.

When budgeting for the learning effect it is important to identify other factors that affect learning-curve costs. Some of these factors tend to offset, and thereby submerge the learning-curve effect. Inflation and price changes affecting specific resource inputs may escalate the cost of material or labor as much as 15 per cent in a single year. In some situations it might be desirable to develop an index of prices to compensate for inflation and price changes in the cost estimation models.

Several uses of cost data that have been adjusted for the learning effect were suggested in the preceding paragraphs. The use of cost data adjusted for the learning effect potentially can also enhance the accuracy of cost-volume-profit analyses and provide more realism in the establishment of the pricing policies of the firm.

To illustrate in moderate detail one application of cost data (adjusted for the learning effect) in the development of pricing policy assume a fact situation in which a firm was preparing a bid on a contract to produce diesel engines. There was a strong possibility of a follow-on production run. The learning effect was substantial, but the firm was not aware of the learning effect and other firms with which it was competing for the contract presumably were aware of this effect.†

The Sampson Machine and Tool Company was a custom machine and tool manufacturer. The company was preparing a bid for a production contract for eight large diesel engines incorporating newly designed features. There was a strong possibility of a follow-on order for eight more. John Brown, manufacturing cost analyst, developed manufacturing cost estimates for the engine contract based on standard costs. His estimate was:

First engine direct costs $200,000
Each subsequent engine, direct costs 180,000
Total Direct Costs $1,460,000
Conversion Costs and Profit at 100 per cent of Direct Costs $1,460,000

Total Bid, First Contract $2,920,000
Total Bid, Second Contract $2,900,000

Glen Campbell, director of marketing services, was concerned when he heard (reliably) that a competing firm was planning to submit a bid of $2,500,000 for the first contract and $2,000,000 for the

†This illustration is based on a case prepared by one of the authors and appearing in Short Cases in Managerial Accounting, Prentice-Hall, Inc., 1970.

FIGURE 1

Conditional Costs per Unit versus Total Number of Diesels Produced

March-April, 1970
Published by eGrove, 1970
second contract. These bids were far below the prices that Mr. Brown felt Sampson would have to obtain in order to realize an acceptable profit.

Mr. Campbell felt that "something" had been overlooked in preparing the Sampson bid. "Surely," he said, "it doesn't cost as much to make the eighth unit as it costs to make the first or second unit, and our figures don't take that into account."

"You may be right," said Brown. "We have never been too successful in bidding on high-cost, low-volume production contracts, either. However, we have quoted average costs." The two men agreed to call in Tom Sawyer, a quantitative analysis specialist from the engineering department. After reviewing the situation, they asked him to "analyze the facts and let us have your suggestions."

Within two days Mr. Sawyer was back. "Look," he told them, "here are some cost figures from the Robbins contract, which was similar to this diesel affair. Our direct costs on the first unit were $34,000, and for the second unit, $26,800, and so on. Now, as I see it, approximately $24,000 of the costs on the first unit were subject to the learning effect, which means that they decreased as experience was gained. Let's call these our "conditional" costs, that is, costs subject to the learning effect. I estimate there were $16,700 conditional costs on the second Robbins unit, and so on down to $6,750 on the twelfth and last unit. Note here that all these points fall in essentially a straight line on this log-log paper."

"What about the costs not subject to this learning effect?" asked Brown. "What happens to them?"

"They just stay about the same; they aren't particularly affected by experience. Now the interesting thing is that I plotted this straight line on the log-log paper with conditional costs against total units produced for several other recent contracts, and each time I got a line with a slope of about - 0.7."

"Are you implying that the slope of the line for conditional costs versus total production on our diesel contract would be the same?" asked Campbell.

"Yes, and I have assumed a slope of - 0.7 in preparing this other graph (Figure 1 on page 49) for the diesel contract," Sawyer answered. "I assumed that the first-unit cost would be $200,000 in direct costs; that $20,000 of direct costs would not be subject to the learning effect; and that none of the conversion costs and profit would be subject to the learning effect."

Sawyer continued: "Note that the vertical axis is in dollars of cost per engine produced. The horizontal axis is scaled in engines produced. The line intercepts the vertical axis at $180,000, which is the avoidable direct cost on the first engine. The line was plotted by computing the conditional direct cost of the first, second, fourth, eighth, and sixteenth units. Each of these was computed as 0.7 of the cost immediately preceding it. The figures on the other sheet (Figure 2 at left) summarize the computation of bids from the graphs."

After glancing at the sheet (Figure 2) Campbell said: "Does this mean that you are prepared to suggest what our bid prices should be?"

"Obviously," Sawyer responded, "these are suggested bids that I have developed, and the bids of $1,863,580 and $1,108,000 will beat the competition's bids of $2,500,000 and $2,000,000, and we would still do okay on the profits. In fact, if the information about the competitive bids is reliable, and if those would be the low bids without Sampson, sound bidding strategy would indicate that the bids I have computed could be inflated somewhat to provide additional profit and less money left on the table. You should bear in mind that the costs will not behave this way because a learning model indicates they should, but that the model describes objectively an observed phenomenon. It would be up to us to meet the learning-curve targets."

![FIGURE 2](https://egrove.olemiss.edu/mgmtservices/vol7/iss2/10)
Sometimes, in variance analysis, the addition of the sub-variances differs from the total variance. This discrepancy can be eliminated by using the accounting method described in this article.

VARIANCE ANALYSIS—
THE ‘STEP-THROUGH’ METHOD

by Fred M. Kirby

Pittsburgh Coke & Chemical Co.

