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SEPTEMBER-OCTOBER, 1968

MANAGEMENT SERVICES

a magazine of planning, systems, and controls

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"Business deserves consumer confidence"

This past year, American consumers made 3,296,293 calls to 126 Better Business Bureaus across the country.

For every *one complaint* there were *nine inquiries*—people who simply wanted to check on the reputation or reliability of a company, or find out about some business practice.

Compare that to 30 years ago, when the opposite was true: most people called the Bureaus to *complain.*

Besides, Bureau records show that not all consumer complaints are serious or justified. Frequently even serious complaints are the result of a company's unintentional mistake.

In the vast majority of cases, whether the mistake was intended or not, the Bureaus obtain *voluntary* corrections.

Despite these favorable signs, business today faces a crucial need to do a still better job of self-regulation of advertising and selling, and to do more to inform both government and the public concerning business progress in serving customers in the public interest.

Hence the Better Business Bureaus, drawing on their unique 54-year experience, have launched an expanded action program. It features these developments:

1. Expanded Service By Individual Bureaus. In city after city BBBs are broadening the geographic areas they serve, adding more telephone lines, installing automated filing and reporting systems—so they can give more consumers better and faster service.

Increasingly, individual Bureaus are called upon to testify before state legislatures.

In some cities, Bureaus are setting up Consumer Affairs Councils to provide local forums for discussion of consumer problems.

And each year new Bureau offices are opened.

All this costs money; but it demonstrates the spirit of a great business community which understands that it can survive only if it enjoys the confidence of its customers, and which will go beyond any possible law in protecting this relationship.

2. BBBs' Research and Education Foundation. Activated under the direction of a distinguished Board of Trustees, this foundation will conduct urgently-needed studies to shed the light of objective fact on issues of concern to consumers. Under its aegis the BBB will initiate new programs to protect both the consumer and the enterprise system.

3. Office of National Affairs. This office has been opened in Washington. It will use the goldmine of information gathered by Better Business Bureaus across the nation, providing federal officials—for the first time on a systematic, continuing basis—with reliable data based on more than three million consumer contacts per year.

It will also offer facts on how business regulates its marketplace activities in the public interest, and report back to business on government activities and plans affecting business-government relations in the consumer area.

4. Stepped-Up Mass Communication. This program will express industry's concern for the consumer, explain industry's self-regulation efforts, upgrade consumer buying skills, and increase public understanding of the enterprise system.

How can you as a businessman cooperate with this expansion program?

Bear this in mind: the heart of the BBB complex remains the individual Better Business Bureau.

It works to improve the business climate, to safeguard your community's buying power and maintain a market environment in which your business can operate profitably.

And it supplies data now being relayed to both federal and state governments to show why *business deserves consumer confidence.*

Write or call the manager of your nearest BBB. Tell him your reaction to the Bureaus' expanded action program. See how you can help to make it succeed. Association of Better Business Bureaus International, Chrysler Building, New York, New York 10017.

BBB®

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MANAGEMENT SERVICES

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George was a big man with his company. Until the phone rang.

George wished he could hide from his telephone. Instead, at the sound of the bell, he had to come out fighting. Fighting an endless battle against paperwork. Because nearly every call was a complaint about a lost order or late delivery.

Finally, the steel company George works for got tired of tying up one of their bright, young men as an inefficiency expert. So they called in Standard Register. And we designed an efficient new system for finished goods control. With forms to meet their specific needs.

Now George knows the day-to-day status of orders. He can give exact delivery dates. And acknowledge orders immediately. He's even learned to like Alexander Graham Bell.

Making paperwork move as smoothly as the rest of your operation is our specialty. We've been experts in the field for over 50 years.

If you've got a paperwork problem that stumps you, bet it won't stump us. Whether you make steel or soap. Whether you're big, small, or somewhere in between.

Just write Standard Register, Dayton, Ohio 45401 and we'll help bring your information system up to the minute. Doesn't that have a nice ring to it?

The Standard Register Company

people, events, techniques

Real Computer Payoffs Will Remain Limited If Technicians Continue to Control Applications, McKinsey Study Warns

Technicians rather than managers control the ways in which business computers are used in too many companies. As a result, such companies lose profits which they could otherwise earn.

This is the conclusion of a recent study by McKinsey & Co., the management consulting firm. The study involved 36 large U.S. and European companies in 13 different industries. Of the total, 25 had annual sales of $500 million or more and 15 had sales of $1 billion or more.

In terms of technical achievement, the study says, the computer revolution in U.S. business is outrunning expectations, but in terms of economic payoff on new applications, it is rapidly losing momentum. From a profit standpoint, the findings indicate, computer efforts in all but a few exceptional companies are in real, if often unacknowledged, trouble.

Potential untapped

Faster, costlier, more sophisticated hardware; larger and increasingly costly computer staffs; increasingly complex and ingenious applications: these are in evidence everywhere. Less and less in evidence, as these new applications spread, are profitable results. This is the familiar phenomenon of diminishing returns, the report notes. But there is one crucial difference: As yet, the real profit potential of the computer has barely begun to be tapped.

The report suggests that what has gone wrong lies in a failure to adapt to new conditions. "The rules of the game have been changing, but management's strategies have not."

Companies that continue to use their data processing machines as super clerks rather than apply them in solving critical management and operations problems probably will not be able to justify increasing computer costs, the report cautions.

In 1963, computer manufacturers shipped hardware worth $1.3 billion to their U.S. customers, and by

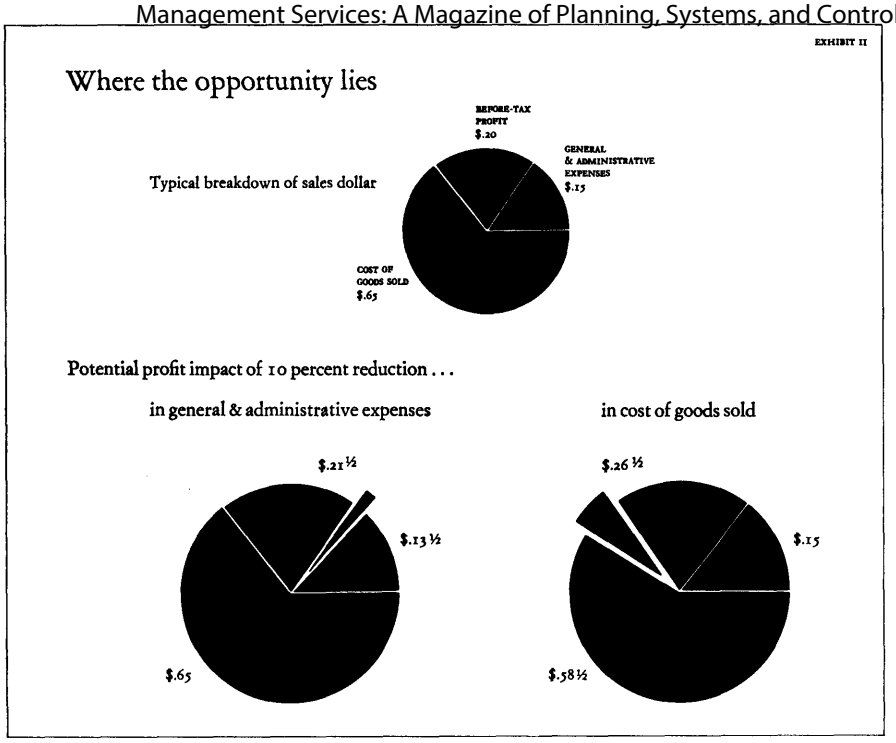


Chart from the McKinsey report shows where that company believes the true potential of computer savings is to be found: in decision making process.

1967, the value of computer shipments had risen to $3.9 billion, an increase of 200 per cent in four years. According to McKinsey, well over a hundred industrial companies have rental bills running into seven figures, and there are a handful whose total computer outlays approach $100 million a year.

The payroll component of the total outlay is rising more rapidly than the rental bills, the report states. Personnel cost is $187 for every $100 spent on hardware.

In a typical company, only 20 cents out of every dollar spent on computers goes toward development of new programs and applications.

This is a fraction of the per dollar amount spent on equipment (35 cents) or on computer operations (30 cents).

(The remaining 15 cents goes for updating current programs.)

The 20 cents spent on development expense can have an "enormous" leverage on future costs and benefits, the report says, because that money is the source of so many new applications.

"Unless management segregates these costs and understands the nature of the resources they buy," McKinsey warns, "the direction of future computer developments will be in doubt."

Problem solving urged

Use of the computer to solve management and operations problems is a fruitful, largely unused, means of raising profits, the study says. But it concludes that such new applications probably will not be exploited as long as the control of new applications is in the hands of computer specialists.

The people being asked to change their ways are executives in marketing, distribution, and production, not just account clerks. Some chief executives interviewed showed an enlightened awareness of their role; one was quoted as saying, "I ask my department heads to give me regular formal reports on their current successes and failures with computers and their future objectives. Right now they are a bunch of sheep with computers. I aim to convert them into enthusiasts, so that later I can be jockey, not herdsman."

In an interview with the *New York Times*, David B. Hertz, a director of McKinsey & Co., who was in charge of the study, stated, "Businesses are spending more on added computer capacity without really thinking through how to use what they already have . . . It's like building up a military arsenal without thinking out the strategy and tactics of how to use it."

Check list

Three principles, in the form of a check list for senior executives who are dissatisfied with the performance of their computer departments, are listed in the report:

(1) The rule of high expectations—do not settle for less than economic success.

(2) The rule of diversified staffing—the computer manager must command respect for both his personal stature and his professional skills; if he is good, his location in the organizational hierarchy doesn't matter.

(3) The rule of top management involvement—the chief executive cannot delegate his personal responsibility for the success of the activity. He must initiate the plans and see that the results are achieved.

The recent AICPA-sponsored conference of CPA Computer Users (reported in this issue, p. 52, and in the July-August issue, p. 49) will be followed by another computer user meeting this fall. The dates are November 12-13; the place, the Mariott-Twin Bridges Hotel, Washington, D.C.

Among the most stimulating parts of the conference were the question and answer sessions that followed most talks. Unfortunately, the MANAGEMENT SERVICES report had to be prepared from a transcript of the conference, and these sessions could not be reported this time.

Need to Standardize Computer Languages Will Intensify As Use of Time Sharing Grows; NBS Report Urges Action

The growth of time sharing makes the need for standardization of computer languages even more acute. That is the conclusion of a report prepared for the National Bureau of Standards by John L. Little, director of the NBS Center for Computer Sciences and Technology, and Calvin N. Mooers, of Rockford Research Institute, Inc.

Today, the report says, the scientist or businessman subscribing to a central time sharing service gets access to the central computer from his own terminal, a typewriter-like keyboard with circuitry for connecting the two by a telephone line. To obtain computer service the subscriber has only to place a telephone call and then key in his identification, data, and instructions. The computer output he wants can be printed out, in most cases almost immediately, by the same terminal.

Time sharing boom forecast

More than 20,000 terminals now have access to shared computers, according to the report. By 1972, it is anticipated, something like 300,000 terminals will be incorporated in about 15,000 storage and processing complexes, large and small.

Unfortunately, the report notes, there is almost no agreement among the various systems on means of calling for the same operation. Unless the problem is corrected, computer users will find themselves increasingly confused about how to speak with the computer—"much like a traveler unsure of whether to ask directions in French, Spanish, or Portuguese."

Other areas of computer systems have been standardized to some extent. On the media level, for example, magnetic tape is supplied in specified widths, thicknesses, and magnetic characteristics. Punched cards come in standardized sizes with holes of standardized size in standardized locations. Data encoding also has been standardized; all users of punched cards recognize that punches in a specified two positions of a column represent the letter A.

Now what is needed, the report urges, is standardization of procedures for communicating with the central computer. "User signals to gain access to the system, to de-

lete, and to stop an operation, for example, should be as universally recognized as is the meaning of an octagonal red sign at an intersection."

Standardization efforts are now under way, the report notes; the most likely candidate is USASCII (The USA Standard Code for Information Interchange). There is not enough similarity of computer languages to produce a natural consensus; as a result, any code adopted will be unfamiliar to most users.

Even so, the report warns, standards should be selected and advanced now to avoid the greater cost of postponement. Now that the original novelty of the computer has worn off, "its users are becoming less inclined to endure technical difficulties."

Uniform Securities Numbering System Proposed by CUSIP

A uniform identification system for securities, developed by the Committee on Uniform Security Identification Procedures (CUSIP) of the American Bankers Association, has now been endorsed by the majority of the financial community, including the New York and American Stock Exchanges.

The agreement should speed automation of all phases of processing and handling of securities, since it will provide a common language for all automated systems within the financial world.

It should also help solve the severe back-up in paper work that has plagued so many stockbrokers for so long, since it will eliminate so much of the manual handling of security transactions.

An eight-character identifying number will be assigned each piece of paper representing ownership of commonly traded securities. The identifying number will show the issuer, whether corporate, municipal, or state or federal government, and the particular issue. Since the CUSIP number will be machine-readable, automated handling of securities will become much simpler as soon as standard imprinting of new securities begins. The common code designation will also facilitate communications among all those involved in the transaction cycle.

Two-Week Forecasting Of Weather Conditions Is Nearing Feasibility

Recent computer experiments performed by the Geophysical Fluid Dynamics Laboratory in Washington, D.C., indicate that the weatherman may, before too long, be able to predict whether it will rain or shine some two weeks ahead.

Using formulas that represent the interaction of the forces of the oceans and atmosphere, two UNIVAC 1108 computers have succeeded in forecasting wind flows, temperature, and precipitation with reasonable accuracy.

Forecasting technique

One computer test, for instance, begins with data showing the wind at zero and all temperatures at a constant. Further inputs, representing, in turn, starting of the earth's rotation, the turning of the sun, and the activating of all the physical processes in the atmosphere, are then added. The resulting general circulation is compared with actual atmospheric conditions.

In one case, the lab forecast the birth and development of three storms which developed successively at four-day intervals off the coast of Texas and moved into the Eastern third of the United States during a twelve-day period.

According to R. D. Graham, executive assistant of the laboratory, "New and improved models now being tested will hopefully improve the accuracy of our forecasts." Mr. Graham adds, "We hope after several more years of research and testing, to produce two-week forecasts which will be as accurate as today's two-day forecasts."

The forerunner of the Geophysical Fluid Dynamics Laboratory was established in 1955 in the Weather Bureau as an outgrowth of two earlier successes achieved by the Institute of Advanced Study in Princeton, N.J., in 1949 and the Joint Numerical Weather Prediction Unit in 1953-1954. At that time, charts depicting the flow of air at the 18,000- to 20,000-foot level of the atmosphere were used. The research plan of the 1955 group, to establish general circulation models for tests and experiments, is still being used today.

FCC Directs AT&T To Permit Installation Of Foreign Attachments

American Telephone & Telegraph Company and the other communications common carriers have lost the first round in their battle with the computer industry over who is to do what in data processing communications.

In their briefs answering the Federal Communications Commission's request for opinions in its inquiry into computer communications problems (see news story M/S July-August '68, p. 7), most of the computer industry groups attacked the common carriers' prohibition of "foreign attachments" to their systems. Carriers' equipment is frequently incompatible with specific data processing equipment, the data processors argued; therefore, interconnection of non-carrier devices and systems should be permitted.

FCC indicated it did not plan to issue comprehensive new data communications regulations this year. However, it already has ruled on the attachment issue—in favor of the data processors.

In a decision issued this sum-

mer, FCC held that telephone companies must allow their customers to plug any device they want into the telephone network unless it can be proved harmful to the system. The ruling does not mean that anyone will be able to attach any device whatsoever to a telephone line. But it puts the burden of proof that a given attachment is harmful on the carrier, and it requires the carriers to provide permissive technical specifications and standards.

Test case

The decision was the result of a relatively minor conflict between AT&T and Carter Electronics Corporation, a small Dallas company that makes a device to connect base stations for mobile radio systems to the telephone lines. When AT&T banned use of the device, called the Carterfone, Carter filed an antitrust suit. The courts shifted the suit to the commission.

To the surprise of many, AT&T, instead of appealing the decision, promply filed a proposed set of tariffs for interconnection of data processing and other equipment.

Meat Packer Uses Computer to Calculate Percentage of Yield

The Spencer Packing Company, Spencer, Iowa, has developed a computerized system which calculates the "percentage of yield" on slaughtered beef cattle and automatically determines payments due the stock raiser.

"Percentage of yield" is packers' language for the proportion of saleable meat and other products to gross weight of the animal.

The system is built around a National Cash Register 315 computer, which accepts data from NCR tape-punching accounting machines as well as from Toledo scales adapted to produce punched tape records.

In operation, the system begins when a steer walks across a scale; its weight and a carcass number are recorded on punched tape. After the animal is processed to its saleable state, the "hot weight" is recorded by another set of scales. By comparing the "before" and "after" tapes, the computer calculates the percentage of yield for each carcass.

Subsequently, as government inspectors determine the grade of the meat, these data also are entered into the computer system. It can then calculate the amount to be paid the stock raiser.

By entering such information as carcass number, weight, grade, and portion into the computer as parts of the animals are sold, the packing company can analyze profits for particular lots of cattle.

In addition to its payment and profit analysis applications, the system also handles inventory reporting and payroll for the company.

NCR Offers Hospitals Package to Automate Personnel Reporting

At a time when hospitals are "constantly under pressure to hold down operating costs in the face of rapidly increasing administrative expenses and rising prices," H. M. Schene, director of NCR's data processing centers, has announced that the National Cash Register Company has developed a packaged data processing program for hospitals believed to be the first of its kind to be offered on a nationwide basis. It provides automatic processing of hospital personnel and payroll records.

Costs low

Under the new system, a hospital or medical center of any size can apply electronics to personnel management reporting, including budgets and employee reports as well as payroll. "Costs are low," Mr. Schene reported, chiefly because the data center can spread programing expenses over a broad base. For example, a hospital with 300 employees can process all personnel and payroll records and receive all necessary computer reports for less than the salary of one clerical employee.

The Hospital Personnel Management System offers fourteen personnel reports and fourteen administrative and accounting reports, including all necessary payroll functions. A hospital may elect to utilize all reports or may select reports ranging from labor distribution to pension programs according to its individual requirements.

Customers

Groups of hospitals in Ohio, Maryland, and New Jersey have already contracted for the service. They will supply basic accounting and personnel information to NCR data centers in the form of punched paper or magnetic tape.

Small Banks Get Automation Through New Type Of Correspondent Banking—Satellite Centers

The Texas Commerce Bank, Houston, Texas, has announced plans for a series of "satellite" computer centers that will enable small banks in outlying towns to offer complete, computerized banking services.

Computerization has, until now, always spelled "problems" for small banks. On the one hand, the complex hardware coupled with the need for highly paid, highly skilled specialists to operate the computer centers were luxuries banks outside metropolitan areas could not afford. On the other hand, without computers the regional bank customers and management were left stranded with outdated services for the former and antiquated information reporting techniques for the latter.

Satellite center

But as a result of the plans made by the Texas Commerce Bank, the Alice National Bank and the First National Bank of Alice will be able to serve banks in such communities as Alice, Falfurrias, Beeville, George West, San Diego, Kingsville, and Freer with the latest updated equipment and services through a satellite computer center located in Alice, Texas.

The satellite will be tied in by special transmitting equipment and telephone wires to the data processing facilities at Texas Commerce in Houston. Data will be delivered to the Alice Center by courier from the outlying banks, relayed from Alice to Houston by telephone for processing, returned to Alice by the same high-speed transmission, and then fed out to the smaller banks from Alice by courier.