There are many reasons why actual profits are different from those anticipated. Determining these reasons is an important first step toward increasing profits. Variance analysis techniques attempt to determine these reasons by breaking down the total profit variance into meaningful segments which can then be analyzed. The breakdown of the total variance will vary with the situation but can be as fine as desired, consistent with cost and time considerations.

The objective of this report is not to determine a meaningful variance breakdown but to determine how the variances should be computed once a specific breakdown has been decided upon. This objective will be met by taking a look at the ABC Company, which has a direct cost system and utilizes a relatively simple budgetary control system. The analysis of the ABC Company’s performance for January, 1969, will illustrate the “step-through” method of breaking down the total variance into various sub-variances.

In breaking the total variance down into sub-variances, the analyst oftentimes encounters a problem of inconsistency—the sub-variances do not always add to the total variance. Yet, one knows that the sum of the sub-variances must equal the total variance if the total variance (and no more than the total variance) is to be accounted for. It is this problem that the “step-through” method eliminates.
EXHIBIT I

<table>
<thead>
<tr>
<th>ABC Company</th>
<th>Profit &amp; Loss Statement</th>
<th>January, 1969</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variances</strong></td>
<td><strong>January</strong></td>
<td><strong>Budget</strong></td>
</tr>
<tr>
<td><strong>Volume (Units)</strong></td>
<td>130</td>
<td>150</td>
</tr>
<tr>
<td><strong>Sales Revenue</strong></td>
<td>$1200</td>
<td>$1410</td>
</tr>
<tr>
<td><strong>Variable Costs</strong></td>
<td>600</td>
<td>660</td>
</tr>
<tr>
<td><strong>Gross Margin</strong></td>
<td>600</td>
<td>750</td>
</tr>
<tr>
<td><strong>Fixed Costs</strong></td>
<td>200</td>
<td>250</td>
</tr>
<tr>
<td><strong>Income Before Taxes</strong></td>
<td>$400</td>
<td>$500</td>
</tr>
</tbody>
</table>

Exhibit I above is a comparison of January's profit and loss statement against the budget for the ABC Company. Exhibit II below shows some of the details underlying Exhibit 1. As can be seen, January's Income Before Taxes was $100 lower than budgeted. It is the analyst's job to break this variance down in an attempt to determine its causes. For simplicity, it is assumed that the ABC Company computes only five variances, i.e., Volume, Mix, Market Price, Direct Cost, and Fixed Cost. (Bear in mind that each of these major variances could be broken down further depending on the sophistication of the control system.)

In the example of the ABC Company, the $(100) unfavorable variance would be broken down as follows:

```
Volume $ (100)
Mix (20)
Market Price 10
Direct Cost (40)
Gross Margin Variance $ (150)
Fixed Cost Variance 50
Total Variance $ (100)
```

There should be no question about the computation of the Fixed Cost Variance, which is merely the difference between the budget and actual Fixed Costs ($250 - $200 = $50). However, the sub-variances making up the Gross Margin Variance (i.e., Volume, Mix, Market Price, and Direct Cost) are another story. In the case of the ABC Company, the variances are interrelated and must be assigned some way (preferably in a rational and consistent manner). The determination of these variances is as follows:

**Volume Variance**

The Volume Variance was computed by subtracting the budgeted volume from the actual volume and multiplying the difference by the average budgeted margin per unit. (See Figure 1, page 53.)

**Mix Variance**

The Mix Variance was computed by: (1) determining what the mix of products would have been if the total actual unit sales (130 units) had been in the same ratio as the budgeted sales; (2) subtracting the unit sales so derived from the actual unit sales of each product; (3) multiplying the difference by the budgeted margin per unit; (4)

---

Some analysts argue that the volume calculation should include the mix effect of different margins at the different levels of activity. That concept would result in a recategorization of part of the mix variance to the volume variance in the method illustrated.

EXHIBIT II

<table>
<thead>
<tr>
<th>ABC Company</th>
<th>Profit &amp; Loss Statement—Backup</th>
<th>January, 1969</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product</strong></td>
<td><strong>Volume</strong></td>
<td><strong>Market Price</strong></td>
</tr>
<tr>
<td><strong>Units</strong></td>
<td><strong>(Units)</strong></td>
<td><strong>Per Unit</strong></td>
</tr>
<tr>
<td>1</td>
<td>60</td>
<td>$10.00</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
<td>6.00</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>15.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>130</td>
<td>$ 9.23</td>
</tr>
<tr>
<td><strong>Budget</strong></td>
<td>150</td>
<td>$9.40</td>
</tr>
</tbody>
</table>

https://egrove.olemiss.edu/mgmtservices/vol7/iss2/10
adding the variances was computed. (See Figure 2, below.)

**Market Price Variance**

The Market Price Variance was computed by multiplying the actual volume of each product by the difference between the actual and budgeted market price for each product. (See Figure 3, below.)

difference between the actual and budgeted variable cost per unit. (See Figure 4, below.)

In the above illustration, notice how the computations progressed. (See Exhibit III, next page.) The analysis started from Point A (Budgeted Volume, Budgeted Mix, Budgeted Price, and Budgeted Cost) and moved to Point B (Actual Volume, Budgeted Mix, Budgeted Price, and Budgeted Cost), and in the

---

**FIGURE 1**

<table>
<thead>
<tr>
<th>Actual Volume</th>
<th>Budgeted Volume</th>
<th>Difference</th>
<th>Avg. Budgeted Margin Per Unit</th>
<th>Volume Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>150</td>
<td>20</td>
<td>$5.00</td>
<td>$(100)</td>
</tr>
</tbody>
</table>

**FIGURE 2**

<table>
<thead>
<tr>
<th>Product</th>
<th>*Budgeted Mix of Products</th>
<th>Total Actual Unit Sales</th>
<th>Actual Volume at Budgeted Mix</th>
<th>Actual Volume at Actual Mix</th>
<th>Budgeted Margin Per Unit</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>46 1/2%</td>
<td>X</td>
<td>130</td>
<td>60.7</td>
<td>0.7</td>
<td>$6.00</td>
</tr>
<tr>
<td>2</td>
<td>33 1/3%</td>
<td>X</td>
<td>130</td>
<td>43.3</td>
<td>6.7</td>
<td>$3.00</td>
</tr>
<tr>
<td>3</td>
<td>20%</td>
<td>X</td>
<td>130</td>
<td>26.0</td>
<td>6.0</td>
<td>$(6.00)</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td></td>
<td>130.0</td>
<td></td>
<td></td>
<td>$(20)</td>
</tr>
</tbody>
</table>

**FIGURE 3**

<table>
<thead>
<tr>
<th>Product</th>
<th>Actual Market Price</th>
<th>Budgeted Market Price</th>
<th>Difference</th>
<th>Actual Volume</th>
<th>Market Price Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$10.00</td>
<td>$10.00</td>
<td>$0</td>
<td>60</td>
<td>$0</td>
</tr>
<tr>
<td>2</td>
<td>6.00</td>
<td>7.00</td>
<td>(1.00)</td>
<td>50</td>
<td>(50)</td>
</tr>
<tr>
<td>3</td>
<td>15.00</td>
<td>12.00</td>
<td>3.00</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>130</td>
<td>$10</td>
</tr>
</tbody>
</table>

**FIGURE 4**

<table>
<thead>
<tr>
<th>Product</th>
<th>Budgeted Variable Cost/Unit</th>
<th>Actual Variable Cost/Unit</th>
<th>Difference</th>
<th>Actual Volume</th>
<th>Direct Cost Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$4.00</td>
<td>$5.00</td>
<td>(1.00)</td>
<td>60</td>
<td>$(60)</td>
</tr>
<tr>
<td>2</td>
<td>4.00</td>
<td>4.00</td>
<td>0</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>6.00</td>
<td>5.00</td>
<td>1.00</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$(40)</td>
</tr>
</tbody>
</table>

* Determined by dividing the budgeted volume of each product by the budgeted total volume (i.e., 70 ÷ 150 = 46 2/3%, 50 ÷ 150 = 33 1/3%, 30 ÷ 150 = 20%).

**Essentially, this says that the ABC Company is selling more of a lower-margin product and less of a higher-margin product, resulting in an unfavorable variance.**
EXHIBIT III
ABC Company
Progression of Variance Computations

<table>
<thead>
<tr>
<th>Volume Variance</th>
<th>Mix Variance</th>
<th>Market Price Variance</th>
<th>Direct Cost Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Budgeted Volume</td>
<td>B Actual Volume</td>
<td>C Actual Volume</td>
<td>D Actual Volume</td>
</tr>
<tr>
<td>B Budgeted Mix</td>
<td>B Budgeted Mix</td>
<td>C Actual Mix</td>
<td>D Actual Mix</td>
</tr>
<tr>
<td>B Budgeted Price</td>
<td>B Budgeted Price</td>
<td>C Actual Price</td>
<td>D Actual Price</td>
</tr>
<tr>
<td>B Budgeted Cost</td>
<td>B Budgeted Cost</td>
<td>C Budgeted Cost</td>
<td>D Budgeted Cost</td>
</tr>
<tr>
<td>E Actual Volume</td>
<td>E Actual Mix</td>
<td>E Actual Price</td>
<td>E Actual Cost</td>
</tr>
</tbody>
</table>

process the Volume Variance was computed. In this first step, the analysis progressed from Budgeted Volume to Actual Volume—the Budgeted Volume was not used again in this analysis. In the second step, the analysis moved from Point B (Actual Volume, Budgeted Mix, Budgeted Price, and Budgeted Cost) to Point C (Actual Volume, Actual Mix, Budgeted Price, and Budgeted Cost), and in the process the Mix Variance was computed. In this step, the analysis progressed from the Budgeted Mix to the Actual Mix—the Budgeted Mix was not used again in this analysis. In the third step, the analysis moved from Point C (Actual Volume, Actual Mix, Budgeted Price, and Budgeted Cost) to Point D (Actual Volume, Actual Mix, Actual Price, and Budgeted Cost), and in the process the Market Price Variance was computed. Here, the analysis progressed from the Budgeted Market Price to the Actual Market Price—the Budgeted Market Price was not used again in this analysis. In the final step, the analysis moved from Point D (Actual Volume, Actual Mix, Actual Price, and Budgeted Cost) to Point E (Actual Volume, Actual Mix, Actual Price, and Actual Cost), and in the process the Direct Cost Variance was computed.

Notice that the computations progressed from the "pure budget" (Point A) to the "pure actual" (Point E) and that each variance that was computed was calculated by changing one factor (volume, mix, price, cost) and only one factor. Furthermore, each change was permanent; i.e., the factor never reverted back to its original state. For example, in computing the Volume Variance, the analysis moved from the budgeted volume to the actual volume and the actual volume was used for the duration of the analysis; in computing the Mix Variance, the analysis moved from the budgeted mix to the actual mix and the actual mix was used for the duration of the analysis; and so on. In this manner, the total variance was accounted for in a rational and consistent manner.

Fine breakdowns
Although this illustration was highly simplified, the concept of the "step-through" process described above can be utilized regardless of how finely the total variance is broken down. Indeed, when the breakdown is very fine the "step-through" method is the only way to account for the total variance accurately.