In effect, it is a regional system in which Alice serves as a data-gathering point for its immediate area. Distance and time are conquered by high-speed transmission between Alice and Houston.

"Eventually, Texas Commerce hopes to have seven to twelve such satellite centers scattered throughout the southeast and southern half of Texas," Mr. Donald C. Fiske, vice president and manager of the Texas Commerce Data Processing Division, said.

"This is the way of the future," he continued. "Ultimately, most computer work will be done this way, for businesses as well as for banks. The cost of equipment and programing, the constant advances in data processing technology, and the need for specially trained operating personnel are making large, centralized computer complexes an economic necessity.

"At the same time, new types of transmitting and receiving terminals are being developed that can give the user almost instantaneous access to the computers—either directly or through satellite centers such as those we are establishing."

Particular emphasis will be put on accounting and the resulting management information records at the Alice center. Among these are demand deposit accounting, savings accounting, and certificate of deposit accounting. Payroll processing and long-distance data transmission will also be possible with this new satellite system.

Sheikh of Abu Dhabi To Install Computer

The sheikh of Araby—or in this case of Abu Dhabi—is installing a computer.

The Abu Dhabi Finance Department is installing the new National Cash Register Century 100 computer as part of the five-year modernization plan decreed by Sheikh Zaid bin Sultan al Nahayan.

The system will maintain the sheikhdom's supply inventory, process accounts payable and payroll, and handle budgetary accounting.

One of the world's top ten petroleum exporters, Abu Dhabi has a per capita income of about $7,000 a year, the world's highest. It is located on the northern tip of the Arabian Peninsula and is the largest of seven independent sheikhdoms referred to as the Trucial States.

Some 15,000 foreign technicians are currently in the sheikhdom, planning schools, homes, hospitals, and many other types of modernization projects. It is expected that the Finance Department's data processing load will have grown vastly by the time the NCR Century 100 system is delivered in mid-1969.

The sheikh also has announced he will invest most of his $3 million oil income in public works for the benefit of his people.

Computer Management Of Retail Inventories Forecast for 1970s

A completely computerized retail inventory management system is rapidly approaching feasibility, and department stores should begin getting ready for it soon.

This was the consensus of a panel of speakers who discussed the essentials of an effective purchase order control system at a recent Washington, D.C., meeting of the Controllers Congress, a subdivision of the National Retail Merchants Association. The panelists were Allen H. Ecton, assistant vice president—retail systems, National Cash Register Company; William S. Harris, director of department store systems, NCR; J. R. Davidson, general manager of research and planning, Robert Simpson Company, Ltd., Toronto; and William L. Hatcher, manager of accounting and control systems, department store systems, NCR.

Mr. Ecton set the early 1970s as an attainable target date for a full-scale, economically justifiable purchase order management system—as soon as low-cost communications and terminal equipment now on manufacturers' drawing boards is brought to market. The development of an accurate system for automating the receiving and marking operations will be the final step.

Information tools

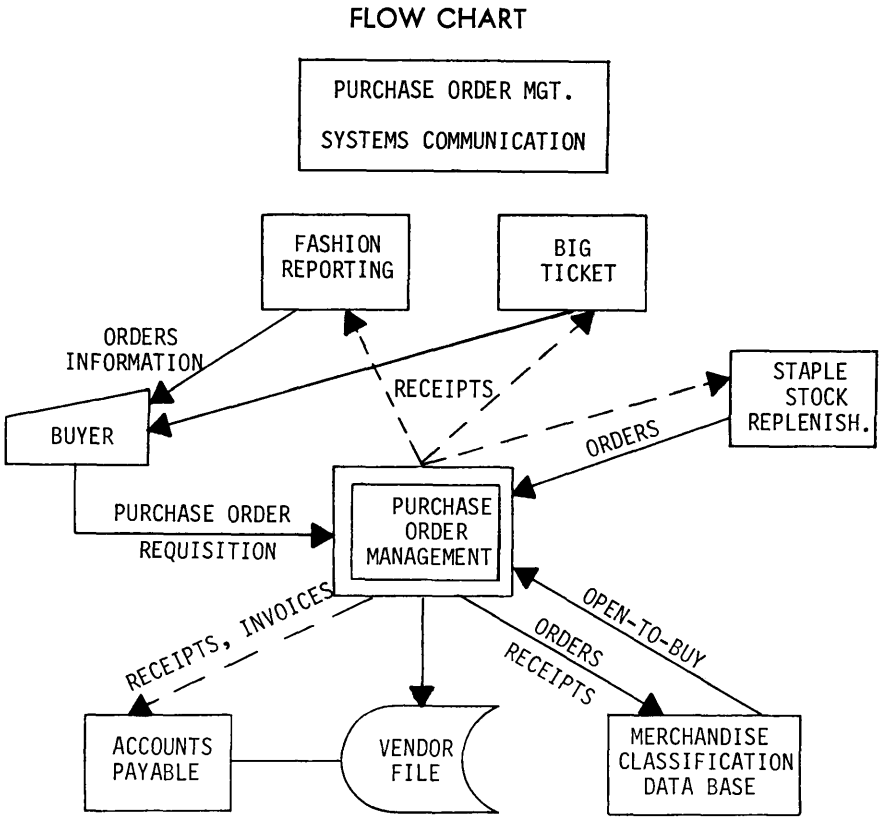
Under the system described by Mr. Harris, the department store buyer would have a number of computer-generated information tools at his disposal. The information would be made available to him either in printed form or through on-line display devices.

The buyer would have access, through a terminal, to a merchandise classification data base and a vendor master file. Buying order data would be entered at this terminal and processed automatically by the system to generate complete documentation. The buyer would use the terminal to obtain immediate, current data to support purchasing decisions.

Receiving and marking of purchased merchandise would also be controlled through new, special purpose, on-line terminals. The system would be geared to guarantee that more than 90 per cent of incoming shipments would be identified, marked, and delivered to the proper merchandising units within the store within 24 hours—and the remainder would be processed within 48 hours.

Ultimately, Mr. Hatcher said in his discussion of the finer operational aspects of the system, department stores will be using terminals in receiving areas that deliver finished marking tags on the basis of data sensed from random access files.

Such a terminal would have some remarkable capabilities. For example, it could identify and release individual items within an incoming shipment. If a shipment contained some items that could be readily identified by the computer's purchase order file and others that could not, the identifiable ones could be priced and processed immediately; there would be no need to hold a whole shipment because of problems with a few items.



This flow chart shows the communication pattern that would be the basis of the inventory system presented at a recent Controllers Congress workshop.

Substitutions specified

The marking operation would tie in to controls initiated by the buyer with his on-line requisitioning of the merchandise. He could specify the exact parameters he would accept in the substitution of merchandise—in terms, for example, of style, color, and size—by the vendor. These parameters would be applied to receiving operations by the computer. Only registered orders or alternatives would be processed through marking areas on a routine basis; exceptions would immediately be called to the attention of the buyer for a decision on whether to accept goods received or return them to the vendor.

Documentation options incorporated into the system would include the delivery of shipping labels with orders sent to the vendors. These labels—or identical markings created by the vendor—would be affixed to packages of merchandise. The label information, then, would be used as input for receiving information fed into the retailer's computer.

The Simpson Company has already begun to move toward such a system, Mr. Davidson reported. It will begin with transactions involving one department in the downtown Toronto store. One administrative employee has been assigned to perform all of the file and document processing for this department, reacting in the same sequence as if the transactions were being processed by a computer.

This pilot study will be used to develop procedures that will be converted to a computer.

All the panelists agreed on three principal conclusions:

Such a system represents a practical, economically feasible goal.

Retailers will be successful in getting vendors to affix labels furnished with orders to shipping packages.

The biggest single benefit of the system will be to get incoming merchandise marked and on sale sooner. The goal of one day for processing of routine merchandise and two days for problem merchandise can be met.

Linear Programing Used to Improve Evaluation of Bids

Using mathematical modeling and a UNIVAC 1107 computer, the Minneapolis Processed Commodity Office of the United States Department of Agriculture has made what it considers remarkable advances in perfecting automatic bid evaluation techniques.

The computer system uses linear programing to select the most favorable combination of bidders. "It used to take our marketing specialists days or even weeks to provide an answer and even then we didn't know whether we had the 'right' answer," according to John Wenn, Jr., director of the Minneapolis office. "The computer does the same job with absolute accuracy in seconds or minutes."

The Minneapolis office is nationally responsible for the purchase and handling of more than sixty processed commodities. In its procurement process it may call for bids from 50 to 100 commercial suppliers for delivery to several hundred destinations. Its annual disbursements sometimes exceed a billion dollars.

A recent butter packaging contract involved seven warehouses, fifteen packaging firms, and some thirty basing points. The computer came up with the optimum combination in twenty seconds. In a flour procurement task involving 55 bidders and 110 destinations, the computer beat the staff's lowest-cost effort by $46,000 and also purchased an additional 100,000 pounds of flour that somehow had been lost in the course of the manual calculation.

Largest Computerized Medical Information System Is Too Small

MEDLARS, the world's largest computerized medical information system, is now too small for the job it has to do and is about to be expanded.

A $3-million computerized information storage and retrieval system, MEDLARS (Medical Literature Analysis and Retrieval System) was installed in 1964 at the National Library of Medicine in Bethesda, Md. (See news story M/S September-October '64, p. 11.) It cut the time needed to produce *Index Medicus,* NLM's massive monthly bibliography of current medical literature, to ten days.

Now the system will be expanded into an integrated one capable of performing all major functions of the library. Computer Sciences Corporation has been awarded a $2-million contract to develop what its president describes as the "most sophisticated total data management system yet developed for today's third generation computers." The new system will control the flow of information from the time material is ordered from a publisher through cataloging and indexing to its appearance in a library publication or in response to a search request from an individual researcher.

The heart of MEDLARS II will be a CSC-designed data management system called COSMIS (Computer System for Medical Information Services). With it, users will be able to address the computer in a language closely approximating conversational English.

An initial version of MEDLARS II will go into operation next year. An on-line version, using remote terminals linked to the computer by communications circuits, is planned for mid-1970.

The library accumulates new medical books, journals, and graphic materials in some 70 languages at the rate of more than 100,000 a year. By 1972, its officials expect, more than two million items of information will be stored in MEDLARS II, and the system will be processing more than 26,000 special requests for medical information annually.

Smithsonian computerizes

Another organization with information retrieval problems, the Smithsonian Institution, has installed a Honeywell Model 1200 computer to help catalog more than 50 million fossils, flowers, fish, and other specimens kept in its Museum of Natural History in Washington.

The museum's staff of 75 researchers is as much as 25 years behind in filing and correlating data on the collection, and new specimens are being added at the rate of one million a year. "The real value of the collections," according to Dr. Donald F. Squires, museum director, "is in the information and not in the specimens alone, and the value begins to decrease as the information backlog plies up."

Will speed searches

A scientist in a museum, Dr. Squires said, now spends up to 60 per cent of his time doing clerical work, poking around in files and books. The computer system is expected to increase search efficiency by about 70 per cent.

The museum's system is on direct computer-to-computer link to a system in the Smithsonian Astrophysical Observatory in Cambridge, Mass.

Nationwide Computerized Job-Matching System Backed By NAM as Aid in Reducing Ghetto Unemployment

Information Science, Inc., New City, New York, has recently introduced a new computer job-matching system designed to help solve the problem of ghetto unemployment on a nationwide basis.

It had the support of the National Association of Manufacturers in developing its plan. It will institute the program in any city or area where a sponsoring organization willing to act as liaison agent between local unemployed and local employers can be found.

Dale Learn, president of Information Science, told a recent *Wall Street Journal* interviewer the computer services firm would announce plans to establish the service in any city in which a sponsor could be found.

A "sponsor" is any local or regional organization or company that wishes to act as liaison between the local unemployed and the local employers—such as the National Alliance of Businessmen, Urban Coalitions, community action agencies, Urban League, CORE, NAACP, etc.

The duties of the sponsor are twofold: to enlist unemployed workers at no cost to the workers and to submit data on their skills and background to the computer. The result is the "instant" computer-printed resume for the unemployed's personal use and reference.

How system works

The JOBSystem works by connecting communities to a central computer on existing nationwide TELEX and TWX tele-communications networks. Those who are unemployed complete applications. This information is then transferred to the computer. The computer produces a resume for the applicant and also keeps this information on file so that it can be scanned as each employer queries the computer directly or through the sponsor. The service is similar to the telephone, in that it is rented . . . the employer pays only for what he uses.

In operation, the system consists of five simple steps; (1) A periodic inventory report of available skills is compiled for use by participating employers and educators in filling out manpower requests—job or training specifications; (2) the computer receives manpower requests from either the sponsor or a participating employer via TLX or TWX. It then (3) compares the manpower request with all application for jobs data, and (4) when the applicant's resume matches the job specifications, a computer match report is transmitted to the employer or sponsor via TLX or TWX; (5) finally, a telegram is sent to the applicant, advising him to contact the company.

The computer, located in New City, is linked by Western Union lines to the local offices of the sponsoring organizations. The sponsors, in effect, act as a remote terminal input-output station. Or, if the employer has TELEX facilities, he may query the service directly.

Unit cost low

The cost of entering one job applicant's resume in the computer is low. A typical monthly budget would include: $4.30 per new applicant, plus $55 per month for rental of TELEX machine; $7.50 per printout of qualified applicants; and $3 per match. The entire cost for setting up a JOBSystem is between $7,000 and $10.000.

JOBSystem has been tested on a large sample in Greensboro, North Carolina, and is now scheduled for expansion to statewide operation.

The system combines all of the techniques developed in preceding systems—e.g., STEP System, PICS, and others—and extends the operational capability to local, statewide, regional or national implementation by utilization of the low-cost existing communications network.

At a recent press conference, NAM's president W. P. Gullander described NAM's continuing interest in urban problems and the necessity for industry's participation in their solution. Explaining briefly the development of the program, he stated that the association long has been interested in the need for job matching and the possibility that this could be a computerized operation.

Per Student Cost of Computer-Assisted Teaching Will Drop

The per student cost of computer-assisted instruction systems will come down sharply—perhaps to a tenth of what it is now—if the systems are applied to the full range of school operations, Henry E. Hockeimer, vice president and general manager of Philco-Ford Corporation's communications and electronics division, told a recent meeting of the Philco-Ford computer users group.

The division designed and installed a large CAI system for the School District of Philadelphia. With it several hundred Philadelphia students have been learning biology and reading since last October.

Philadelphia school officials, Mr. Hockeimer said, are pleased with the effectiveness of their system, which he described as "the highest-performance system used in education today." Students' "continued response over the months is nothing short of remarkable."

Expansion for the sake of expansion solves no problems and covers no shortcomings. Rather a company must be very sure all is well in its own house before looking for new worlds to conquer —

PLANNING CORPORATE EXPANSION

by David F. Linowes
Laventhol, Krekstein, Horwath & Horwath

DURING World War II, when Americans were trying to conserve everything, including food, so that they could feed the great war machine, the Army designed a poster for display in some of the mess halls. This poster read, "Don't be a pelican. Don't let your tray hold more than your belly can." And the picture showed a pelican with a very large beak and a much smaller belly.

Expansion-minded businessmen would be well advised to heed this admonition not to try to expand beyond the company's capacity to digest. A company that cannot control and manage its present operations should not look for new fields to conquer. To plunge into a major expansion program or a large acquisition, even if it comes off, could leave management quoting Pyrrhus, king of Epirus, after a victorious battle against the Romans, "Another such victory and we are undone."

Correct timing is essential—but how does one know when time and opportunity are right? For success in any endeavor it is first of all essential to be alert and alive to opportunity. There are certain conditions, however, that should be apparent in a business enterprise as a prerequisite for expansion. We are not, of course, talking here about the normal expansion that comes from gradual sales increases or periodic improvements of product lines. We are talking about a major expansion move—such as biting into a new market, adding new items to a product line, or plunging into an entirely new industry in a

significant way. Any one of these goals can be achieved by adopting new products developed internally or brought in from the outside or by acquiring an entire company. Acquiring a new product places a strain on management. However, acquiring an entirely new company places a *great* strain on management.

Too often management does not devote adequate time and energy to planning for the long term. This is inevitable when aspects of present-day operations have important shortcomings; for example, when the marketing manager is weak, top management must put extra effort into backing him up and cannot give proper attention to future moves. Many organizations today are suffering from such weak links in the management chain; for some, the condition seems chronic. And a corporate body that is impaired is in no position to undertake a major expansion move.

When not to expand

Expansion or diversification is not a panacea. When adverse conditions prevail, executive management should not consider undertaking a significant move. Rather, all efforts should be directed toward correcting the existing weaknesses. Only then should management look for new markets to conquer, new needs to fill. Deliberately forging ahead despite known weaknesses can result, all too often, in catastrophe.

Frequently, when a business organization is having internal problems, management looks longingly outside its company hierarchy for a quick, simple solution. If only we could arrange for another $10-million long-term loan, we could expand our plant and bring our per-unit cost down. If only we could hire an engineering vice president away from some other organization, all our production problems would be a thing of the past. If only we had more effective sales coverage in the Midwest, we could soon produce enough volume to turn our operating loss into a profit.

These simple recipes for success generally are wishful thinking. The very fact that general management has permitted weaknesses to develop within the organizational structure is evidence that there is something wrong with the management team—something that must be dealt with courageously without subjecting the company to the strain of major expansion.

Here are ten common situations in which major expansion or acquisition programs are often proposed as a way out but are seldom justified.

Substandard product quality

The product line does not match its competition in quality. Every effort should be made to redesign the product and improve its competitive position while the corporate organization is unencumbered with the many problems that develop during an expansion program. To neglect to correct this situation while management is devoting its efforts to diversification or expansion may undermine the basic structure of the business.

For example, a company in the electrical products field was working hard to hold its own, even though competition from larger and more efficiently run corporations was very severe. Its product line was not comparable in quality or price, but the company managed to keep its sales volume up by

Companies that cannot control their present operations should never embark on new ventures.

. . . management looks longingly outside its hierarchy for a quick solution

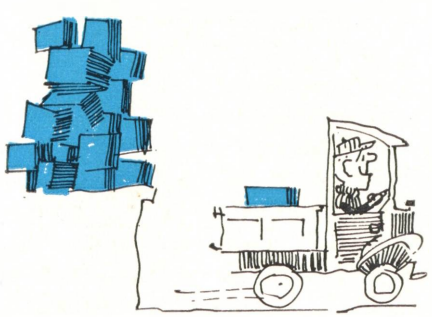
a high-pressure marketing approach. By this means it was able—but barely—to break even. Then, in a burst of ambition, management decided to acquire a company in an unrelated field and in a different geographical location. Within two years after this acquisition the company had to be reorganized under the terms of the Federal Bankruptcy Act.

Excessive costs — When production costs move out of line on the basis of the company's own past experience as well as the cost patterns of its competitors, the underlying problems should be brought to the surface and solved. Appropriate study may lead to one of two end results:

1. The areas of excessive costs are isolated, and corrective action is immediately taken.

2. The areas of excessive costs are identified, but the causes prove to be beyond the control of management. In this instance, the only solution is to adjust sales prices accordingly—or face up to the fact that it is economically impractical to continue making the same product in the same way.

Poor product distribution system —A company whose distribution setup is inefficient, outmoded, or otherwise inadequate is not prepared to carry through a successful expansion program. Various alternative methods of handling the distribution of the product line should be explored; and, on this basis, either corrective action should be taken or a wholly new distribution system should be adopted.