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https://egrove.olemiss.edu/mgmtservices/vol7/iss2/10
Cost, volume, and profit decisions—despite the fact that they are vital to any business—are perhaps determined less scientifically than any others. Here's a suggested formula for systematizing—

COST-VOLUME PROFIT ANALYSIS

by David O. Jenkins

University of Southern California

A generalized formula approach to cost-volume-profit analysis can serve as a foundation on which to build a systematic pattern of data gathering and can be applied to companies of varying sizes in various industries. Such a formula can be derived from the behavior of a few basic variables and can be applied by computer.

Cost-volume-profit analysis is, of course, relevant to many questions that management must answer. What volume and mix of products or services constitute the optimum profit plan? What prices must be charged to provide a sufficient contribution toward coverage of fixed costs and generation of adequate net income? What is the maximum cost that could be paid to an outside manufacturer in lieu of internal production? What ceiling must be placed on discretionary expenditures that are nonvariable in relation to volume? What profit will result from a specified combination of quantities, prices, and costs?

A systematic data gathering approach is needed to provide answers to questions such as these, but is often absent in practice. A research monograph recently published by the National Association of Accountants suggests that executives in small and medium-size manufacturing firms "could attempt to become more orderly in their general decision-making activities" and "could begin to use more of the concept, theory, and techniques (such as contribution margin analysis) of managerial accounting in their decision activities."1 Replies to a questionnaire indicate the following average order of importance of various operating decisions:2

1. Cost-volume-profit analysis
2. Product pricing
3. Financial budgeting
4. Capital equipment analysis
5. Inventory control
6. Make-or-buy products or components

However, "research indicated that in the decision areas of cost-

2 Ibid., p. 57.
Care must be taken to identify properly the pattern of cost or revenue behavior. For example, it would not be appropriate to include in V variable cost per unit sales commissions based on a percentage of dollar sales. Such commissions would vary with selling prices as well as with units sold.

volume-profit analysis, inventory control, and make or buy, no set procedures are followed by decision-makers,” whereas in the other decision areas “evidence indicates some pattern in the gathering of data and the rendering of a decision.” It is noteworthy that the most important area of cost-volume-profit analysis (along with the two areas judged least important) was found to be lacking in a systematic pattern of data gathering. Detecting the relationships among the variables involved would make a considerable contribution toward filling that gap.

The basic formula

Careful consideration reveals that, among all of the seemingly diverse questions requiring cost-volume-profit analysis, there are only five basic variables, and that a generalized formula involving these variables can provide a framework for the systematic gathering of relevant data, regardless of the nature or size of the business involved. The basic equation is:

\[ Q (P-V) = F + I \]

where:

- \( Q \) is quantity or volume in units
- \( P \) is selling price per unit
- \( V \) is variable cost per unit
- \( F \) is fixed cost in total
- \( I \) is income or profit

Multiple sources of income can be represented by:

\[ Q_1(P_1-V_1) + Q_2(P_2-V_2) + \ldots + Q_n(P_n-V_n) = F + I \]

“\( F \)” is placed on the right side of the basic equation because it is a nonvariable sum unaffected by the mix of revenue sources. Any attempt to reduce it to per unit terms is artificial and may be misleading.

The general formula can be applied to various types of businesses. The multiple sources of revenue on the left side of the equation could represent various products, services, rental units, admission prices, or whatever is involved in the business under consideration.

The use of a formula must not be allowed to convey the impression that specific solutions can be determined with absolute precision. Most costs are mixed costs which include both fixed and variable elements. Even purely fixed or variable costs may be subject to random variations. The relation between selling price and volume is seldom known more than roughly, and demand is generally unpredictable. Cost-volume-profit analysis must be preceded by and supplemented by other techniques such as market surveys to help forecast sales and regression analysis to identify when and how costs vary. However, despite its admitted limitations, cost-volume-profit analysis is still deemed to be very useful, as evidenced by its number one ranking in the survey mentioned earlier. Furthermore, there does not appear to be any limitation involved in a formula approach which is not inherent in the very nature of cost-volume-profit analysis itself.

Care must be taken to identify properly the pattern of cost or revenue behavior. For example, it would not be appropriate to include in “\( V \)” sales commissions based on a percentage of dollar sales, because such commissions would vary with selling prices as well as with units sold—with “\( P \)” as well as “\( Q \)” whereas “\( V \)” is defined as cost which varies only with units—only with “\( Q \)” Commissions should be treated as a reduction of “\( P \)”.

Occasionally certain data may not seem to fit anywhere in the suggested equation. For example, lease revenue may consist of a fixed minimum amount plus an additional amount varying with sales of the lessee. Where does the basic formula provide for “fixed revenue”? The answer is to treat such revenue as an offset to fixed costs. Thus, “\( F \)” is to be thought of as a net fixed dollar outlay.

\( ^8 \) Luoma, op. cit., p. iv.
Once problem data are identified in terms of the generalized formula, it is a relatively simple matter to rearrange the terms to solve for any unknown. Thus the equation for required quantity in units can be expressed as

\[ Q = \frac{(F + I)}{(P - V)} \]

and the formula for the breakeven point \((I = 0)\) is simply

\[ Q = \frac{F}{(P - V)}. \]

The breakeven point in dollars of revenue would be

\[ QP = \frac{F}{P}. \]

Note that the breakeven formula is just one of several possible variations of the basic equation and that the formula can be varied in other ways to assist in solving problems in which a target volume has been established and some other variable must be computed.

For example, the income that will result from a specified combination of volume, price, and cost factors can be determined as

\[ I = [Q(P - V)] - F. \]

Given cost data plus a target volume and profit, the formula for required selling price is

\[ P = V + \frac{(F + I)}{Q}. \]

The formula for maximum allowable variable cost per unit is

\[ V = P - \frac{(F + I)}{Q}. \]

Note the similarity of the two preceding equations, each of which requires computing a required constant margin per unit. If a similar problem occurs, the breakeven point is simply

\[ P = \frac{(F + I) - [Q(P - V)]}{Q} + V \]

where \(P\) is the required selling price of the second product.

Other examples could be given, of course, but the foregoing should be sufficient to illustrate the flexibility and applicability of the generalized formula. Although the last example was stated in terms of multiple products, it could just as well have been applied to multiple services or other sources of income as noted previously. In other words, the generalized formula is applicable to a variety of situations involving one or more categories of revenue and related cost.

The use of a basic equation also facilitates the preparation of a computer program for solving cost-volume-profit problems. A more realistic situation involving many products or services would not increase the number of basic variables or the relationships among them and a computer simulation should be quite feasible.

Cost-volume-profit analysis is useful in helping management deal with a wide range of questions, but a systematic data gathering approach is needed to facilitate such analysis. Since there are a limited number of basic variables involved, explicit recognition of these in the form of a generalized equation may help management establish a system that will provide relevant data in a form suitable for use in cost-volume-profit analysis for any size of organization. The larger the organization, the more effective the use that may be made of a computer.
what people are writing about

BOOKS


A curious mixture of factual reporting and blue sky forecasting, this book nevertheless contains a good deal of information that will be valuable to anyone who is professionally interested in any aspect of electronic data processing. Its appeal to the general reader, to whom it is ostensibly addressed, is questionable.

The information utility—or on line-real time computer service bureau—is already much closer to reality than most people realize, Mr. Sprague claims, and he offers plenty of evidence in this book to back up his statement. By analyzing various existing, proposed, and possible examples of information utilities at work, he attempts to predict the sort of impact this development will have on businessmen and consumers.

The information utility, in the simplest definition offered by Mr. Sprague, is a type of on line-real time system "in which a large number of individual users from many different organizations will be sharing a central data processing and memory complex. Each user will be supplied with a data terminal, or input-output device, connected directly to the center at the time of use." It differs from a conventional data processing service bureau in that it supplies information directly at the subscriber's own location in a format that he normally uses and in that payment usually is on a per transaction basis.

No single organization (or small group of organizations) has yet emerged as the information utility (comparable to telephone or power utilities); perhaps none ever will. However, to the extent that any OLRT system available to be

REVIEW EDITORS

In order to assure comprehensive coverage of magazine articles dealing with management subjects, Management Services has arranged with fifteen universities offering the Ph.D. degree in accounting to have leading magazines in the field reviewed on a continuing basis by Ph.D. candidates under the guidance of the educators listed, who serve as the review board for this department of Management Services. Unsigned reviews have been written by members of the magazine's staff.

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shared by more than one organization may be considered an information utility, a surprising number of them have already developed. In an appendix Mr. Sprague reproduces a list (undated) of 39 commercially oriented time sharing systems and 29 research-oriented ones now in operation.

These and other organizations are now providing a wide variety of services, ranging from billing, tax service, and credit information to employment placement, criminal intelligence, and tickets to sporting and theatrical events. In another appendix Mr. Sprague lists 34 types of service that have been offered or proposed; nearly all are already available.

**Services offered**

Savings account processing is available to nearly every savings institution in the United States. Professional billing services operate in nearly every large city. Three national services offer stock brokerage information. Medical and/or accounting data processing is available to hospitals in several parts of the country. Complete travel services is not yet available, but most of the pieces of it exist, and their combination is not far away. Only a few information retrieval systems are operating so far, but many are under development.

Most of these services are highly specialized, directed to a particular group or industry such as airlines, libraries, and railroads. A number of organizations, however, are seeking to operate as general purpose information utilities, providing service to many different kinds of subscribers. Among them are Keydata (probably the first), Western Union, ITT, General Electric, and Service Bureau Corporation. In addition, some of the time sharing systems that provide engineering problem solving service will probably evolve into general purpose utilities; the time sharing service, says Mr. Sprague, are "really the general purpose utility in its infancy."

Mr. Sprague presents detailed descriptions of four types of information utility service. Only one of them seems to be actually in operation in the form he describes (ticketing service). One, Personal Data Services (PDS), is apparently the service to be provided by the firm of which Mr. Sprague is now president, Personal Data Services Corporation; he fails to specify the state of its development, but the chapter is written in the future tense. Another (SAVE, for System for Automatic Value Exchange) is a funds transfer system somewhat similar to that provided by the Bank of Delaware.

The most interesting of the four systems to the accountant is Mr. Sprague's proposal for a national tax service that would maintain all tax records for the Internal Revenue Service and state and local governments. Individuals and corporations would enter their tax data directly into its equipment. Any errors or discrepancies would be pointed out by the machine immediately; the taxpayer would not have to wait for the IRS to return a reply.

Such a system, Mr. Sprague suggests, could be operated by the IRS. However, the "prevalent" fear of Big Brother might make it preferable for some independent organization to own the system. Then the various governments—plus law and accounting firms and all corporate and individual taxpayers—would be subscribers.

After a "semitechnical" section on considerations in the design of an information utility and a chapter that briefly touches on such questions as who should be permitted to operate information utilities, whether they should be regulated and by whom, and who should audit them, Mr. Sprague takes off into the forecasting sky. His final chapters attempt to predict the effect the availability of information utilities will have on daily life and business.

Most of his forecasts follow the pattern already made familiar by popularizers in the data processing field, but some of his ideas are provocative. For example, he feels that the problem of invasion of privacy—which already exists, he points out, to a much greater degree than most people realize—would be solved, not intensified, by the establishment of a national information utility for individuals. The reason is that a law protecting the rights of individuals and regulating access to data would be much easier to enforce against a single national information supplier than against the multitude of credit bureaus and grantors, government agencies, and the like now collecting data.