Vacant executive posts — If the present organizational structure does not have an adequate supply of manpower and the limited talent available is already spread thin, the No. 1 priority should be to alleviate the shortage by setting up any new executive positions that may be needed and filling all vacancies.

Although one occasionally hears that this or that acquisition is being made primarily to gain valuable manpower, as a general rule this is a risky way to round out a management team. Of course, it is entirely possible—and sometimes quite desirable—to obtain scientific and technical capability by acquisition. Technical research people work independently for the most part and can produce equally well under any corporate umbrella. Executive management personnel, however, must work as part of a team. This requires interdependent relationships, personality adjustments, and a comfortable give and take in getting things done on a day-to-day basis.

Executive relationships grow slowly and must be nurtured.

Inadequate working capital— Any business organization soundly conceived and managed should be able to make arrangements that will ensure an adequate supply of working capital. The financial community is made up of many institutions, including commercial bankers, investment bankers, factors, and the like, who are eager to assist in supplying needed working capital. No firm should attempt a big league move with a weakness in this area.

Shortage of long-term capital— In a small or medium-size business, one of the major drains on executives' time that commonly must be endured results from the misguided effort to satisfy long-term financial needs through short-term financing arrangements. Why not free executive management time by negotiating appropriate long-term debt? Investment bankers can help here.

The president of X Corporation, for example, needed assistance in developing an acquisition program. Discussion of the matter with financial men eventually turned to the general availability of executive management time to be devoted to the effort. At this point the president said, "We have excellent, dynamic officers, and I know they will enjoy the challenge of expanding our business through acquisition. Right now, however, and for the past several years, my executive vice president and I have been spending almost half of our time constantly negotiating with seven different banks for short-term loans. Actually, we need some long-term financing, and we thought perhaps the acquisition of a company that was loaded with cash might solve our problem."

In looking over the company's financial statements and making further inquiries, it became apparent that what these executives were doing was juggling short-term commercial bank loans among seven banks to meet a shortage of long-term working capital. When the president was asked what effort he had made to consolidate all those short-term loans into one long-term debt, his answer was, "Frankly, we've been so busy we haven't had a chance to find out what kind of long-term financing might be available to us."

A company producing an inferior product line asks for trouble by branching out into an unrelated field.

Obviously, before giving any thought to a possible acquisition, this firm should have taken immediate steps to investigate the available sources of long-term debt and negotiate a loan promptly. This would have had the double advantage of improving the company's financial position and freeing top executives' time so that they could then devote their energies single-mindedly to exploring opportunities for expansion.

Volume and profits at a plateau —When the charts portraying the company's performance begin to show a "plateau" effect, this is a warning that the executive hierarchy may be suffering from a lack of vitality and may need renewing. How, then, to put greater vigor into the executive suite? (On the other hand, if investigation reveals that the leveling off of profits is the result of conditions within the industry, diversification, expansion, or both may be warranted.)

"Grasshopper"-type management —Frequently, in a growing field, especially if top management is technically oriented and full of ideas, a company may find itself with a wide and diverse line of products. It is just impossible to give any one item or line adequate attention; management jumps from one to another, depending upon the current whim of the chief executive. This is "grasshopper" management, and it is a common ailment among some of the more ambitious entrepreneurs who have established their own companies in fast-moving technological fields.

One company, founded and operated by scientists, has accumulated this varied list of products: salt-water-activated batteries, barometers, semi-automatic control systems, photographic materials, diagnostic instruments for the medical profession, stretchable cable, and so on and on. The total annual sale of all these products for each of the past three years has averaged about $500,000. Clearly, this company should not, simply because the price of its stock has risen to more than 200 times earnings, consider making acquisitions with this inflated paper.

Inadequate second-tier management — This deficiency is closely related to the problem of vacant executive posts. However, it represents an aspect of the executive manpower shortage which has different dimensions.

The concept of a major expansion program implies building an organization for a long life. This means that there must be upcoming executives ready to take over the reins when current management begins to falter and productivity tapers off. Planning, patience, and careful guidance are required here. It is never too soon to begin developing a second tier of management, whether expansion and diversification are in the offing or not.

Poor control setup — An adequate control system is basic to effective management, yet it is surprising how frequently controls are lacking. In a small but going business, continuing at its own modest pace, the absence of controls may be compensated for by the informal relationships that develop over the years among executives. During expansion, however, it is often necessary to move management people around and to break up these traditional relationships. When this occurs, the absence of a control system may create difficult problems for top executives as they attempt to direct new and complex operations.

When to expand

A business organization may begin thinking seriously about a major expansion move when it has certain characteristics:

High executive morale — Morale among key executives must be high. They must be dedicated to the conviction that major expansion is desirable and necessary. They should have such concern about the welfare of the organization that its success and growth are the focus of their daily activity. They

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must have that deep-down feeling that expansion will bring greater and quicker success to the enterprise for whose future well-being they are responsible.

Good communication — Communication within the organization should be well developed and effective. It should be the kind of communication that permits objective feedback. Only by this means can appropriate rapport be developed and maintained so as to assure timely decisions.

In one large, unusually successful growth company, the two top executives used to meet each Sunday morning for a two-to-three-hour walk during which the important developments of the past week were reviewed. This was a somewhat unconventional device for maintaining regular internal communication, but it worked. The Sunday morning walks continued for some fifteen years. They stopped only when one of the officials withdrew from the company to accept a government post.

Clearly defined mission — There must be a deep-rooted understanding of the company's mission, its *raison d'etre* and philosophy. This understanding should be stated in terms of where the company is going, not from whence it has come. It should be a looking forward, not a looking backward. In this respect it resembles the attitude of the driver of an automobile who keeps his eyes straight ahead toward his destination yet frequently glances at the rear-view mirror to satisfy himself that no unexpected problems are developing behind him.

A company that is ready to begin thinking about a major expansion should not waste time preening itself over past successes, however glorious. Its resources of time and thought should be applied to the problems of where it is to go from here. To grow and to take its place in the dynamic society of the future, management must concentrate on today's achievements and on plans for tomorrow.

Creative environment—The business organization must be truly conductive to creativity and innovation. It must be people-oriented, not equipment- or product-oriented. The individual with ideas should feel comfortable here.

The mind is one of the most viable elements of the human system. It grows or degenerates, depending upon the demands made upon it and upon the environment in which it is placed. If a person with a good, creative mind is placed in an environment that constantly stifles and rejects ideas—the lifeblood of any dynamic organization—his mind will soon begin to atrophy. Such atrophy is contagious, and once it attacks one mind it will spread to others within the organization. Management personnel will begin to play it safe and be suspicious of originality.

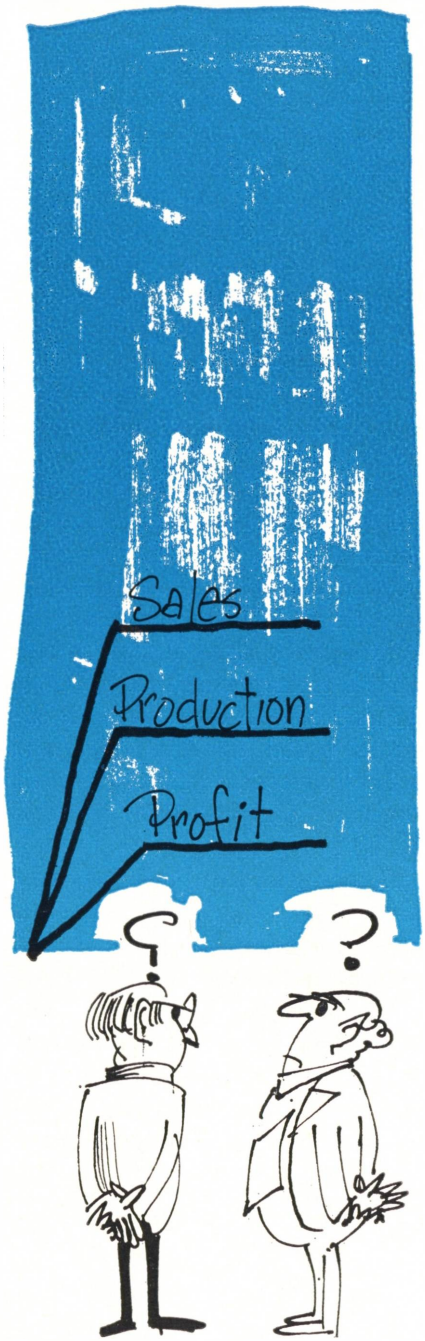
No major expansion program should be undertaken when the minds of potentially creative executives are blocked. Successful expansion programs require flexible thinking and imaginative solution.

Executive manpower program— Inasmuch as people are the key to any organizaiton, it is essential that a business corporation have an effective program for recruiting and training executive manpower. A pipeline should exist for bringing new, capable "comers" into the executive hierarchy. Self-motivated, well educated, trained executives are always in short supply, and when a major expansion or diversification program is undertaken, this shortage becomes even more pronounced.

Once a competent young executive has been attracted to the organization, a carefully designed program for coaching and developing him should be available. In addition, to ensure at least a reasonable chance to attract and hold the kind of man who can make decisions based on firm facts and sound judgment, a tried and proved executive compensation program should be operative.

No one-man show can grow and thrive for very long. Although many businesses are started and built by autocratic rule, for long-term efficiency an executive hierarchy must be developed. Henry Ford built an empire dominated by one man. He had the vision to apply assembly-line techniques to the

A company whose distribution system is outmoded or inadequate is not prepared to carry through a successful expansion plan.



When charts portraying the company's performance begin to show a "plateau" effect, it is often a warning that the executive suite may be suffering a lack of vitality.

production of automobiles and the imagination to strive toward making every worker an automobile owner. But eventually the once-successful Ford Motor Company almost found itself a victim of autocratic management; it was saved by the courage and determination of old Henry's heirs, who brought in and developed an effective management team.

Then there is the story of the DuPont Company. Most of the heirs of the dynamic founder were ready to sell out because E. I. DuPont had not built an effective management team. The determination of two young cousins to take hold of this great, unbalanced, headless industrial complex and fit an executive team to it preserved the enterprise and made possible even further expansion and success.

Major expansion or diversification moves naturally play a dual role so far as young executive talent is concerned. Not only do they create the need for additional talent, but they also should provide "protected" yet satisfying assignments in which young executives can be developed for more important management posts.

Internal flexibility — An organization must have internal flexibility so that it can cope with the many unforeseen problems that arise during a major expansion program. The older an organization is the more rigid are the departmental lines of authority. Sometimes an executive devotes as much effort to protecting his authority as he does to executing the function that justifies that authority.

A basic trait of human nature is the need to feel important. Too often, executives assert this natural self-importance by assuming jealous custody over their departments. Soon vested interests develop. Sales managers refuse to permit production executives to look through their sales catalogs. Production executives frown upon a marketing vice president who wants to inspect a plant and see how the products he sells are being made. Accounting executives are deaf to suggestions from production managers concerning the redesign of internal information forms.

These fences created and maintained between departments can have depressing effects on the smooth, efficient functioning of a business organization. When a major diversification program is under way, the results can be enervating and perhaps destructive.

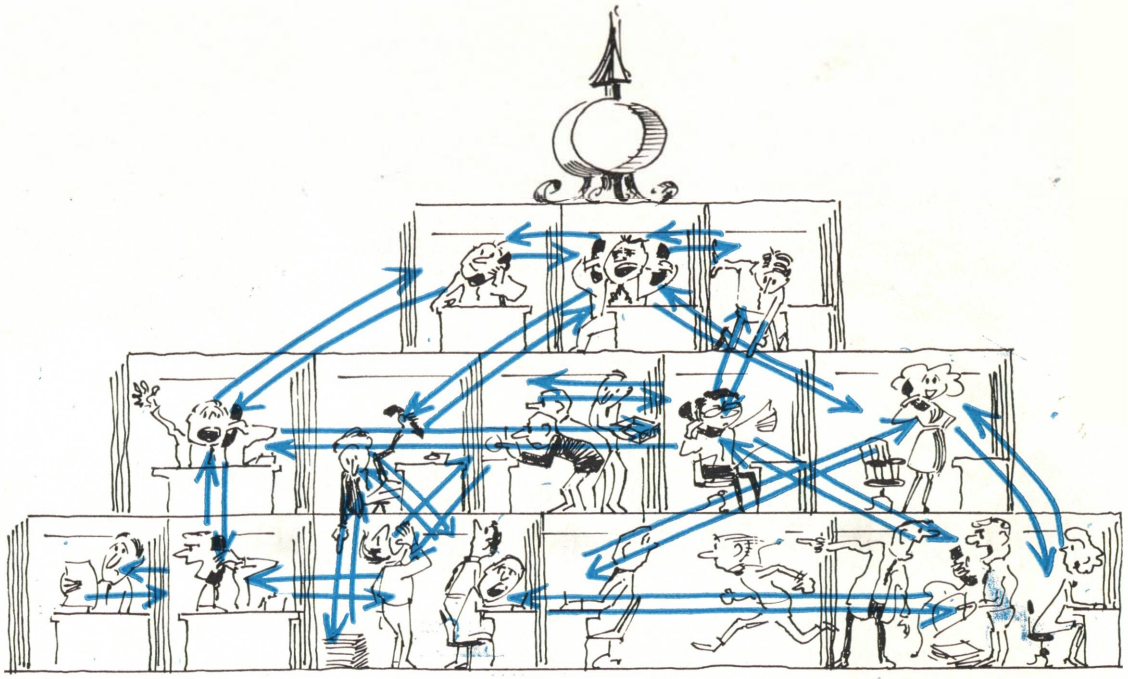
Receptivity to objective self-criticism — During expansion problems come up almost daily. A corporate organization should be able to confront them objectively, and to do this it must make conscious provision for self-analysis.

Good ideas are not the sole province of the particular executive who happens to be in charge of a program. His way of doing things or his solution to a problem is not necessarily best—in fact, it may not even be correct. An effective organizational structure permits and encourages subordinates to express themselves and to present their ideas for consideration without fear.

The older an organization gets and the longer an executive has been in his slot the more likely it is that rigid procedures will be interfering with efficiency. Precedence frequently dominates to such an extent that perceptive suggestions for getting a job done are effectively squelched.

In many old-line public utility and quasi-public utility corporations the executives fit into their positions as they would into comfortable old shoes. Even a minor change in long-standing procedures tends to cause loud and vengeful repercussions. Unwittingly, these executives have become manacled to methods for methods' sake even though some of these methods lost their usefulness decades ago.

Major expansion requires creativity, vitality, and dynamism. If a company has cobwebs in the form of outmoded rules and procedures, management should get rid of them before entertaining any dreams of extensive growth.



Communication within an organization should be of the sort that permits effective feedback.

Today's business environment is dominated by growth. Some observers of the economic scene have gone so far as to suggest that, over and beyond the making of profits, two prime objectives of most companies are constant growth and the creation of new challenges for their own sake. Increased volume seems to dominate the thoughts of numerous top executives.

In many instances, the urge to expand is something of a fad—everybody seems to be doing it. So, if management wants to appear progressive—and who doesn't?—it begins seeking out expansion or diversification opportunities. Yet most of the business moves that are made merely to keep up with the expanding Joneses rather than as a result of careful thought wind up as disasters.

Planned growth by expansion or diversification can be an effective means of achieving a business organization's stated objectives. We assume, of course, that every business organization has objectives. But too many organizations, even nowadays, drift along in a rudderless fashion, without leadership, buffeted by the winds of economic ups and downs. When such companies undertake an acquisition program, anything can happen—and it usually does.

Thus Step No. 1 in planning for growth is to define one's objectives: the long-range objectives of the business and those to be achieved by a particular program at a particular time. This definition requires substantial soul searching and introspection on the part of management. What business are we in? What business do we want to be in ten years from now? Are we competitive? Can our management structure tackle this program we have in mind?

Here are some objectives that might well be considered:

1. ***Increase in number of products***—The aim is to broaden the product line so that the needs of present customers and potential new customers are satisfied.

2. ***Broadened market area***—This objective is especially relevant for those organizations that have grown up in a particular region and have tended to concentrate all their distribution in a specific geographical area.

3. ***Diversification***—The objective here is to get the company involved in other fields for any number of reasons: to balance a seasonal operation, to move from a decaying industry into a growing industry, to continue growing larger yet not incur the wrath of the Department of Justice.

4. ***Vertical expansion of the business***—The manufacturer may seek to expand in the direction of acquiring retail outlets that distribute his manufactured products to the ultimate consumer. This vertical integration is fully accomplished when the company begins with a basic commodity like iron ore and ends up with completed widgets for sale to the public.

5. ***Growth for the sake of size***—Some entrepreneurs have a growth objective that is essentially financial expansion. This is especially true of most financial entrepreneurs. Anything that appears to be available at a bargain price or anything that can be acquired with a minimum cash outlay even at an unrealistically high price interests them. As untraditional as this objective may be, it must be

This article has been adapted, with permission, from a book being published this fall by the American Management Association (*Managing Growth Through Acquisition* by David F. Linowes, copyright 1968 American Management Association, Inc., New York).

A common objective of a well-thought-out expansion plan is to broaden the company's range of products so that the needs of present customers and potential new customers are satisfied.

recognized as a fact of business life.

6. ***Use of idle capacity*** — Idle capacity may take the form of plant equipment, executive personnel, capital, or even unexploited mineral resources.

Regardless of what the company's objectives may be, it is important that they be clearly defined. They should, in fact, be set forth in writing and formally approved by the board of directors for the guidance of all those charged with the responsibility of helping the company grow. The form of the statement is not important in itself —it may be simple or elaborate— but it must be couched in clear, unambiguous terms.

The definition of objectives has distinct advantages. It forces the company's policy makers to think about the future, to engage in objective self-appraisal, and to give sober and unhurried thought to where the company wants to be by a given date and how it expects to get there.

Only after the objectives have been defined can management begin planning how best to go about achieving them.

Ironically, top management often devotes much time and money to investigating and evaluating manpower programs, research and development programs, and marketing studies. Somehow, though, the same management will plunge into a major expansion (especially through acquisition) with very little, if any, depth investigation of objectives, products, markets, and personnel.

No major expansion move should be undertaken without a full and complete investigation of the facts of the case. This investigation, moreover, should include adequate self-examination. Only when both management team and operations can be shown to be functioning effectively should a company attempt planned, deliberate expansion.

Effective management is evidence that the organization has the needed vitality and motivation to try the acquisition route.

The myths of acquisitions . . .

Any management considering an expansion program should be alert to the dangers of the following widely held myths about acquisition:

1. ***If it can be bought cheaply enough, you can't lose.*** This is not true. Any business executive who has had to live with the discomfort of operating a division or a company that is constantly losing money can testify to the devastating drain such an operation can be. If the means of quickly converting losses to profits are not readily apparent, any price paid for the business entity is too high. Physical assets waste away when operating losses cannot be stemmed. A small leak can sink a big ship.

2. ***There have to be hard assets to back up the price paid.*** Again, it's simply not so. Business today is dominated by change. A valuable hard asset in yesterday's technology may be valueless scrap tomorrow. What counts is the earning capacity, the management team, the research facilities, and the know-how.

3. ***Combining administrative functions, purchasing functions,***

and distribution organizations will save overhead costs. This observation appears to be good logic, but it hardly ever agrees with the actual experience of business combinations. When a much larger company acquires a small operation, some saving in overhead may result; however, when both companies are of relatively good size, any saving made by consolidating lower-echelon personnel is often more than offset by an increased central-office superstructure.