**Personal computers coming**

By the year 2000, Mr. Sprague predicts, information utility costs will have been reduced sufficiently and the market will have become large enough that a housewife should be able to have personal data service for no more than twice the amount of her telephone bill. By the early 1970's, he anticipates, the selling price of a cathode ray terminal should be down to well under $1,000, with rentals in the $10 to $25 a month range.

Fascinating though it is, this is a peculiar book in many ways. Its complete lack of any organization structure and the wide range of styles of writing employed suggest that it was assembled rather than written. It reads, in fact, as if Mr. Sprague had collected some writings of his own and some memorandum prepared by researchers (acknowledgment is given to the advanced business systems staff at Touche Ross & Co., where Mr. Sprague formerly was principal director in advanced business systems, for its research work) and combined them with some new material written to fill gaps and some transitional paragraphs to make a book.

One consequence for the reader is that he must read the entire book to find any specific information he may be looking for. A more serious consequence is that any reader,
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depending on his level of sophistication, is certain to find sections of the book either irritatingly simple and “popular” or beyond his comprehension.

The jacket blurb, preface, and some section introductions state flatly the book is aimed at the “general reader.” In certain sections the style is conversational and personal, with liberal use of the second person: “What is that you say? I have never done anything wrong and I have always paid my bills on time. OK, good for you, if it is true.” Yet other sections read exactly like a consultant’s report.

More seriously, these sections frequently introduce terms unfamiliar to the general reader without any explanation of them: multiprocessor, communications buffer, executive program. And the chapter on the market for information utilities (which explains how to conduct a market study, among other things) contains little that would be of interest to the general reader. Indeed, it is explicitly introduced as being “of special interest to current or potential owners and operators of utilities.”

On balance, the book is clearly for the specialist. For him it offers a good deal of reportorial-type information not readily available elsewhere and some provocative and stimulating ideas. Mr. Sprague is unquestionably one of the best informed men in the industry on information utilities, and those who are interested in this subject should not miss anything he writes.

Accountants traditionally have been interested in numbers rather than people. This is probably the reason the relation between them, although obviously important, has been so little explored until recently. Most of the systematic research in this field has been conducted in the last decade, and most of it is at least touched upon in this anthology.

The articles go from the general (communication theory, work motivation, and work group relationships) to the particular (applications to accounting). The accounting-related chapters focus on two major areas, the effect of accounting on management decisions (the results of varying accounting methods, the motivational impact of performance measurement, the influence of responsibility reporting) and the problems of gaining employee acceptance of budgetary goals, controls, and systems changes.

This book is a useful guide for anyone engaged in the practice of accounting, financial management, or systems design, if only to show, as the editors point out, how “little is known and much remains to be done” in the way of research in this subject.

(Four of the articles originally appeared in this magazine.)

Briefly listed


This anthology of articles on EDP and the accountant covers such subjects as basic computer concepts, auditing by EDP, internal control, systems planning and design, feasibility studies, organization, EDP applications, service bureaus, and simulation. Although the book is intended primarily as a supplementary readings text for college students, its value to the practicing accountant is obvious. Seven of the articles originally appeared in MANAGEMENT SERVICES.


This compilation of 40 articles on behavioral science and its relation to accounting is a sampling that stresses breadth rather than depth. It provides an excellent introduction to a relatively new field.

The Financial Executives Institute continues its defense of the existing pattern of pension systems and its opposition to new regulation.


Billed as the first book to present a unified theory of optimization, this book combines such mathematical elements as unconstrained optimization; nonlinear, linear, geometric, and dynamic programming; Pontryagin’s maximum principle; and block search procedure into a single theory of how to achieve the maximum gain or minimum loss in a rational manner. The authors say that the principal mathematics required is understanding of differential calculus. Even so, this book is not for the mathematically unsophisticated.

MAGAZINES


Mathematical models of specialized functions such as inventory control are getting fairly routine by now, and some operations researchers are turning their attention to corporation-wide models. This article reports the result of a survey of progress in this field.

Sixty-three companies—out of 333 member companies of the Planning Executives Institute that replied to a questionnaire prepared by this author—have corporate op-
erations research models in use or under development. Another 39 intend to begin development of such models within the next year.

This group, Mr. Gershefski notes in the article, includes nearly every company in the survey sample that has an operations research group. These companies vary widely in size, industry, and nature of business. Model building appears “to be a matter of individual initiative. Models appear to exist in those companies where someone has heard about them and has proceeded to ‘sell’ management.”

The models are used primarily to project statements of net income, capital expenditures, source and use of funds, and balance sheet. Their most common application is to evaluate alternative operating or investment strategies. Other applications frequently mentioned by the respondents are to provide revised financial projections rapidly, assist in determining feasible corporate goals, and analyze the effect of interacting items.

Nearly all the models are simulations (five per cent are mathematical programming, or optimization, models), and nearly all are deterministic (twelve per cent use probability distributions). Virtually all are computerized.

About one-third of the models were developed from the bottom up; the researchers started with a detailed model of a part of the company with the idea of expanding it function by function to cover the entire company. The rest began as relatively undetailed models of the total corporation.

On the average, Mr. Gershefski reports, it took 3.5 man-years to develop the first working version of a corporate model. The range was from .5 to 23 man-years.

More than 90 per cent of the survey respondents felt that the benefits derived from the model justified the effort expended to develop it. Indeed, 50 per cent reported that their management's gave more weight to conclusions derived from the model than to results of other analytical studies.


The Bureau of the Census has recently begun research aimed at developing a statistically adequate set of construction price indexes. This research is motivated by the inadequacy of the Department of Commerce’s “composite” construction cost index, the closest substitute for a comprehensive construction price index currently available. In this article, Mr. Musgrave describes recent Bureau research on price indexes for new single-family houses. The problems encountered and the approach used, as well as the validity of the resulting index, warrant the attention of all accountants considering the merits of replacement cost financial reporting.

Currently compiled construction indexes are deficient, according to this author, because, among other reasons, they (1) depend entirely on secondary data, (2) assume no change in productivity over time, (3) often suffer from improper weighting of wages rates and building material prices, and (4) use wage rates and prices which “frequently do not represent actual prices but rather some type of quoted or ‘normal’ price.” Furthermore, the present “composite” index, a Paasche index, measures not only the results of price changes but also changes over time in the relative importance of different types of construction. Consequently, Mr. Musgrave believes that a fixed-weight (Laspeyres) index would be more appropriate as an indicator of construction price movements.

Two major problems have impeded the derivation of a price index for new one-family houses: “(1) the separation of ‘pure price’ changes from changes in the ‘quality’ of houses and (2) the separation of value of site from the price of the house itself.” The second
difficulty can be eliminated by collecting sufficient data on site values. However, the first problem is conceptual in nature and plagues the construction of every type of index, general or specific.

**Characteristics chosen**

A great many characteristics determine the price of a house. After careful examination, the Bureau selected eight of these characteristics which seemed to account for a significant amount of price variability. By use of regression analysis, an equation was developed which explained about 70 per cent of the variability in house prices, assuming a constant “mix” of the eight characteristics. Index numbers were computed using the regression coefficients from the equation plus information regarding the proportion of houses having each given characteristic. This index is of the Laspeyres (fixed-weight) type with 1963 as the base year and 1964-65 as the weighting period.

**Accounting issues raised**

From an accounting standpoint, this article raises several important issues. First, currently existing construction price indexes are defective and may not provide reasonable estimates of replacement cost for use in current cost financial statements. Whether this is true of available specific indexes in general is conjectural. Second, most indexes ignore changes in quality over time. Mr. Musgrave’s regression approach provides a means of treating only one aspect of this problem, the importance of which varies depending on the commodity involved. Third, a specific type of index (e.g., Paasche, Laspeyres) must be chosen. Each has certain advantages and disadvantages. In addition, selection of the base year and weights will affect the resulting index numbers. All these factors must be evaluated in choosing the most appropriate index.

To summarize, the author describes the difficulties involved in developing an adequate price index for new single-family houses. Significantly, however, he demonstrates that a reasonably accurate index can be constructed if sufficient effort is expended. A careful reading of this article will give all accountants a better understanding of the practical and conceptual problems underlying the development of specific price indexes.


Many of the problems faced by the rapidly growing small business are symptoms of inadequate administrative systems. This article describes how such a company can proceed in improving these systems.

The imaginary Do-Right Manufacturing Company is presented in this article as a rapidly growing company with typical growing pains. Production delays, poor inventory control, and a tight cash position are among the problems that the directors now seek to alleviate. After months of discussion, the board has decided to seek the aid of an outside consultant.

Mr. Young believes that many of the problems afflicting Do-Right are symptoms of inadequate administrative systems. He presents a list of sample questions that can be used to identify such symptoms. The proper course of action for the Do-Right Manufacturing Company, he says, is to undertake a thorough review and analysis of the company’s administrative systems.

Such a review can be performed by management and supervisory personnel from within the organization, by outside consulting firms, or by a combination of both. The review may be limited in scope, or it may be extensive. The scope and the personnel used will generally depend on the financial and personnel resources available to the firm.

The process of improving systems can be divided into five stages: (1) fact-finding, (2) analysis, (3) definition of alternative and recommended solutions, (4) decision, and (5) implementation. Mr. Young describes each of these steps in the article.

Fact-finding consists of the collection of data relevant to the scope of the review. Analysis involves the orderly arranging of facts and data so that the nature of the existing problems and potential solutions to them can be discerned. The definition of alternative and recommended solutions involves the determination and comparison of: (1) immediate and long-range systems benefits in terms of increased efficiency, control, and quality of information, (2) relative costs, and (3) achievement of other goals.

Upon receipt of the consultant’s report, Do-Right enters the decision stage. Management must decide on the degree to which it will accept and implement the consultant’s proposals. The consultant recommends that the company hire a chief financial executive and a data processing manager, install a small computer, start preparing condensed and comparative reports of operations for management, and design a computer-based cost and inventory control system.

New systems and procedures can be implemented by a cutover process or a parallel process. In the cutover method, a cutoff date is established and all transactions subsequent to that date are processed under the new system. Under the parallel method, both old and new systems are operated for whatever period of time is necessary to assure that the new systems are functioning properly. Each approach has advantages and disadvantages, and these are discussed by the author. He concludes that in practice a combina-
Methods of Systems Installation

The author classifies administrative systems in which improvements can be made into four categories: (1) clerical, hand posted, and one-write systems, (2) auxiliary office equipment, (3) bookkeeping and accounting machines, and (4) in-house or service bureau computers. Illustrations of system improvement situations in each category are presented in the article. For example, microfilm is presented as a means for improving clerical efficiency by making it possible to locate and obtain copies of necessary documents rapidly and for substantially reducing the space costs of document storage.