4. ***New management policies will reduce inventories and receivables.*** This may happen, but management should be prepared to suffer the consequences of reduced product lines and shorter credit periods. Sales can drop off drastically. Besides, the mores of some industries make curtailed lines and credit periods impossible.

5. ***Weak executive personnel in an acquired company can be strengthened by backing them up with strong home-office supervision.*** The record of past acquisitions does not justify this assertion.

6. ***Increase the gross business, and net profits will rise.*** No operating executive will accept this statement without qualification. Increasing the volume of a product unknowingly being sold at a loss (a condition that exists more frequently than most executives like to admit) means lowering net profits.

7. ***Control over spread-out operations can be established by appropriate reports.*** In time, this may be possible. However, until the acquired company has been effectively integrated, control of its operations requires a major effort.

8. ***Management should quickly determine what divisions of a business are not contributing their share of profits, then improve operations or cut them off.*** This is easier said than done. One of the most difficult tasks in evaluating business operations is to try to determine the profitability of a particular division. Many costs overlap. Service functions are shared with other divisions. Loss products are required to round out a line. Frequently, archaic internal information systems cannot furnish creditable figures.

9. ***The first job is to dismiss the executives who opposed the acquisition and replace them with new, cooperative men.*** Good executives are a scarce commodity in business today. Competent replacements are painfully unavailable. The executive who has the courage and intellectual independence to express his convictions may be the best man in the company. No effort should be spared to try to mold him into a cooperative team member.

10. ***A good board of directors can set a proper policy for any type of business.*** Some apostles of the conglomerate merger preach this philosophy—to their later chagrin. Executives of successful conglomerates concentrate their boards' attention in the areas of financing, furnishing technical and professional advisers, and dealing with new acquisitions. They leave operating policy to the components' own boards of directors.

. . . the warnings against acquisitions

Here are a few warnings that should be kept in mind during all acquisition negotiations:

1. ***Don't believe everything you are told by the seller.*** He is not necessarily trying to mislead you consciously. But his impressions of his own business are obviously biased, and he is impelled to tell you all the good things about it. Full and effective communication between two people is always dif-

An executive hierarchy must be developed if the company is to perpetuate itself; the company dominated by one man is all too apt to disintegrate when anything happens to the man.

Acquisitions can't be negotiated and integrated in executives' spare time

ficult. The same words too often have different meanings to different people.

2. ***Don't be rushed into a decision before all the facts are in.*** All facets of a business operation must be examined. The function ignored may be your Nemesis. The seller always makes sure that you don't overlook his good points. Better to miss out on a closing than rue the day.

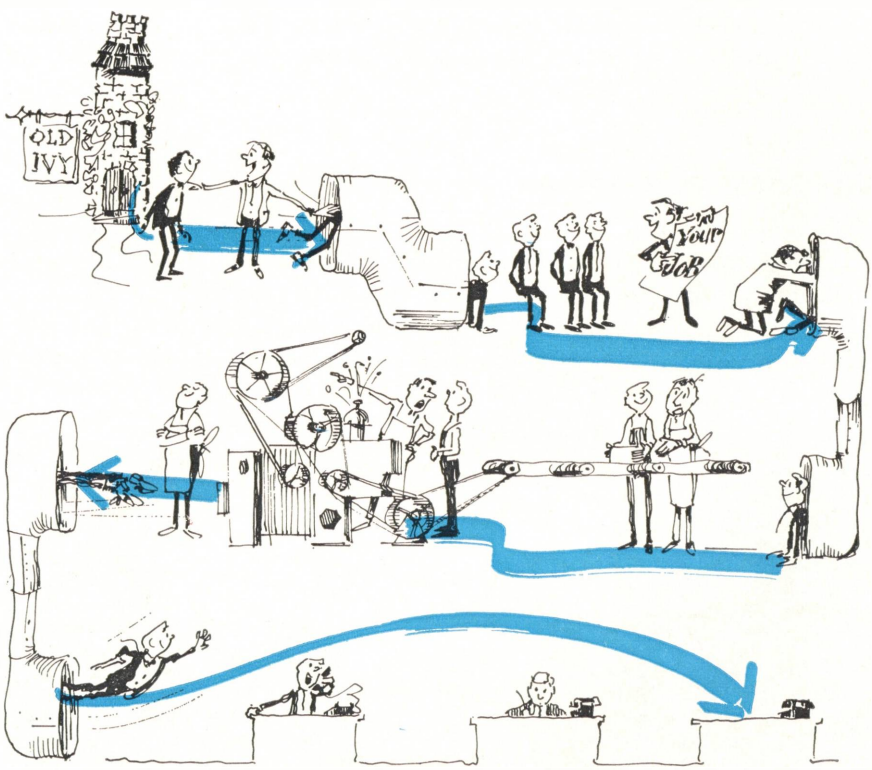
3. ***Don't let personality likes or dislikes get in the way of acquisition.*** Objectivity is always important in business decisions. If necessary, switch to negotiators with different personality types to keep the evaluation process and its findings impersonal.

4. ***Don't be dazzled by the physical facilities of a company.*** Acquisition of a business entity is undertaken for the purpose of increasing profits and growing. A physical plant that is beautifully designed but engineered for inefficient production must be rated accordingly.

5. ***Don't think an acquisition can be negotiated and integrated by executives in their spare time.*** Acquisition is a full-time task requiring all the abilities and concentration a man can give it. It is a distinct function of business and should be staffed accordingly.

6. ***Don't think the job of acquisition is over when the legal papers are signed.*** The real job is just beginning. You want to help the company grow. Very well, then. Growth is possible when the acquired operation becomes an integral part of its new environment.

7. ***Don't expect all your plans for integration to work smoothly.*** They never do. Be prepared for some disappointments, and the solutions to your problems will come more readily.



Once a competent young executive has been attracted to an organization a carefully planned program for coaching and developing him should be available.

The well planned EDP installation has its roots in a condition and management attitude that must precede any planning for the installation itself. It is only when the system's objectives are clearly spelled out that a good system can be developed —

PITFALLS IN PLANNING AN EDP INSTALLATION

by Michael R. Moore
Arthur Young & Company

THIS IS A story about pitfalls in the path to a successful EDP system—and how to avoid them. Many managements today are puzzled and frustrated by the lengthy, seemingly endless, turmoil involved in converting basic information systems to EDP. It is the purpose of this brief article to identify some of the more common problems associated with the conversion to EDP systems and to suggest how they can be minimized by a planned, controlled, systematic approach to the design and installation process.

Success in EDP systems design and installation begins long before an analyst first lifts his flow-charting template to sketch out the initial rough approach. The roots of success or failure are to be found in the management philosophy and organizational framework within which the EDP system is to provide service.

Early management involvement

From the very outset the systems analyst must be assured of management's commitment to the scope of the system which he is responsible for designing. If management has carefully specified its information requirements, the systems analyst will have a large head start toward a successful job.

Such tangible evidence of management's commitment will enable the analyst to develop a well considered set of system specifications and reasonable estimates of the time and cost required to meet these specifications. Further, management itself will appreciate, to a much greater extent, the complexity of the work involved in design-

ing and installing a system which will successfully meet the specifications it has established.

It is difficult to find much sympathy for the unhappy management which doesn't get seriously interested in defining its objectives until the EDP project has almost reached operational status—only then to discover that the system isn't designed to produce the information that management really needs or wants. The practical lesson here is that the user must remove himself from the conceptual level of definition and get into the specific details at as early a point as possible in the systems definition and design effort. If he does not, the implementation cycle will become a merry-go-round for everyone concerned.

Third-generation computer equipment is a far cry from punched-card tabulating machines. This equipment has truly enormous processing capability, and its most effective use requires the design of systems which integrate or pool the information needs of several users whenever feasible. This need to "blend" the requirements of several different users increases the importance of top management's involvement in and commitment to the project.

Ideally, an applications advisory group should be established which includes representatives of all the potential users of the data processing system. The first task of this group should be the development of an inventory of proposed projects to (1) evaluate feasibility, (2) assign priorities, and (3) develop plans of action and cost estimates for implementing approved applications.

One of the practical advantages of this approach is that it should substantially decrease the frequency of crisis-type requests which otherwise could be expected from any one (and typically all) of the users. If all requests are identified in the projects inventory and priorities are established by top management, the data processing organization will have a reasonably effective defense against the overly aggressive manager who pushes for specialized applications, on a "top priority" basis, which serve only his limited needs.

One of the greatest roadblocks to the effective integration of information systems has historically been the mistake of placing the EDP function and its control at too low a level within the overall organization structure. Recently, however, there has been a trend toward the consolidation of responsibility for information systems at a relatively high level in the corporate hierarchy. Ultimately, it seems clear, the information systems function will be raised to the status of a major corporate activity reporting to a top-level executive (e.g., an administrative vice president) and operating as a service to all line organizations. The advantages of this type of organization are obvious:

Specific responsibility for the development of integrated applications is assigned at a high level in the company.

Authority is granted to cross departmental lines as necessary for analytical and other purposes.

The possibility of the system's becoming dominated by any one major user is minimized.

Consistent documentation and programing standards can be established and maintained on a centralized basis.

Opportunities for consolidating files and applications are substantially increased.

The essential steps involved in planning, designing, and installing an EDP-based management information system are not much different from those required in any major systems design effort. Briefly, these steps include the following:

1. Define objectives in terms of specific, measurable results or outputs. It is admittedly difficult to be specific but critical to do so—especially about the following:
   a. Report formats, frequency, timing, planned uses, etc.
   b. Cost objectives for system development and for continuous operation
   c. Benefits to be realized—in dollars, if feasible; otherwise, the improved timing, specific new or summarized information to be received, etc.

2. Establish responsibility and authority for managing the job through to completion. A committee can be expected to operate as an organized diffusion of responsibility, although it should be able to fulfill a useful advisory role. One individual must be designated to take responsibility for getting the job done.

3. Develop a specific plan of action with interim milestone events. Systematically identify the input forms, processing routines, and output reports which need to be defined and estimate the time requirements in terms of specific skills—accounting systems analyst, machine systems analyst, programer, etc.—and staff up for the job.

4. Develop a timetable for accomplishment by adding the estimated time requirements for all the scheduled tasks and spreading these time requirements across the available manpower. The final schedule should show the relative timing and interdependence of events, and the total time commitment should be expressed in a manpower and dollar budget.

5. Summarize the plan into a formal document and establish a progress reporting and review procedure. Progress should be measured by:
   a. Actual vs. estimated com-

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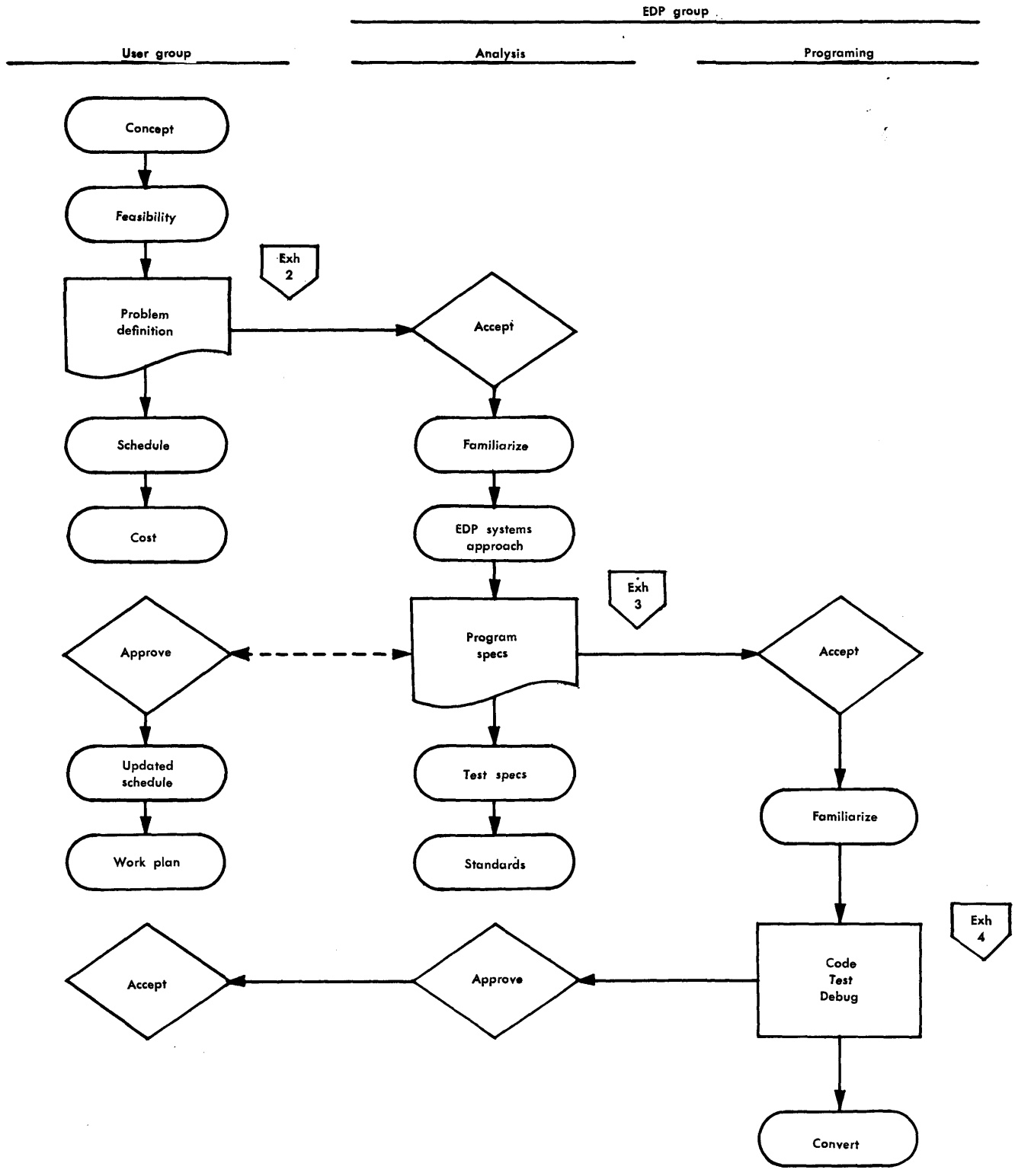
EXHIBIT I

EDP SYSTEM DESIGN AND INSTALLATION

(SIMPLIFIED FLOW)



pletion date of each interim milestone event

b. Actual vs. estimated time and cost expenditure in accomplishing each milestone event.

The development of a list of tasks in the form of a critical path network can be of great value in planning and scheduling the steps necessary to complete the job. The primary benefit of this approach lies in the detailed planning necessary to construct a meaningful network. The analysis required to develop such a network will instill a large and helpful measure of realism into the project and establish most of the necessary controls over the job schedule.

Management of the project is much simpler if it entails measurement of progress against a well formulated set of plans. Effective management is much more difficult when the job is planned "as you go along."

The major pitfall to avoid in the use of the network approach is the preparation of overly detailed networks. For most EDP installations it is far more desirable to diagram only major milestone events, then supplement each milestone with summary narratives or Gantt charts.

Exhibit 1 on page 27 shows the major steps and the logical flow of procedures in the design and implementation of an EDP system. The flow of procedures emphasizes the necessity for formal communications and continuous user involvement in three highlighted areas on the chart:

1. Application definition or problem statement
2. Program specification
3. Detailed programing and conversion cycle.

Application definition

In a small data processing installation, or for small applications, it would be appropriate to combine the application definition and program specification statements into a single effort-and-output document. In all installations, these formal definitions should be the joint product of the user and EDP groups.

The primary responsibility of the user is to make a comprehensive inventory of his information requirements and express these in a formal application definition. This document should reflect the transition in the user's thinking from a general concept of his information requirements to the detailed expression of these requirements in EDP terms. In making this transition the user will, in most cases, need to be guided by the EDP systems analyst.

Exhibit 2 on page 29 suggests the organization and content of a formal application definition statement. In theory, any EDP process can be performed by manual means. The user should think through the basic processing steps and present an abstract of them to the EDP organization. The application definition statement is intended to accomplish this communication.

The primary emphasis of this statement is the definition, in detail, of the input and output requirements of the system. The processing steps should be stated in summary form but should be relatively specific as to (1) control and balancing procedure, (2) main-line processing steps, and (3) error detection and correction procedures.

Definition of the application at the level described in Exhibit 2 requires that the user have a reasonable understanding of data processing terminology and techniques. The method of achieving the suggested standards of the application will differ from company to company. In some few instances, the user will have the necessary background to complete the application definition himself. More commonly, the application definition will be a joint product of the user and the systems analyst. In such cases, the systems analyst assumes primary responsibility for review and approval of the program specification.

It must be clearly understood, however, that the user cannot delegate his responsibility wholly to the EDP services group and expect that this approach will satisfy his needs. Rather, it is up to the user to recognize and pursue his responsibility to define his own needs as best he can.

The application definition also serves as a means of communication with top management, emphasizing the management uses of the recommended reports and the cost/benefits relationships of the recommended approach.

Programing and conversion

The second point of emphasis on the flow chart of procedures (Exhibit 1) is the preparation of a formal program specification statement. One of the principal objectives of this specification is to restate the problem statement prepared by the user. This restatement by the EDP organization, in terms understandable to the user, will go a long way toward assuring that a clear, correct communication of the system requirement has in fact been accomplished. Exhibit 3 on page 30 shows a suggested organization and content of the program specification.

The organization of this specification is very similar to the application definition. However, the content of the program specification is intended primarily for the programer and therefore emphasizes the specific input and output formats, data field sizes, processing steps, edit routines, and controls.

Approval of the program specification by the user organization should go a long way toward assuring that the system which is ultimately developed will satisfy the user's needs without further substantial changes.

One of the most significant elements of programing expense is the cost of making changes in programs after the specification has been "frozen." The formal program specification will minimize such eleventh-hour changes and will

serve as the basis for developing a specific work plan, time estimates, and programing standards for the project.

Exhibit 4 on page 31 shows the basic sequence of events in putting together the programs required to get the system on the air. Its principal points of emphasis are:

1. The importance of adequately designed test cases in which the user should participate to assure that the resulting program will do the job
2. The cyclical nature of desk checking and machine testing of written programs to identify and correct deficiencies in the written program
3. The requirement for some form of comprehensive parallel run or pilot test and formal acceptance by the user of the completed program.

The most common pitfalls

The basic steps in the planned, controlled, systematic approach to EDP systems design have been outlined in Exhibits 1 through 4. Successful implementation will require attention to, and avoidance of, the common pitfalls discussed below.

Communication

The single most significant pitfall in the design and installation of EDP systems is the problem of communication. A user presumably knows what he wants, but he typically cannot communicate with the machines and has great difficulty in explaining his need to the man who can make the machines talk. The EDP analyst-programer presumably can make the machine sing if he wants to, but he typically has a problem scoring the music because he can't figure out the user's composition.

The planned, controlled, systematic approach to communication via the application definition (the user's problem) and the program specification (the programer's approach) is an absolutely necessary price to pay for successful installation.

APPLICATION DEFINITION

(Outline)

TITLE PAGE
Title, date, author.

TABLE OF CONTENTS
Sections, exhibits, appendices, page references.

ABSTRACT OF APPLICATION
Introduction, description of major objectives, scope, relationships to other systems, major users and uses of the system output, special problems, summary of costs and benefits.

OUTPUT REQUIREMENTS
Definition of final content of all reports, draft version of formats, description of use of each report, number of copies and distribution of reports.