Benefits listed

The general benefits of system redesign and procedural revisions are said by Mr. Young to include cost savings through personnel efficiency, cost savings through management control, profit growth through improved management decision making, and achievement of other company goals. The happy aftermath of the system improvements by Do-Right Manufacturing Company, as envisioned by the author, was the disappearance of many of the growing pains noted previously. The company had adequate working capital to pay suppliers on time; control of inventory and accounts receivable had been substantially improved; plant operations were more efficient; and the organization was more effective.

In the conclusion Mr. Young warns that many companies solicit advice only after it is too late to save the organization. The time for management to improve administrative systems, according to this author, is when the company's growing operations are basically sound and profitable. Systems improvement at this point in a company's growth will enable it to realize its true profit potential.

Eldon R. Bailey
Louisiana State University

Another Look at Depreciation Policies

The recording and reporting of depreciation of fixed assets has long been a topic of controversy, both inside and outside the accounting profession. This article provides a new perspective.

Historical-cost depreciation concepts are usually not adequate to describe the relationships among asset depletion, earning power preservation, and income measurement, the authors believe. They therefore propose a depreciation accounting system intended to measure the asset service potential used or expired in a period, measured as the amount of capital expressed in current dollars to produce the cash flow associated with use of all fixed assets during the period for which income is measured.

Principal objectives

The authors begin their analysis of depreciation policies by presenting seven objectives that have been suggested at one time or another for depreciation accounting:

1. To provide for the replacement in kind of worn-out assets
2. To provide for the replacement of original invested capital
3. To provide for maintenance of asset ability to produce cash flow
4. To provide for the recovery of the original (historical) cost of assets
5. To produce a taxable income figure that harmonizes with federal tax legislation
6. To "protect" cash flow sufficient in amount to cover the cost of financing assets
7. To provide for the replacement of asset service potential used or expired.

One or a combination of these objectives may be attained through various depreciation policies. According to the authors, a "depreci-


(A) Total Recovery
1. Dollar price paid (or equivalent) at time of acquisition
2. Dollar price paid at time of acquisition, expressed in dollars of the most recent balance sheet date
3. Replacement cost of asset services at the most recent balance sheet date
4. Capitalized decrement in earnings expectations resulting from holding and using an asset in the most recent time interval of account.

(B) Allocation
1. Uniformly to each operating period of the asset's useful life
2. Primarily to some fraction (segment) of the asset's useful life (such as the first part, etc.)
3. To a specified point in time, such as the time of acquisition or disposal
4. As a function of other variables, such as the financing schedule for the asset or entity-system parameters which are not necessarily related to specific assets.

Thirteen of the sixteen possible combinations of these elements, which form the set of plausible depreciation policies, are assigned to at least one of the previously suggested objectives for depreciation policies. The excluded combinations, namely, A4B1, A4B2, and A4B3, are rejected because they are logically inconsistent.

Preferred goals

As previously implied, a depreciation policy is always selected with some particular objective or objec-
Objectives in mind. The authors say they have observed that business managements often select Objectives 1, 2, 3, 5, and 6 as preferred objectives for depreciation policies. However, none of the feasible depreciation policies can satisfy more than one of these "preferred objectives." There are several groups, for example, taxing authorities, the public, and internal management, that require information of which a depreciation policy is an inherent part. The depreciation policy selected for reporting to each of these groups may vary, formally or informally. "Obviously, historical cost depreciation concepts (those beginning A1) [while being potentially acceptable for tax purposes] fail to accomplish any of the first three objectives. Indeed the propriety of listing these first three objectives might be considered suspect since many accountants would be chary about recognizing them as legitimate," the authors say.

Replacement objective

Thus rejecting further consideration of historical cost policies, the authors turn their attention to Objective 7, the provision for the replacement of asset service potential used or expired. They admit that Objective 7 is the most complex objective listed. They point out that "in an economy where general and specific prices are stable, Objective 3 (maintenance of cash flow) [which is a 'preferred objective'] would be in all respects equivalent to Objective 7. When prices are unstable, however, a given number of dollars will not, from period to period, represent the same ability to engage in exchange activity." The depreciation policy that fulfills both Objective 3 and Objective 7 is the one classified as type A4B4.

Example described

Summers and Griffin now proceed to describe an example of an A4B4-type depreciation policy. Their example groups assets of varying ages, lifetimes, and functions into "operational entities." A firm would consist of at least one entity. Once the operational entity is defined, a measure of the change in "capital," the depreciation charge, with respect to that particular operational entity may be determined. "Capital is an attribute of a scarce resource, namely, the present service benefit that is equivalent to all future service benefits from the resource." As a surrogate for change in capital, the authors choose net cash flow attributable to a particular operational entity multiplied by a factor "F," which is a measure of "how many dollars of capital investment are currently necessary to purchase one dollar of cash flow—as a function of industry, asset, and functional utilization."

Policies compared

Statements prepared using a straight line historical cost depreciation policy are compared with statements prepared using the Summers-Griffin proposed depreciation policy over an eight-year period for a property with an original cost of one million dollars. The comparison indicates that "if the United States adopted a measurement of depreciation based on diminished ability to produce cash flow, the payments to government and equity holders under present public policy would be drastically reduced."

Management use

In summary, it appears that the grouping of assets into operational entities and the analysis of their decrements in earning potential can provide useful information to management for resource allocation decisions. The Summers-Griffin system could easily be adapted to include increases in asset value resulting from conditions other than general price level changes. Such adaptation is accomplished via a negative "F," which, when multiplied by cash flow, produces an amount to be considered as income. There are difficult problems in determining meaningful values for the "F" factor, as well as for cash flow related to specific operational entities. "Yet the hope persists that if the concept of service potential measurement has superior merit, they [the authors], as well as others, will in the future be able to attack the problems of implementation with more directness."

Ronald S. Barden, CPA
The University of Texas

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