INPUT REQUIREMENTS
Complete definition of all input data to be captured, source of data, field sizes, master files and transaction files, constants, draft version of formats.

PROCESSING SUMMARY
Definitions of input editing criteria, major calculations and logical operations to be performed, history files to be maintained, special conditions, formulas, exceptions, restrictions and limitations, overall flow diagram.

CONTROL AND BALANCING
Batch balancing and other controls over input preparation, data conversion and capture, programed edits, run-to-run controls, checking procedures on output.

ERROR CORRECTION
Procedures and criteria for error detection, display, suspense account treatment, correction and re-entry.

SCHEDULE
Timing requirements for input, processing, output.

GLOSSARY
Definition of any special user-oriented terminology.

EXHIBIT 2

The steps described in the exhibits accompanying this article represent a tested approach to the solution of the communications problem. A few additional points worth mentioning are as follows:

1. It is important to have some type of orientation meeting in which the user organization presents its business application requirements to the data processing people and the analyst-programers present basic EDP concepts and approaches to the user organization. Both groups should recognize the usefulness of the jargon (or shorthand) that each of them uses in its own line of work. Emphasis in the orientation meeting should be on trying to express concepts in *the other man's language.*
2. The systems analyst function must be user-oriented. For most organizations today, this means the separate maintenance of a systems function in the user organization, outside the so-called data processing family. In the long run, it seems clear that the functions should be consolidated in the higher-level MIS (management information systems) organizations, which are not yet as common as they should be. A frequent problem in the implementation of EDP systems is the shortage of people who understand the user's needs and can bridge the communications gap.
3. There should be frequent (e.g., weekly) meetings to measure progress against some reasonable schedule. These meetings should not be Hollywood-type production affairs. They can be informal. They should emphasize problems.

The previous discussion has emphasized the absolute necessity of

PROGRAM SPECIFICATION

(Outline)

TITLE PAGE
Title, date, author.

TABLE OF CONTENTS
Sections, exhibits, appendices, page references.

ABSTRACT OF PROGRAM
Restatement of application definition in user-oriented EDP terms, description of major objectives, scope, relationship to other systems, special problems.

PROCESSING METHOD
Flow chart of EDP systems approach showing equipment used and major processing flows, summary of input balancing and editing, major calculations and logical operations, history files, special conditions, exceptions, limitations, formulas, constants, sort keys, tables, checkpoint and restart procedures.

INPUT FORMATS
Specific record layouts for card or tape input, master file and transaction records, tables.

OUTPUT FORMATS
Specific print formats, card and tape output, record layouts, console messages.

CONTROL AND BALANCING
Batch balancing, programed edit checks and edit tables, run-to-run controls, output checking procedures.

ERROR CORRECTION ROUTINES
Procedures for display of error conditions, program halt conditions, suspense account maintenance and reports, management flags, correction and re-entry procedures.

SCHEDULES
Due-in, due-out schedules, run-timing estimates, EAM and keypunch estimates.

PROGRAM WORK PLAN
Estimate of manpower requirements, staffing, elapsed time, timing of systems test and conversion.

FILE CONVERSION
Estimate of data history file conversion requirements, special program requirements.

GLOSSARY
Definition of any special EDP-oriented terminology.

EXHIBIT 3

management understanding and support for a successful EDP installation. Without such support, it is only a matter of time before the ship bubbles down beneath the waves.

Management support does not always come easily. One very common lament about the new EDP system is that "We have lost the flexibility that we had with the old card system." There is an education job to perform with this type of manager. For the most part, that old "flexibility" was actually the source of most of the problems and limitations of the old system. The systems analyst has a real job to do in selling management on the concept of *controlled flexibilty* which is feasible in third-generation systems design.

A very common pitfall in the implementation of EDP systems is the attempt to skimp on the quantity and quality of people assigned to getting new systems on the air. A realistic, adequate allowance must be made for system analysis, design, programing, and documentation staff and for adequate clerical support for these people. It is dangerous to expect one person to do all the detail work and still expect him to maintain the necessary overview of the basic purpose and objectives of the system being developed.

Specialists essential

Recognition also must be given to the contribution which specialists can make in the programing area. Although it is tempting to think about training a bookkeeper or a clerk to be a programer, it should be recognized that the larger third-generation systems require a skill and knowledge of equipment which are independent of the application to be programed. Application knowledge may be useful, but it doesn't necessarily qualify one to cope with the programing of a sophisticated EDP system. One of the most significant buried costs of EDP installations lies in the underutilization of equipment capability because of poor systems design and an inadequately trained technical staff.

Progress monitoring

The importance of planning and progress monitoring has been clearly established. Emphasis should be on the plan. A well conceived plan suggests that a manager has really thought the job through and has established most of the control that he will need to perform the job effectively.

Control should de-emphasize formal reporting of progress but should require that progress be covered frequently and informally, always in comparison with the plan that was so carefully developed.

Testing of programs

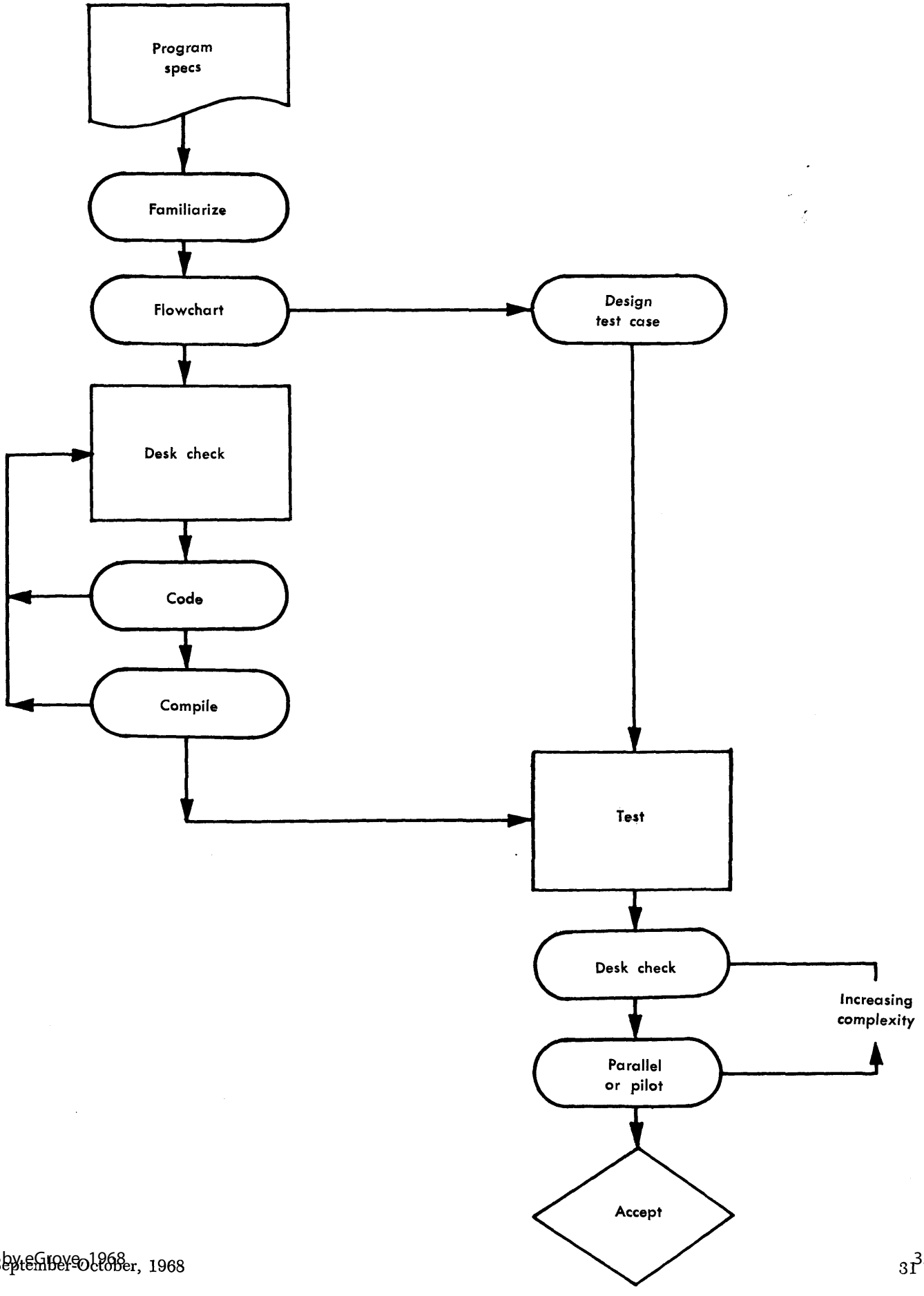
The user must involve himself as much as possible in the actual testing of the EDP system. Too often the user treats this as an area of responsibility exclusive to the EDP organization. In many ways, however, it is the user who is in the best position to interpret the adequacy and the results of tests. He should plan to participate heavily in the design of the test data.

Documentation

As a practical matter the only way to achieve good documentation is to do it as you go along. There are two very significant advantages to this approach:

EXHIBIT 4

FLOWCHART OF PROGRAMING FUNCTIONS



1. The communication is improved because documents such as the application definition and the program specification are prepared in a comprehensive, formal manner.

2. These same formal documents which were used primarily to communicate now become the basic data for preparation of formal documentation and manuals—both for the user organization and for the programing and operations groups.

Conversion of files

It is extremely important to achieve an early definition of the history files and master files which will be needed for the new system. The processes of file cleanup and reorganization to suit the new application can be very lengthy and difficult to control. In some cases, the file conversion job is so large that the special programs which must be written to accomplish conversion represent nearly as large a programing task as the effort to write the continuing main-line processes of the new system.

The conversion problem exists in every EDP installation. Sometimes it is minor; more often it is huge. Treat it like any other application problem:

1. Define it.
2. Plan and schedule it.
2. Control it.

Every manager considering a "crash" program should be given the opportunity to walk through the ruins of one of the many data processing installations which have never recovered from the implementation of their basic systems on a crash basis.

Crash programs

The very words "crash programs" strike terror in the hearts of system analysts everywhere.

Prepare for trouble if you are going to have a crash program. Recognize that the output in many of the programs will be of the "quick and dirty" variety, with the emphasis on "dirty."

All kinds of justifications have been offered for crash programs, but most of them are founded in sand. Crash programs are usually encouraged by a management which simply does not understand the complexity of the job which it is asking to be done. Too often, the basic problem stems from a desire to use a new piece of equipment before the organization is really ready for it.

No simple answer

There is no happy solution for the analyst who is faced with this kind of problem. And the only sound advice that can be offered to management is "Don't do it." The sad effects of the crash program are lasting; they are not one-time events. Every manager considering a crash program should be given the opportunity to walk through the ruins of one of the many data processing installations which have never recovered from the implementation of their basic systems on a crash basis.

Conclusion

Some people appear to have been able to get through the design and installation of an EDP system by flying it blind. It is not clear whether these people are geniuses or are somehow protected by Divine guidance. They call to mind some of the famous chases in the old slapstick comedies, where the hero, in an uncontrolled car, is careening down the street between and around streetcars, buses, trucks, etc. At the moment of crisis, he closes his eyes and charges blindly forward—and in the next scene the two trucks which have been converging upon him have crashed head on and our hero is in the midst of another calamity.

Most of us, however, do not live in the world of the Keystone Cops. We live in the real world, where a successful EDP installation is simply not achieved by haphazard methods.

EDP systems design and installation requires a planned, controlled, systematic approach. That's the only way to fly. The dollars involved are too many and the systems involved too vital to the basic information and control needs of the business to do it any other way.

In the processing of raw materials into finished goods, the potential exists of using a cheaper substitute for a traditional material. But its utility must be tested — and this costs money. Here's a way to find —

THE ECONOMICS OF USING SUBSTITUTES OR SYNTHETICS AS RAW MATERIALS

by Robert D. Zemnickas
Goodrich-Gulf Chemicals, Inc.

On Monday morning Supplier A contacts Company XYZ offering to supply a raw material at x cents a pound lower than the price of a currently used material. Monday afternoon brings Supplier B to Company XYZ requesting an evaluation of his product, which will reduce the raw material cost of Company XYZ y cents per pound. Tuesday Supplier C submits to Company XYZ a raw material equal in cost to a material now in use but able to accomplish the identical results when used in lesser amount. Company XYZ must now make some decisions. Should Company XYZ incur the development and evaluation costs of studying all of these materials, some of them, or none? Almost all firms today are faced with making these decisions, especially companies in process industries such as the chemical or textile industries.

It is economic suicide for a company to investigate and evaluate all the new products that offer a potential increase in a firm's profits. Some amount of applied research and development is necessary, however, or a firm cannot remain competitive in today's market. A complete analysis is an expensive procedure, and the results may be inconsequential. The costs of nonproductive evaluations must be paid for out of revenues created out of present operations, are not recoverable through increased profits, and detract from current profits.

A method by which a firm, be it a single proprietorship, partnership, or corporation, can determine before the actual analysis whether an

evaluation is economically advantageous or not is therefore desirable. This preliminary economic analysis will increase the return on the costs of applied research in the long run. Such a method is described in this article and illustrated by means of an example from the synthetic rubber industry.

Economic analysis

In an operation that is not utilizing all of its facilities this type of analysis is not imperative. In this situation almost all possible evaluations can be made. Keeping the facilities and manpower functioning is better than idle time. But if an operation has to eliminate some projects because of undercapacity, a preliminary cost analysis is imperative. Each possible project should be evaluated so that the firm can use its existing development resources in such a way as to minimize the firm's opportunity costs, maximize the benefits, and therefore optimize the internal rate of return. This result would be attained by evaluating only those materials likely to return the greatest benefits.

If the outcome of this economic analysis shows that the total cost of the evaluation is less than the probable benefits, the evaluation should be run. If, however, the preliminary economic analysis reveals that the benefits to the company will not recover the costs of the evaluation, the analysis of the raw material substitution should not be started. This will leave the company free to investigate other possible areas where the returns to the company will be beneficial.

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The use of a PERT (Program Evaluation Review Technique) analysis in the evaluation of a possible raw material change has definite advantages. Figure 1 on page 35 is a typical PERT chart showing the events required for raw material substitution in the synthetic rubber industry. One must think the procedure through, isolating all activities that comprise an evaluation in a systematic, orderly manner. This indicates the decision points throughout the entire evaluation. The costs of the analysis can then be determined and evaluated against any possible increase in profits that might result if the material is actually incorporated into the product. The total cost is the summation of the individual costs from the initial decision to investigate to the final decision of whether to substitute or not. This total cost is the critical figure needed to implement this model.

Price/cost relationship

To determine whether the total cost of the evaluation will be recovered and profits will actually increase within a definite period of time if the substitution occurs, it is necessary to develop a manufacturing cost versus selling price relationship. This relationship will be different for each industry and for each firm within a particular market.

The synthetic rubber industry is a high-volume low-margin industry, as indicated in Figure 2 on page 36. Firms that are in this type of market are extremely cost conscious. A small percentage reduction in their costs will have a proportionately larger effect on their profit margin.

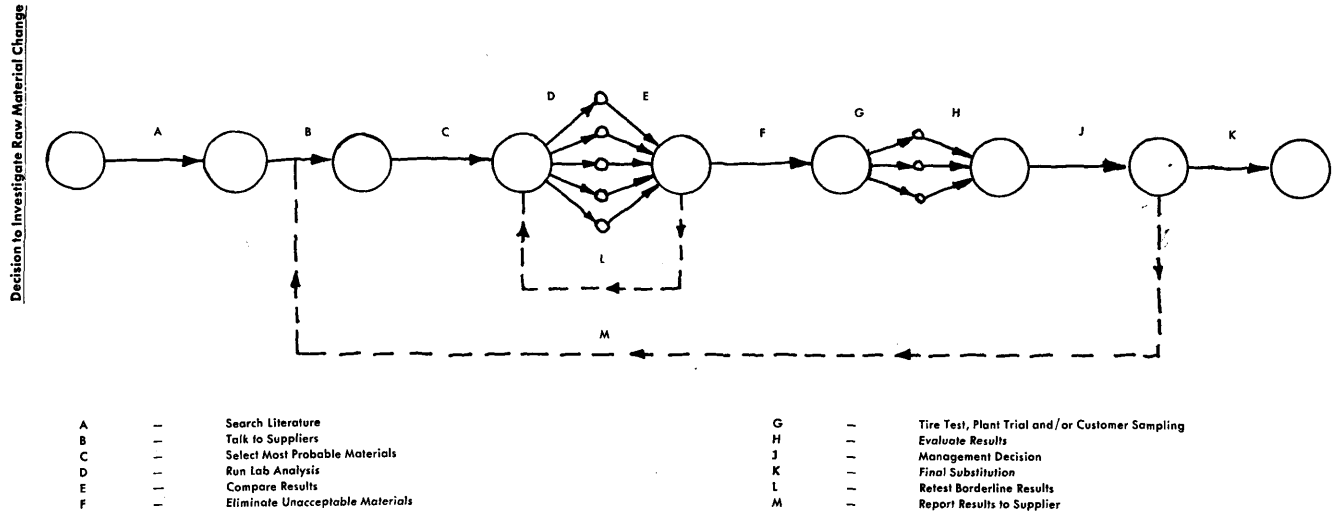
For the purpose of this economic evaluation it is assumed that a constant unit selling price prevails (i.e., constant price/unit volume). This is assumed because to develop a comprehensive evaluation of the pricing structure would involve a complete analysis of the external environment of the firm. The entire marketing structure of the industry and firm would have to be simulated. The details and methods presented in this article would apply to such an analysis, but a detailed evaluation of this type is beyond the scope of this paper. A detailed analysis of the cost components is therefore necessary to develop a meaningful price/cost relationship. This necessitates isolating fixed costs from variable costs. What we are interested in is finding costs that are constant over time and volume [$C = C\ (t,v)$] and costs which are not [$C = f\ (t,v)$].

It can be assumed that the present raw material cost/selling price relationship will remain unchanged. Companies will raise their selling prices as currently used raw material prices increase to maintain the current profit margin. Administration and general expenses are considered fixed. It can also be assumed that inventories, overhead, sales, and marketing costs remain constant at a given level of output. With these parameters constant, the factor of production that will be considered as variable is the cost of direct labor.

The cost of direct labor is assumed to be rising so that at some future time the cost per unit of output will equal the selling price. This follows from our earlier assumption that selling price per unit volume is fixed or will only increase to maintain the same profit margin when raw material prices increase. This is illustrated by Point A in Figure 2. This defines the production cost/selling price relationship for the purpose of this economic model. The relationship is now defined in such a way that the effect a raw material substitution will have upon the returns to a company may be analyzed.

Return on investment

Figure 3 on page 36 presents the cost structure of an evaluation and its effects upon the returns to a company. The expenses during the time from t_o, when the decision was



PERT Chart for a Raw Material Substitution

FIGURE 1

made to investigate the raw material substitution, until the time t_d, when the decision to substitute or not is made, indicates the total cost of the evaluation from inception. These are expenses that have been incurred. They must be paid for out of the firm's revenues.

If at time t_d the decision is that the material cannot be substituted into the product, the evaluation has economically been useless and detrimental to the firm's financial position. It will take until time t_{ns} to recover the evaluation costs at the firm's present profit margin. Having to pay for the evaluation will detract from present profits. Furthermore, the total profits of the firm will never be as high as they would have been if the cost of the evaluation had not been incurred.

If, on the other hand, at time t_d the decision was made to substitute the material into the product, the time to recover the cost of the evaluation would be t_s, a shorter period of time because of a faster rate of return. This time decrease (t_{ns}-t_s), however, must be significantly large enough to increase the rate of return so that the time necessary to recover the evaluation costs is reasonable. A "reasonable" time will differ from industry to industry depending upon the structure of the individual industry and firm.

This increase in profits is the figure that must be compared against the cost of the evaluation. Unless the increase in profits will at least recover the development and evaluation costs and return a rate of return higher than the present price/cost structure, a company is only fooling itself by even evaluating the new material. Unless this type of analysis is done, the development expenses may well cost more than the benefits returned.

The price/cost relationship model has been defined. It is now possible to determine the effect that a study to determine the feasibility of substituting a new raw material for a currently used material will have upon the returns to a firm.

Implementation of the model

The previously determined PERT chart (Figure 1) is the basis for evaluating those costs that must be defined. Figure 4 on page 37 is the cost flow chart for a raw material substitution showing the costs that will be incurred during the investigation. The isolation of the individual costs and an exact determination of them are of critical importance.

If even one of these costs is incorrect, an unsound decision may result. If the costs determined are too high, investigations that might actually benefit the firm will be deleted. On the other hand, if the costs reported are too low, evaluations that might not benefit the firm will be explored. Decisions based upon both types of errors will detract from profits. Costs that are too high will reduce the firm's profits in the long run while costs that are too low will detract from the firm's short-run position by increasing present expenses.

Example

The cost flow chart showed that to evaluate a specific raw material the firm will incur a total cost of $2,300. This $2,300 is the figure upon which all possible future evaluations of this type of raw material will be based. The criterion now has been determined; its application can be examined.

Suppliers A, B, and C contact a

FIGURE 2

Cost/Price Relationship for the Synthetic Rubber Industry

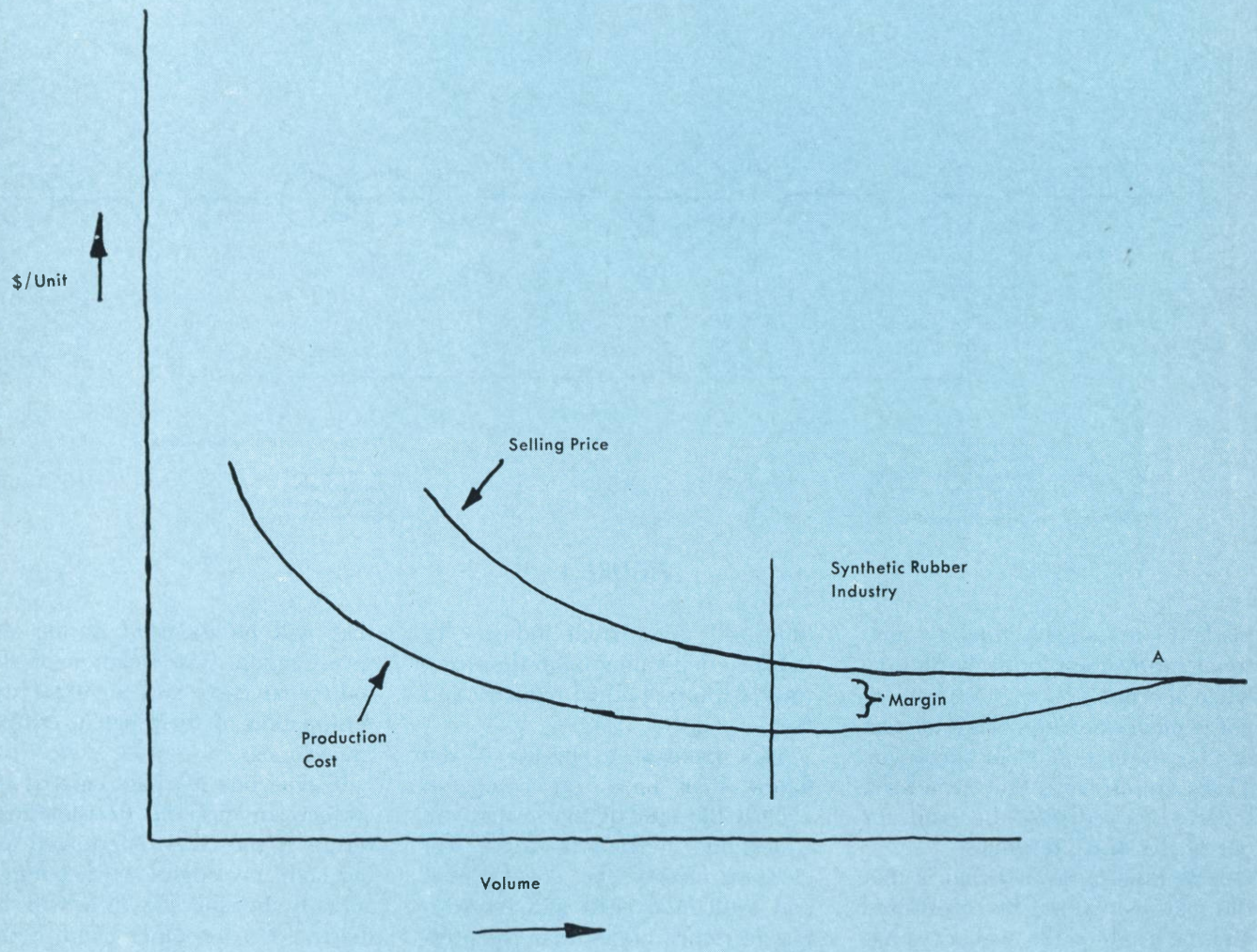


FIGURE 3

Outlay and Return on Raw Material Costs

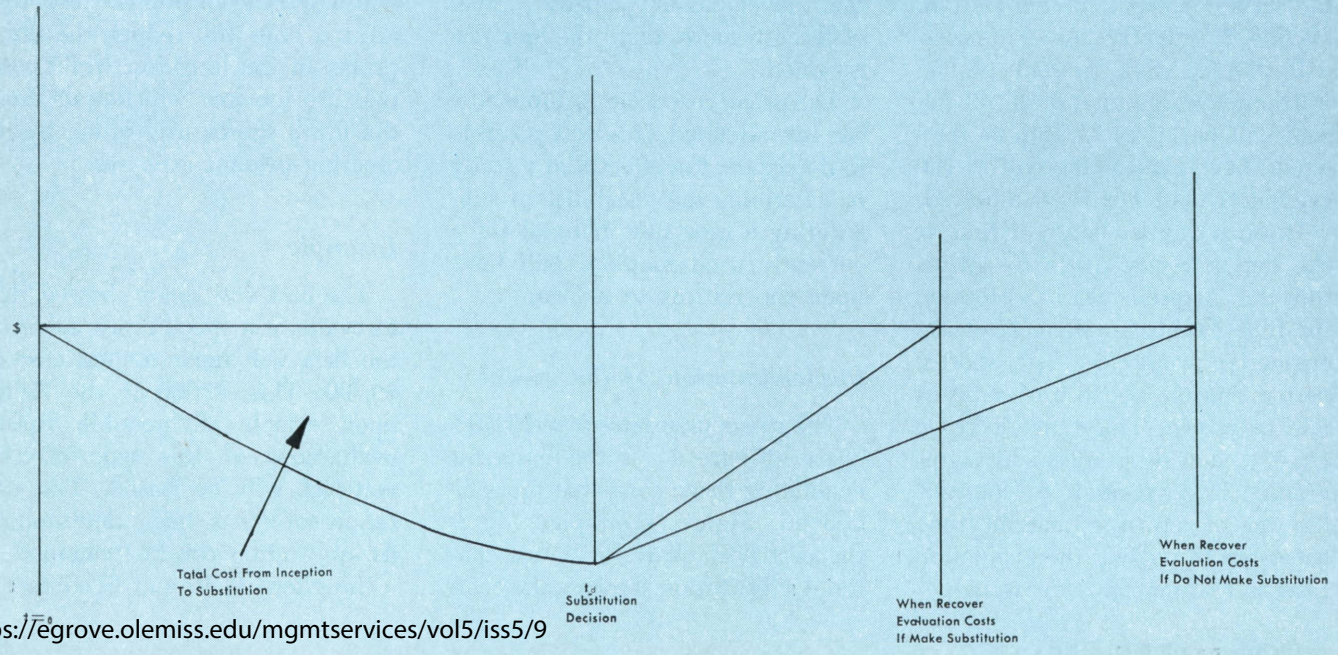
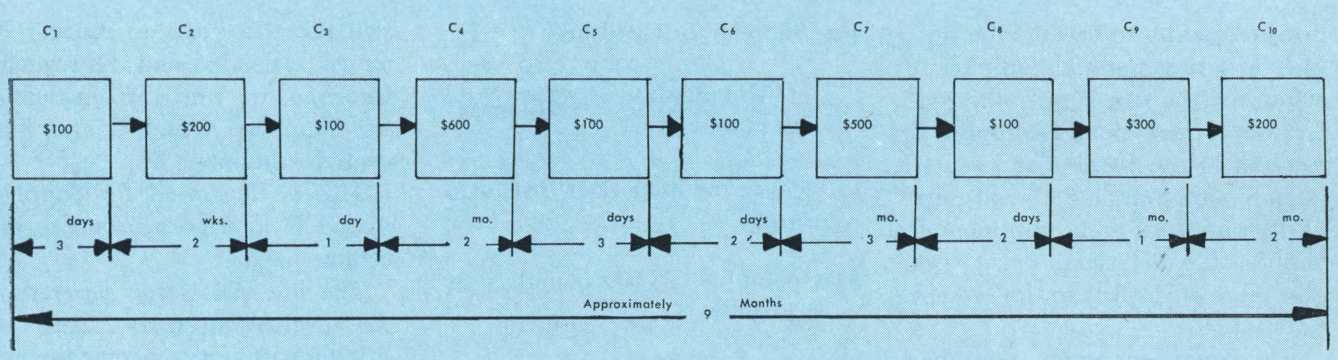


FIGURE 4

Cost and Time Flow for Raw Material Substitution

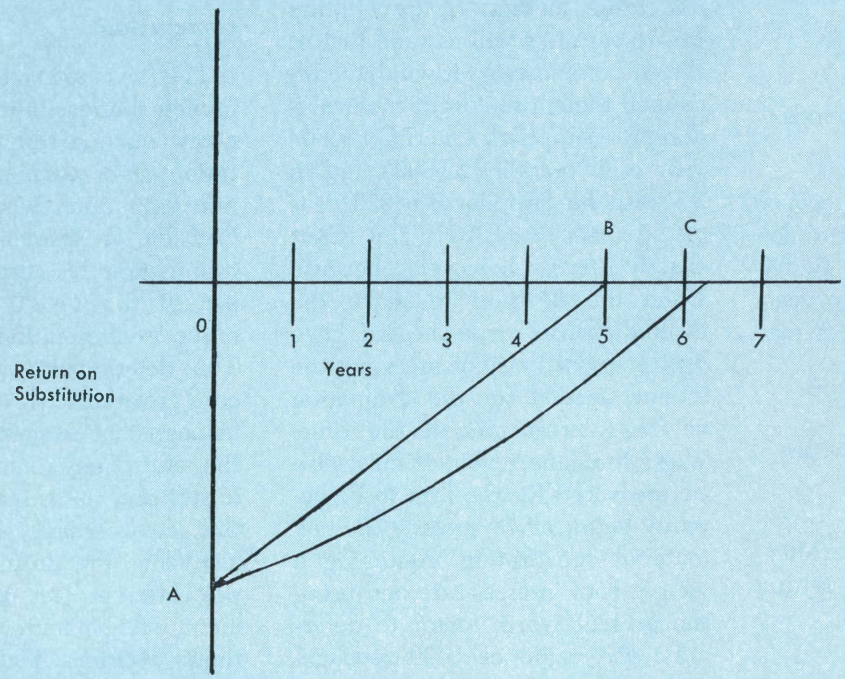


Costs Incurred

C_1	—	Search Literature
C_2	—	Talk to Suppliers
C_3	—	Select Materials
C_4	—	Laboratory Testing
C_5	—	Analyze Results
C_6	—	Eliminate Unacceptable Materials
C_7	—	Tire Test, Customer Sampling, Plant Trial
C_8	—	Evaluate Results
C_9	—	Management Decision
C_{10}	—	Final Substitution

FIGURE 5

Straight Line Versus Present Value Return Analysis



Increase in profits is the figure that must be compared with evaluation costs

firm, requesting to become the supplier of a raw material. Supplier A states that he can supply the material at x cents/pound; Supplier B can deliver the material at y cents/pound; and Supplier C will supply the material at z cents/pound. Supplier C's material is twenty per cent more efficient than the present material.

The economic model now becomes useful.

The firm that must run the evaluation knows that the price it is paying for its current raw material is $.10 a pound. Furthermore, the price quoted by Supplier A is two cents a pound less than that paid for the current material; the price suggested by Supplier B is four cents a pound less; and the price of Supplier C is equal to the price of the current material. The firm also knows that the evaluation will cost $2,300. Therefore, the firm must use

$$\frac{\$2{,}300}{\$.02/\text{pound}} = 115{,}000 \text{ pounds}$$

of Supplier A's material and

$$\frac{\$2{,}300}{\$.04/\text{pound}} = 57{,}500 \text{ pounds}$$

of Supplier B's material to recover the evaluation costs. The firm also knows that it now uses 23,000 pounds of this material per year. At this level for Supplier A's material it will take

$$\frac{115{,}000 \text{ pounds}}{23{,}000 \text{ pounds/year}} = 5 \text{ years}$$

to recover the cost of the evaluation, with an annual dollar return to the firm of

$.02/pound × 23,000 pounds/year = $460/year.

For Supplier B it will take

$$\frac{57{,}000 \text{ pounds}}{23{,}000 \text{ pounds/year}} = 2.5 \text{ years}$$

to recover the analytical costs at a return of

$.04/pound × 23,000 pounds/year = $920/year.

Supplier C, by reducing the amount needed by twenty per cent, will lower the annual consumption to

23,000 pounds/year − .20(23,000 pounds/year) = 18,400 pounds/year or a cost reduction of

(23,000 pounds/year) (.$10/year) − (18,400 pounds/year) ($.10/pound) = $460/year.

Therefore, it will take

$$\frac{\$2{,}300}{\$460/\text{year}} = 5 \text{ years}$$

to recover the costs of evaluating Supplier C's material.

A firm that does not use the present value method of discounting future earnings will assume that at the end of five years it will have recouped the entire cost of the evaluation for Suppliers A and C ($460/year × 5 years = $2,300) and in 2.5 years for Supplier B ($920/year × 2.5 years = $2,300). This is not exactly true, however, because when the decision to make the evaluation was made the firm gave up the opportunity of investing the money needed for the evaluation at the interest rate at the time. These foregone revenues must also be recovered for the firm to be actually better off by making the raw material substitution. Assuming a six per cent interest rate and using the present worth factor to determine the value of $460 received over a future time, the present value calculation shows it actually will take 6.2 years to recover the money expended and the revenues foregone to run this evaluation for Suppliers A and C and three years for Supplier B.

This is illustrated for Suppliers A and C in Figure 5 on the preceding page.

The line AB is the recovery of the evaluation costs using the straight cost versus income method. However, the present value method shows that the cost of capital (the area ABC) must also be recovered, which takes the original 5 years plus an additional 1.2 years to recover the opportunity costs given up by undertaking this evaluation. The 6.2- and 3-year figures are the times that a firm should use when determining if the evaluation should be undertaken.

If the firm is in an industry where, because of economic conditions, a four-year payback is required, then it knows that it should evaluate only Supplier B's material and not the material of Suppliers A and C.

Conclusion

This economic model for determining the feasibility of evaluating a raw material for possible substitution gives to management definite data upon which to base its decision. A systematic, exact determination of costs through the use of the PERT analysis technique isolates individual expenses. The determination of the price/cost relationship demands that management examine and analyze the entire environment of an industry and its own position within this environment. By thoroughly analyzing the entire relationships presented in this paper management will be better able to make those decisions that will increase the overall long-run benefits to the firm.

Multi-programing — the use of one central time sharing computer by several parties — can save both hardware costs and computer time. But there are some caveats to be remembered —

MULTI-PROGRAMING COMPUTER EVALUATION AND MANAGEMENT

by Charles E. Carlson and Philip C. Semprevivo

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WITHIN the next five years multi-programing of computer programs will probably become standard in all but the smallest of computer systems. Incentive for manufacturers to further extend themselves in this direction will undoubtedly be provided by the current enthusiasm within the data processing community for time sharing since the ability to multi-program is a prerequisite for time-sharing computers.

Already manufacturers are beginning to deliver a wider variety of computer systems capable of doing a creditable job of multi-programing. A sophisticated multi-programing computer is now available for as little as $10,000 per month. But don't let the cost fool you. At any price, the operation of a multi-programing computer requires new operating techniques and closer attention than did the conventional, serial-processing computer it is replacing. Indeed, the operation of a multi-programing system is complex enough to provoke some alarm in many computer managers. We may expect to hear of many difficulties experienced in this field, which may be the result of poor software, malfunctioning hardware, bad management, or a combination of the three.

This article attempts to capsulize some multi-programing experience that will be of general assistance to those who are entering into the world of multi-programing computers. In particular, it is hoped that the article will be of some genuine assistance to the reader as

he prepares to meet his own specific computing needs through this advanced operating mode.

The idea of serial processing is actually quite simple. A job is started and then processed to completion by the computer. The machine operator then prepares the next job for processing, and this sequence of job setup and job processing is carried on again and again throughout the day. The deficiencies of this operating method become obvious upon inspection. For example, serial processing is characterized by relatively low utilization of peripheral equipment, memory cells, and processors. Also, there are long setup times between jobs. As a result, it is estimated that the computer processor may be utilized less than 25 per cent of clock time.

The search for an effective technique that would escape the deficiencies of serial processing has led us through a variety of developments to multi-programing. The word multi-programing implies multiple program processing. Stated more simply, it means that two or more independent programs are being processed within the computer (often equipped with a single central processor) during a given period of time. The major objectives of multi-programing are the following:

1. To improve equipment utilization through time sharing
2. To provide faster service through the elimination of unnecessary idle time.

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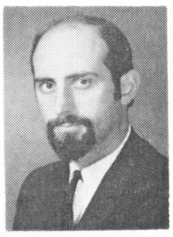

Examine the benefits

A computer center manager should be cautious about committing his computer production to a multi-programing system. If he is unable to obtain the necessary throughput for any reason, his operation will be in serious trouble. And, in case you forget, let us remind you that manufacturers' boasts have little value when the system does not perform as expected.

With this thought in mind, we would like to present one set of guidelines which illustrates a method of determining for yourself the suitability of a multi-programing system for you. Remember—as a solution to processing problems, multi-programing shares in the limitations of all solutions. That is, in part, its effectiveness is dependent upon the nature of your problem.

A gauge for comparison

The manager should attempt to develop a plan or series of plans which provide comparative insight. In the illustration to be described in this article, this was accomplished by gauging the benefits of a multi-programing type of operation and comparing it to a serial batch processing type of operation. A model was constructed that simulated the monthly workload of a diversified computer center servicing both scientific and commercial aplications. It was felt that the use of this technique during selection would enable management to predict with some accuracy actual operation for a given system before any commitment for lease or purchase of that system.

Basic to the selection model were eight computer programs. Of these eight programs, four each were written in FORTRAN and COBOL. The FORTRAN programs were rather complex civil engineering design computations, and the four programs written in COBOL represented a micro-model of accounting and other administrative applications typical of the actual workload. The COBOL programs included a sort as well as routines designed to test the effectiveness of the computer's input and output operation and its computational ability. In each instance, the programs were of a particular type and closely resembled actual production applications.

Equally essential to the model was a series of numerical factors which, when applied to the programs, equated the performance of the programs during the selection test to the total actual work volume and requirements by application area. (See Table 1 on page 41.) For example, the production requirements of the center's structural engineer customers during an average month would be the running time of Bridge Design Program 2602 multiplied by a factor of 125. When considered as a whole, the complete model would determine the data processing throughput of the system being tested.

A test is taken

Utilizing this model, an attempt was made to determine the comparative efficiencies of multi-programing and serial processing in terms of total processing time required. A Burroughs B5500 computer was chosen as the machine to perform this test. The configuration of the computer being tested included a single central processing unit, 24,000 48-bit words of core memory, two high-speed printers, two card readers, a card punch, 8 magnetic tape drives, and a secondary disk storage.

The initial portion of the test required that each of the programs in the test model be run serially. The computer's operating system (called a master control program or MCP) logged both available time and the time actually used for the central processor, input channels, and all peripheral units. The MCP also prepared a summary

report for each of the jobs processed. All timings were, of course, based on this summary log.

As stated before, the entire model was assumed to be representative of a full month's workload in a diversified data processing installation. A serial testing of the computer system utilizing this model indicated that it would take approximately 270.12 hours to process the workload which was assumed by the model. (See Table 2 on this page.)

The next step in the testing procedure was to test the effectiveness of multi-programing. In order to accomplish this, the eight programs in the model were grouped into five distinct mixes as follows:

Mix No. 1—1119, 1112, 7050, 2602, 7060
Mix No. 2—1119, 1112, 7050, 2602
Mix No. 3—1119, 1112, 7050
Mix No. 4—1119, 1112
Mix No. 5—1119

The mixes were run in a continuous flow, and the total running time for each mix was recorded. This total running time was then extended by a factor, and the five factored totals were summed into a total factored running time (See Table 3 on page 42.) The total factored running time represented the amount of computer time required to process (in a multi-programing mode) the workload assumed by the model.

The MCP-prepared summary report told us that the central processor was being utilized 61 per cent of the time during the running of the multi-programing model. Eventually, it became apparent that changes in priority and handling would yield further efficiency in the use of the processor during actual operation.

The overall benefits of increasing processor utilization through multi-programing were dramatically displayed in the test results. Total hours required to process the assumed workload of the model were reduced to 226.38 hours.

Taken at face value, it could be concluded for this particular prototype computer center that roughly 20 per cent more computer time would be required to run this computer system in the serial mode as opposed to the multi-programing mode. Experienced multi-programing practitioners generally agree that this figure could well vary between 15 and 30 per cent.

FACTOR APPLIED TO EACH BENCHMARK PROGRAM TO SHOW ITS RELATIVE IMPORTANCE TO THE WHOLE MODEL

Program Number	Language	Factor
1119 — Roadway Layout	Fortran II	1200.0
1112 — Roadway Elevations	Fortran II	960.0
2602 — Bridge Design	Fortran II	125.0
7050 — Micro-Model of Accounting System	Four Cobol Programs	310.6
7060 — Mass Transportation Research	Fortran IV	60.8

TABLE 1

RUNNING THE MODEL SERIALLY

Program Number	Serial Running Time (Minutes)	Factor	Total Time (Minutes)
1119	0.85	1200.0	1,020.00
1112	1.45	960.0	1,392.00
2602	1.25	125.0	156.25
7050	39.41	310.6	12,240.75
7060	23.00	60.8	1,398.40
			16,207.40 (Minutes)
		OR	270.12 (Hours)

TABLE 2

The particular modeling methods described above were found very useful in exploring the new operating and scheduling techniques associated with the multi-programing mode of operation. Although the model was run on a specific machine, we feel that the problem attack is valid for any continuous-flow multi-programing system. Since that time we have also learned that a cleverly designed model will prove useful to computer center management as a tool in the continuing search for lower operating costs and more effective operations.

Computerized simulation

Another modeling technique that has proved to be successful for many data center managers has been the use of the sophisticated computerized simulation technique known as the Systems and Computers Evaluation and Review Technique, or SCERT. This computerized modeling tool is a proprietary programing package developed by Comress, Inc., of Washington, D.C. The package itself sists of four major components, namely:

The definition language—Used to define the application to be processed

The factor library—which defines the characeristics of both hardware and software

The simulation programs—the computer programs that actually do the simulation (They contain up to 100,000 program steps.)

Output reports—which present the results of the evaluation.

Similar simulation packages have been developed or proposed in conjunction with the federal government and by independent consultants such as the System Development Corporation; however, these products have not been mass marketed to the extent or with the degree of success enjoyed by SCERT. Nonetheless, each of these computerized simulation packages seeks in its own way to provide a level of control and sophistication in the selection and continuing management of data processing systems not economically feasible for

RUNNING THE MODEL IN THE MULTI-PROGRAMING MODE

Mix No.	Factors For Each Mix					(MINUTES) Running Time Each Mix	Total Factored Running Time
	1119	1112	7505	2602	7060		
1	60.8	60.8	60.8	60.8	60.8	56	3404.8
2	64.2	64.2	64.2	64.2		35	2247.0
3	185.6	185.6	185.6			34	6310.4
4	649.4	649.4				2.2	1428.7
5	240.0					0.8	192.0
							13,582.9 Minutes
							OR . . . 226.38 Hours

Factor for Each Program				
1200.0	960.0	310.6	125.0	60.8

Processing Time for Each Program (Minutes)				
0.80	1.40	31.80	1.00	21.00

TABLE 3

INCREASE IN PROCESSING CAPACITY DUE TO ALTERED EQUIPMENT CONFIGURATION

Configuration	Days In Sample	Total Hrs. In Sample	Jobs Processed Per Hours	Percentage Increase In Capacity
8 Magnetic Tapes				
24K Memory	15	261.18	20.1	0.0%
28K Memory	20	344.37	22.1	9.9%
10 Magnetic Tapes				
28K Memory	22	402.25	23.7	17.9%
32K Memory	26	471.65	25.6	27.4%

TABLE 4

the average corporate or public enterprise. What this means in many cases is that a more exhaustive investigation into the operating efficiency of proposed data processing systems is possible before the making of management decisions and commitments.

Case history

Responsibility for the evaluation of all New York State Government data processing systems is assigned to New York's Division of the Budget. Here a special management unit works with each operating agency in the continual assessment of its data processing goals, plans, and management.

In the recent evaluation and selection of a large scale multi-programing computer for the New York State Department of Education, it was decided to incorporate the use of SCERT. As a first step in the evaluation two trained analysts spent a total of six man-months in the definition of workloads. The product of their endeavors made it possible to develop a SCERT model which represented about 60 per cent of the projected workload. A calibration run of the model was then made against the actual systems workload utilizing two existing G.E. computers. Calibration of the model actually required several attempts.

The next step in the use of SCERT was the preparation of specifications. At this time, all prospective bidders were told that SCERT would be used in the evaluation of the system. The specifications were also made to include output from various SCERT runs and a copy of the SCERT simulation input deck. This input deck was used by some bidders in the preparation of their proposals. Once the manufacturers submitted their proposals, simulation runs were made which compared each

Several operational indicators can aid in assessing a multi-programing operation

proposed configuration with the projected workload.

It is important to note at this time that the Division of the Budget did not seek simply to save work effort in its use of SCERT; rather, it sought to increase both its data processing insight and the quality of its final decision. For this reason, several SCERT runs, not a single hit-or-miss test, were made.

Our conclusion was that SCERT had provided the New York data processing management team with greater

- Objectivity in its data processing evaluation
- Insight into data processing alternatives
- Precision measurement of many data processing variables
- Cash savings in the validation of equipment proposals.

In this particular case study, as in all its equipment selection studies, the State of New York also required a performance test on the actual piece of equipment proposed. This is in keeping with New York's philosophy: "The name of the game is show me."

Naturally, to some the simulation setup time will appear arduous and time consuming. To these persons, let us point out that a considerable amount (if not all) of the effort that goes into the original system simulation setup can be reclaimed later on when an evaluation is made of proposed systems modifications or when alternative applications software systems have to be compared.

However, at least one word of caution should be voiced regarding the use of all simulation devices, including SCERT. That is, despite their impressive record, no one-to-one correlation should be automatically assumed between pre-installation simulated forecasts and actual past installation run times. After all, forecasts are inherently limited by the series of events and conditions existing or assumed at the time of the evaluation. Since these conditions and assumptions are not freed from the laws of change, we cannot expect the quality of test results to exceed that of the facts upon which the evaluation is made.

How well are you doing?

If it is true that multi-programing computer systems share devices, then how do we evaluate the extent to which they share devices during day-to-day operations?

In other words, how good is good?

Often managers find themselves so immersed in the technical evaluation of their operations that they tend to assume that processing is processing is processing and that the only alternative is not processing. Now, in a multi-programing mode of operation, they suddenly find that there are qualitative tinges to the processing of data and that subtle variations in workload and/or configuration will result in noticeable variations in processing efficiency. The search should be for information that will increase management awareness and heighten management control over what is happening.

In this respect, experience has taught us that there are several operational indicators that can be of major use to a manager in assessing his multi-programing operation. One of the most revealing indicators of this type is the amount of processor time that remains unused despite multi-programing operations. The authors' experience has indicated that the three-shift, seven-day-week, continuous-flow-type operation of a diversified workload should allow from 60 per cent to 70 per cent of overall processor utilization. Naturally, this figure will vary somewhat with the particular type of processing that is being done and with the specific equipment configuration that is being used.

Another simple yet effective operational indicator is to calculate the average number of jobs processed per hour during some period of time. Table 4 on page 42 shows how this indicator was used to perform an after-the-fact test on the effectiveness of a configuration change in a multi-programing computer.

But even beyond the use of these somewhat simplified operational indicators, it is important, as it has always been, that management be properly informed. Computer center management is no exception, and a sufficient amount of quality information will enable you to decide, with effectiveness, the course of action you are to follow. To accomplish this, a regular reporting system and intensive management review of the ingredients contained in that reporting system have considerable merit.

Conclusion

We have not attempted to undertake the impossible task of providing to the reader a single, all-inclusive recipe for effective management of a multi-programing system. There is no panacea. Rather, we have tried to provide you with a glimpse of some of the methods that can be employed to improve the quality of the information on which you will base your management decisions.

The electronic computer makes possible an entire new approach to the chart of accounts, in which a whole series of necessary outputs can be derived from one input —

TOWARD AN INPUT-ORIENTED CHART OF ACCOUNTS

by John W. Wagner

University of Southern California

ONE WAY of making accounting into a more useful and flexible information system would be to develop an *input-oriented* chart of accounts for computerized accounting systems. The purpose of this article is to move toward this goal by (1) clarifying the concept of "input orientation," (2) showing some of its implications for computer applications in accounting, especially as they apply to the chart of accounts, and (3) indicating why the concept probably must be confined to use in computer systems as opposed to manual systems.[1]

When the computer was first introduced into accounting applications, the natural tendency was simply to transfer to the computer the manual system that then existed. The basic conceptual limitations that the manual system implicitly imposed on the computer system were not at first comprehended or challenged. However, as additional experience was accumulated, one of the limitations was clarified when two new distinctions were made, i.e., the difference between an "input-oriented system" and an "output-oriented system."[2]

In an output-oriented system, the older and more familiar of the two, the questions to be answered by the system are formulated in advance.[3] One usually speaks of this as clarifying the "purpose" or "objective" of the system. After this step has been accomplished, the data (or input) are limited to those which will produce the specific type of output necessary to answer the questions that were formulated earlier.

This kind of system is relatively simple and economical, capable of efficiently satisfying only its preconceived needs, and therefore limited in its usefulness. Its qualities are those which can be readily

[1] For our purposes, manual and mechanical systems will be considered to be the same, since they are different more in degree than in kind when compared to electronic systems.

[2] Robert H. Gregory and Richard L. Van Horn, *Automatic Data Processing Systems,* Second Edition, Wadsworth Publishing Co., Inc., Belmont, California, 1963, p. 566; *Accounting and The Computer,* American Institute of Certified Public Accountants, Inc., New York, N.Y., 1966, pp. 276-277 (a reprint of A. F. Moravec, "Basic Concepts for Planning Advanced EDP Systems," *Management Services,* May-June, 1965, pp. 54-55.)

[3] For example, what is the firm's financial position at the end of the period (the balance sheet), or what is its net income for the period (the income statement)?

recognized as inherent in a manual technology.

Input-oriented system

In an input-oriented system, there is little or at least much less concern with an advance definition of the specific questions to be answered. Instead, the concern is that as many different types of data as possible are integrated into the system. After that, any question is permitted that some combination of the data can answer. This kind of system is relatively detailed and complex, capable of satisfying many specific and general needs simultaneously, and has wide usefulness.

However, in the absence of some new technology such as the computer, it is highly improbable that such a system can be made a practical or economical reality.

Even given the fact that the computer has been a reality for some time, there still remains the task of devising means to incorporate in increasing degree an input orientation into accounting systems. We believe this can best be done by the manner in which the chart of accounts is formulated and utilized.

Chart of accounts

The chart of accounts, as it is usually treated today, is a list of account classifications which is directly tied to the periodic financial statements, the *output* of the accounting system. It is intended that the general ledger accounts summarize data in the same (or similar) manner as they are needed for the financial statements. Thus, while it is not always expressly stated, when we say "chart of accounts," we mean "output-oriented chart of accounts."

Definitions

There is no conceptual reason why we could not also give an input-oriented meaning to the chart of accounts. The word "account" means a "formal record of a particular type of transaction . . . ,"[4] and the word "transaction" means "an *event* . . . or *condition* . . . the *recognition* of which gives rise to an entry in accounting records."[5] Thus, transactions by their very nature are the material from which accountants create the initial inputs into the accounting system, and so it seems quite clear that an "account" can be a record implying types of input as readily as one implying types of output, if not more so. For our purposes, therefore, a distinction will be made between the two cases. The one will be called an "output chart of accounts" and the other an "input chart of accounts"—each term merely implying a different method of preparing a "record of transactions."

Account classifications

In order to clarify the conceptual differences, similarities, and connections between these two types of account classifications, the diagram shown in Exhibit 1 below represents input and output at various possible levels of abstraction.

EXHIBIT I

Levels of Abstraction (from high to low)

(9) . . . . . /Output 5
(8) Input 2/Output 4
(7) . . . . . /Output 3
(6) . . . . . /Output 2
(5) Input 1/Output 1

The levels of abstraction, starting at (9) and moving downward to (5) in the diagram, refer to the degree to which descriptions of concrete events such as transactions have been generalized. In generalizing, certain specific qualities of the events are selected for emphasis while others are obscured

. . . . transactions, by their very nature are the material from which accountants create the original inputs into the accounting system, and so it seems quite clear that an "account" can be a record implying types of input as readily as one implying types of output . . . .

[4] Eric L. Kohler, *A Dictionary for Accountants*, Third Edition, Prentice-Hall, Inc., Englewood Cliffs, N.J., 1963, p. 6.
[5] Ibid., p. 496.

or completely eliminated. For example, if we were told that the total sales of a company were $30,000, this would probably be useful information in itself. If we were told, in addition, that the sales of Departments A and B of the company were $10,000 and $20,000, respectively, we would obviously know even more about the company. By moving from one level of abstraction to a lower one, we have obtained more detailed information about the underlying concrete events.

Level of abstraction

While sales by department are clearly less abstract than the total sales of the company, both are far removed from a detailed description of concrete events. For instance, we still could not answer such questions as how much of the sales were for cash or credit, by product line or supplier, etc. This absence of complete information, which is the usual case, is the reason that the lowest level of abstraction is started at (5) instead of (1) in the diagram. Specifically, this is intended to indicate that every event or transaction is so unique and has so many unique qualities that no manual or computer system is capable of starting with anything sufficiently detailed to be called "concrete." Each system simply starts at the lowest level of abstraction commensurate with its capacity. However, it should not be too difficult to accept the statement that a computer system is capable of effectively processing descriptions far more numerous and detailed than a manual system. It is this difference in ability to handle details that forces the manual system toward a restriction in favor of the output side, while allowing the computer system to accept fewer restrictions and move farther toward the input side.

As shown on Level (5) in the diagram, it is possible to have both input and output on the same level since they are interrelated. By "input" we mean the various *data* that are initially introduced into the system regardless of the level of abstraction at which we choose to make them an input. By "output" we mean the *information* that is produced by combining the given inputs in some way. The information or output for any one set of circumstances may become the data or input for another, but the level of abstraction present in the output in any case can never be lower than the particular input from which it is derived. However, at the lowest level possible in a particular system they may be said to be synonomous, i.e., they are on the same level. In other words, a computer system cannot "tell us" anything more than we have already "told it."

. . . . the level of abstraction present in the output in any case can never be lower than the particular input from which it is derived . . . . In other words a computer system cannot "tell us" anything more than we have already "told it."

Input levels

Two levels of input are given in the diagram, Input 1 and Input 2, to show that it may not always be desirable or possible to have all of the input at the same level of abstraction. As one example, sales tickets for the current period would provide data at one level of detail with which to increase the accounts receivable account, but the beginning balance of the account, also an input in the current period, would be at a higher level. The details of the beginning balance would have been reviewed in the previous period. By giving more detailed treatment to the sales tickets, attention is directed more closely to the activity of the current period. Thus, input may be at numerous levels, whether output- or input-oriented accounts are used.

The various levels of output, ranging from (1) upward to (5) in the diagram, indicate increasing degrees of abstraction in the information produced by the given system. For example, sales of Departments A and B might be Output 4, and the total sales of the company might be Output 5. In regard to the output, moving upward on the scale of abstraction is usually easier than moving down-

ward. That is, if we were told the sales of the two departments and asked what the total sales of the company were, we could develop an answer from the information already provided. But if we were told the total sales of the company and asked what the sales of each of the two departments were, we could not answer without first obtaining additional data.[6] From this reasoning, it can be inferred that it is desirable to maintain accounts at the lowest level of abstraction possible, whether they are output- or input-oriented.

Concrete example

If we were to have an Input 1 at Level (5) resulting in an Output 1 at Level (6), we would have an instance where the accounts were not necessarily maintained at the lowest level of abstraction possible. Take a more concrete example—if sales tickets are received as inputs from the two departments, they could be given account codes indicating department, terms of sales, product line, etc., or they could be given one account code which would summarize the sales of the company in one total. In the latter case, Output 1 produced by the system would be at a higher level of abstraction than is in fact possible given Input 1, and so special analyses of the detailed input would be necessary if information other than the total sales of the company became desirable at some later time. It is this difficulty of predicting in advance what information is likely to become desirable that causes so much need for special analyses in output-oriented accounts. Since input-oriented accounts are less concerned to begin with in predicting which specific questions are likely to be asked, the need for such special analyses would tend to be reduced.

Transaction-related coding

If an Input 1 at Level (5) resulted in an Output 1 at Level (5), as is shown in our diagram, we would have a case where we had successfully brought the lowest level of output possible down to the lowest level of input possible in the particular system. For instance, if our initial account code had defined qualities at the lowest level of abstraction possible in regard to the input, that same code would have determined the lowest level of output the system could effectively produce. Of course, where the two lowest levels of each have become synonomous, we would have a fully input-oriented system. But to the extent the input is not immediately coded for the lowest level possible under the circumstances, only the information then thought desirable would be retained. The remainder of the information would be lost, probably because the coding is initially aimed at answering certain preconceived questions. In such a case, the lowest level of input that would have been possible if proper coding had been used, and the lowest level of output that would in consequence become possible, would no longer be synonomous. *In general, then, the more the coding specifically relates to the particulars of the given transactions, the more input-oriented the chart of accounts will be. Conversely, the more the coding specifically relates to the information it is thought desirable the system produce, the more output-oriented the chart of accounts will be.*

Designing an input system

Having stated the conceptual basis for the differences, similarities, and connections between an input and output chart of accounts, we will now examine a hypothetical example of system design using the concept of input orientation, although the example must be highly oversimplified in a presentation as brief as the one we are providing here. Assume that we are examining a retail organization with:

(1) 3 locations where L equals locations (L_1,L_2,L_3)
(2) 3 terms of sales where T equals terms (T_1,T_2,T_3), and
   a. T_1 designates sales for cash
   b. T_2 designates sales on 30-day open accounts
   c. T_3 designates sales on 90-day installment accounts

In such a case, since the relationships to be considered have been initially limited to three loca-

[6] John Edmund Butterworth, *Accounting Systems and Management Decision; An Analysis of the Role of Information in the Management Decision Process,* unpublished dissertation: University of California, Berkeley, California, 1967, p. 63. In Butterworth's terms, the ability to move downward in the level of abstraction is referred to as making an accounting system "reversible."

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. . . the less restricted computer system can move toward the input side

tions and three terms of sale, only nine types of sales transactions (3 times 3) are assumed possible at the lowest level of abstraction. These nine combinations of initial inputs may be expressed in a matrix as shown in Exhibit 2 immediately below.

EXHIBIT 2
Transactions Matrix

Terms	Locations L_1	L_2	L_3	Input
T_1	I_1	I_2	I_3	
T_2	I_4	I_5	I_6	
T_3	I_7	I_8	I_9	

In addition, since two types of sales are for credit, there are six types of cash collections on accounts possible (2 times 3). In matrix form, these may be expressed as shown in Exhibit 3 below.

EXHIBIT 3
Cash Collections Matrix

Terms	Locations L_1	L_2	L_3	Input
T_2	I_{10}	I_{11}	I_{12}	
T_3	I_{13}	I_{14}	I_{15}	

Taking both matrices into account, there are fifteen types of transactions possible at the lowest level of abstraction in the partial system we are assuming here. Reading from the matrices, the fifteen transactions which can be used as initial input are shown in Exhibit 4 on page 49.

Having restricted the initial input to these fifteen types of transactions, we can now determine the number of questions that might be answered by combining the totals of these fifteen transactions in various ways. If the arrangement of the transaction totals is a significant part of the answer, the totals can be combined to answer fifteen factorial questions. Fifteen factorial is computed by multiplying 15 times 14 times 13, and so on to times 1. This comes out to a little more than one trillion answers. Of course, detailed analysis will show that many of these answers are, in effect, duplications or related to questions which it is unlikely we would ever ask. On the other hand, some of these answers might be for questions we should have been asking all the time. In any case, in an ideal information system it would not be necessary to make such an analysis. An ideal information system would be capable of answering any of these one trillion questions as soon as the need arose without going through any long involved special analysis, before or after the need became apparent. The way to achieve this capability in an information system is by use of an input chart of accounts.

Twenty-two inputs

In our partial system, twenty-two input accounts would be needed to cover what we would assume to be the normal functions of financial accounting in regard to these fifteen types of transactions. The input accounts would consist of one for the beginning balance of the cash account, six for the beginning balances of the accounts receivable accounts, and fifteen to accumulate totals for each of the fifteen types of transactions. Itemized, they would be shown in Exhibit 5 on page 49.

Referring back to Exhibit 1, it will be noted that Input 1 would be the equivalent of Accounts 8 through 22, and Input 2 would be equivalent to Accounts 1 through 7. Since the latter accounts are beginning balances of the period, they are at a higher level of abstraction than the fifteen which deal with the transactions of the current period.

How system works

Now, assume we code the current transactions as they take place and process them in a real-time computer system, where the beginning balances are also stored by account code. By using these twenty-two accounts, we could ask for answers to our questions in the following way:

1. If we wanted to know the current cash balance we would ask the computer system to add Accounts 1, 8, 9, 10, 17, 18 19, 20, 21, 22, etc. (the additional increases and decreases in cash our partial system has ignored). Obviously, it would be absurd to operate a manual system in this manner. The amount of detail involved every time a question was asked would cause undue delay and confusion and probably would result in many errors. Obviously, too, it would be absurd even in a computer system to inquire in this manner for answers to routine questions. Instead, a computer program would be prepared which would simplify the process of inquiry. For example, we might simply ask "What is the current cash balance?" and the calculations mentioned above would be completed in a fraction of a second and the answer given to us.

While computer programing would be advisable to obtain the answer to such a routine question, there would still be no need to maintain a separate continuing account in the computer for the current cash balance. The answer can be calculated so quickly by the computer system from the original input accounts that such redundancy is unnecessary. On the basis of this same principle, it is also unnecessary to maintain account balances for the other answers making up the original estimate of one trillion possibilities.[7] The answers to these other possibilities are nevertheless stored in the input accounts waiting for us whenever we need them. The only requirements we must meet to get an answer is first to define our question and then ask it in a manner the computer system can comprehend, e.g., add Accounts 1, 8, 9, 10, 17, 18, 19, 20, 21, 22, etc.

2. Obtaining information about the accounts receivable would also assume computer programing for routine questions. For example, one such question might be as follows: What is the current accounts receivable balance for the company as a whole? The answer would be obtained by the system by adding Accounts 2, 3, 4, 5, 6, 7, 11, 12, 13, 14, 15, 16 and subtracting Accounts 17, 18, 19, 20, 21, 22.

Double entry unnecessary

The use of Accounts 17 through 22 in this particular calculation reveals another important feature of input accounts. These six input accounts, which represent cash collections on various types of accounts receivable, are *subtracted* in the present case where we are calculating the current accounts receivable balance. Previously, in calculating the current cash balance, these same input accounts

[7] We are ignoring the fact that by adding the six beginning balance accounts we have actually increased the number of answers possible.

EXHIBIT 4

List of Input Transactions

I_1	equals	L_1T_1 (location one, sales for cash)
I_2	equals	L_2T_1 (location two, sales for cash)
I_3	equals	L_3T_1 (location three, sales for cash)
I_4	equals	L_1T_2 (location one, sales on 30-day account)
I_5	equals	L_2T_2 (location two, sales on 30-day account)
I_6	equals	L_3T_2 (location three, sales on 30-day account)
I_7	equals	L_1T_3 (location one, sales on 90-day installment)
I_8	equals	L_2T_3 (location two, sales on 90-day installment)
I_9	equals	L_3T_3 (location three, sales on 90-day installment)
I_{10}	equals	L_1T_2 (location one, cash collections on 30-day accounts)
I_{11}	equals	L_2T_2 (location two, cash collections on 30-day accounts)
I_{12}	equals	L_3T_2 (location three, cash collections on 30-day accounts)
I_{13}	equals	L_1T_3 (location one, cash collections on 90-day installments)
I_{14}	equals	L_2T_3 (location two, cash collections on 90-day installments)
I_{15}	equals	L_3T_3 (location three, cash collections on 90-day installments)

EXHIBIT 5

Input Chart of Accounts

ACCOUNT NO.	ACCOUNT DESCRIPTION
1	Beginning cash balance for the whole company
2	Beginning balance of accounts receivable—30-day accounts—location one
3	Beginning balance of accounts receivable—30-day accounts—location two
4	Beginning balance of accounts receivable—30-day accounts—location three
5	Beginning balance of accounts receivable—90-day installments—location one
6	Beginning balance of accounts receivable—90-day installments—location two
7	Beginning balance of accounts receivable—90-day installments—location three
8	Cash sales—location one
9	Cash sales—location two
10	Cash sales—location three
11	Sales on 30-day account—location one
12	Sales on 30-day account—location two
13	Sales on 30-day account—location three
14	Sales on 90-day installment—location one
15	Sales on 90-day installment—location two
16	Sales on 90-day installment—location three
17	Cash collections—30-day accounts—location one
18	Cash collections—30-day accounts—location two
19	Cash collections—30-day accounts—location three
20	Cash collections—90-day installments—location one
21	Cash collections—90-day installments—location two
22	Cash collections—90-day installments—location three

were *added* in obtaining the new cash balance. In other words, the computer system conceived here does not need to maintain separate double entry accounts with their balancing debits and credits. It can use a single input account balance to denote the amount of a debit in one case, the amount of a credit in another, and the amount to be treated in any other fashion we wish in some other situation. Since the computer does not become confused when faced with numerous highly detailed instructions about each and every input account, the double entry checks and balances that were developed to overcome the limitations of a manual system can be dropped. In fact they must be dropped if the computer is to be allowed to use its full power in taking a single input account and making "innumerable" rather than only "single" or even "double" entry use of it.

The computer system conceived here does not need to maintain separate double entry accounts with their balancing debits and credits. It can use a single input account balance to denote the amount of a debit in one case, the amount of a credit in another, and the amount to be treated in any other fashion we wish in some other situation.

Accounts receivable

Obviously, other routine questions might be asked about the accounts receivable. We might ask for the current accounts receivable balance on:

a. the 30-day accounts (add 2, 3, 4, 11, 12, 13 and subtract 17, 18, 19).

b. the 90-day installment accounts (add 5, 6, 7, 14, 15, 16 and subtract 20, 21, 22).

c. accounts at Location one (add 2, 5, 11, 14 and subtract 17, 20).

d. and so on.

In all of these cases, the answers would be derived by adding and subtracting the appropriate input account balances.[8]

3. If we needed various facts about the current sales activity, we could ask the computer system to provide or combine Accounts 8 through 16 in various ways:

a. The balance in Account 8 is the cash sales for Location One. This balance would provide useful information by itself.

b. By adding Accounts 8, 11, and 14, we would have the total of all sales for Location One. We could ask that these input account balances be given to us in total, separately, or both.

c. By adding Accounts 11, 12, and 13, we would have the total sales on 30-day accounts for the whole company. Again, we could ask for just the total, the supporting account balances, or both.

d. By adding Accounts 8 through 16, we could have the total sales for the company, and/or its supporting details.

e. And so on.

All of these accounts, 8 through 16, have been used before in making calculations of the current cash balance or the current accounts receivable balances. The input account balances may be used over and over again in as many combinations as are needed in the specific applications.

In the above limited examples of the use of input accounts in connection with cash, accounts receivable, and sales, we have confined ourselves to the kind of information usually related to a balance sheet or income statement. From the input account balances we computed some of the output account balances included in balance sheets and income statements and some of the information included in schedules supporting those output balances. We produced all of this information for the balance sheet and income statement by combining the input account balances in various ways. Of course, we do not have to limit ourselves to these two types of statements. We could produce other types of statements by the same advantageous combination of input accounts, e.g., we could prepare a statement of sources and applications of funds.

The advantage of the input method can be further demon-

[8] *Accounting and The Computer*, American Institute of Certified Public Accountants, Inc., New York, N.Y., 1966, p. 295 (a reprint of A. F. Moravec, "Basic Concepts for Designing a Fundamental Information System," *Management Services*, July-August, 1965, p. 40). Moravec applies the input concept in what he calls the "single information flow concept."

strated by comparing it to the traditional method accountants are taught to use when preparing a statement of sources and applications of funds. The traditional worksheet method starts with the balance sheets for the beginning and the end of some accounting period. (Note that all of the account balances on these balance sheets would be output-oriented.) On the worksheet, the net change in each of the output account balances *between* the two points in time would be calculated. Then, these net figures would be divided into those that are classified as current accounts and those that are non-current accounts. The net changes in the non-current account balances are the figures that will be used to begin the preparation of the statement of sources and applications of funds.

Funds flow statement

However, the account balances on each of the balance sheets were originally computed to answer one question, i.e., what *is* the financial position of the company at some *given point in time*? The question, "What were the sources and applications of funds between two given points in time?" was not contemplated in the preparation of the balance sheets. Consequently, the calculation of the net changes in the non-current output account balances produces a conglomeration of data which cannot answer the new question. The conglomeration hides within its net totals some information that does apply to the funds flow question and some that does not. From this point on, then, the process is a familiar one to the accountant. He refers to other records, analyzes the net change figures in detail, sifts out what he needs, and excludes what he does *not* need. All of this process is required because the initial information being used comes from an output-oriented system which was never really intended to provide funds flow information. Faced with a question its designers did not preconceive, the output-oriented system can provide an answer, but only in a very inefficient manner.[9]

Sources of funds

Now let us look briefly at how our twenty-two input accounts would be used to prepare a statement of sources and applications of funds. As before, the preparation of the new statement would be accomplished by the simple expedient of combining input accounts in various ways. Since we did not conglomerate the data to answer some preconceived question in the first place, we will not have to engage in any separation or analytical process to make the data useful in serving our new requirements. Accounts 1 through 7 are beginning balances and so cannot be sources or applications of funds in the current period. Accounts 17 through 22 represent the conversion of one type of current asset (accounts receivable) into another type of current asset (cash) and so are neither sources nor applications of funds. Accounts 8 through 16, sales for cash and on account during the current period, are sources of funds and are already in an appropriate form to be used in the preparation of a partial statement of sources and applications of funds. For example:

1. By adding Accounts 8 through 16, etc. (the additional input accounts our partial system has ignored) we could obtain the sources of funds for the company as a whole. From these same accounts we could also obtain a partial statement of sources by location. For instance, Accounts 8, 11, and 14 are sources of funds from Location one; Accounts 9, 12, and 15 are sources from Location two; and Accounts 10, 13, and 16 are sources from Location three.
2. If we had the additional input accounts that would be provided in a complete system, we would apply the same combination procedure to obtain the applications of funds for the company or its separate locations.

It seems readily apparent, even in this admittedly limited example, that an input system would be capable of providing a statement of sources and applications of funds with relative ease, while an output system would require a great amount of special analysis and adjustment.

Concluding comments

Throughout the preceding presentation, we have had to leave much to the reader's imagination in order to provide a concise statement of some of the more important implications an input chart of accounts would have for a computerized accounting system. We wish, however, to outline one additional thought before closing our commentary. Earlier, when discussing the fifteen types of transactions to be used as examples in our partial system, we indicated they could produce fifteen factorial or about one trillion different answers. Strictly speaking, this is merely the number of ways the fifteen input account balances can be arranged in the process of computing output account balances. If we had wished, of course, we could have done much more than simply arrange and compute account balances. For example, we could also have the computer system calculate the ratio each account or combination of accounts is to various totals, compare any of these figures to those of past periods, make projections of future periods based on the activity of the current period, and so forth. In short, since the accounting system we are visualizing here would truly be an information system in every sense of the term, the number of answers such a system could provide is beyond imagination or calculation.

[9] Butterworth, *op. cit.*, p. 61. Butterworth makes exactly the same point, i.e., accountants experience difficulty in using account balances at the beginning and end of a period to derive a statement of sources and applications of funds.

A continuation of the last issue's report

AICPA HOLDS THIRD COMPUTER CONFERENCE

PART II

A Management Services staff report

TODAY, the ability to "go around" the computer in auditing exists in only the most limited cases, Stanley Halper, S. D. Leidesdorf, New York, last of the panelists discussing the new AICPA book, *Auditing and EDP*, told the recent semi-annual conference of CPA Computer Users at Kansas City.

The going-through-the-computer approach, while it may be more costly, is vastly more satisfactory to the auditor since the system he is auditing perforce includes the computer system, he added.

"The book's objective of providing a starting point for building the consensus of expert opinion on auditing practices has been substantially accomplished," he said. "The book, however, should, in my opinion, and I think the opinion of the people who worked on it, not be looked on as a panacea, because within the framework of the profession the art is consistently changing, and there is no one set of answers.

"Within the framework of the few minutes alloted me it obviously would be impossible to go through a critical review of the work of this magnitude. However, I'd like to make this point. In the exercise of an art, the painter has the privilege of moving his brush to depict the picture as he sees it. The manual gives us the palette, and the way we move the brush and use the color in the palette may differ philosophically among us."

The book could have given more emphasis to utilization of statistical sampling with the computer, Mr. Halper went on, saying that he believed the use of statistical sampling today and of sampling data to be tested back to source documents is something which is in the forefront of the final union of computer capacity and statistical sampling.

Sampling neglected

"I would also have liked to have seen somewhat more emphasis on the utilization of the computer itself to test attributes of the system," Mr. Halper declared, "for example, the scanning of a file to set out an exception to something which does not meet a predetermined norm. I feel . . . that most auditors probably spend 90 per cent of their time trying to figure out what to audit... 10 per cent... with exceptions to the system itself. I would prefer a little more emphasis in the book in terms of the utilization of the computer for exception and attribute sampling.

"This procedure, by the way of going through the computer again, becomes even more important as the printed audit trail disappears. Our experience has indicated that the printed audit trail, in fact, is disappearing. *This* may not be true in all installations, but the third generation computer is starting to make the concept of management by exception more prevalent. The auditor must therefore monitor the system and, I can't emphasize this strongly enough, work in conjunction with the internal auditor in doing this."

Mr. Halper also criticized *Audit-*

ing and EDP for not emphasizing the interrelationship of data files and the testing of them and the economy possible with a through-the-computer approach.

"Our experience has led us to the opinion that the cost of a computer application can usually be justified and that the benefits last more than one year," he said, adding that as labor costs go on rising, the benefits of using machines wherever possible, rather than people, will continue to increase.

One of the best-attended sessions at the automation conference was a panel discussion in which several CPAs discussed their individual experiences with their own computers, a discussion which soon revealed that each of them had solved his problem in completely different ways.

One of the panelists, Edwin T. Boyle, of Edwin Boyle, Hackensack, New Jersey, implied some dissatisfaction with the CPA's ethical stand on publicizing the profession's use of the computer.

"Is there something that the profession could be doing that it's not to assist in alleviating this problem (CPA firms investing heavily in computer knowledge and then finding themselves handicapped in making their expertise known)?" he asked. "I believe there could be more assistance in the form of institutional advertising, to compensate for the direct solicitation by others. The public should be aware that the CPA is a logical participant in computer work. The success of an individual CPA in this field is not sufficient; unless the successes are of a large enough number, they are identified with individuals, not the profession. In my opinion we must raise the level of the entire profession."

Mr. Boyle pointed out that the AICPA had last year issued an interpretive opinion which now permits AICPA members to incorporate the computer part of their practices, as long as they operate within the profession rather than for the general public.

"Why then, haven't more practitioners taken advantage of this provision permitting us to join forces financially, intellectually, creatively?" Mr. Boyle asked. "Why haven't we set up the equivalent of a doctors' hospital where the less knowledgeable CPA can secure the aid he requires to be able to advise his clients at the highest level of professional development?"

The doctors' hospital approach would also solve major problems facing CPA firms because it would eliminate much of the duplicate cost of hardware, programs, and research and development, Mr. Boyle pointed out.

"Through joining forces we could change our way-back position as a profession in this race to a lead position," he continued. "It is not enough that CPAs be told of the wonderful opportunities that exist today in the computer field. The profession en masse must take advantage of these opportunities if we intend the profession and therefore ourselves to be identified with them. We now have the format in which to operate. Why not take advantage of it?"

CPA first, then EDP specialist

Jerome Farmer, J. K. Lasser & Company, New York, a panelist who spoke before Mr. Boyle, said that he considered himself a CPA first and then an EDP specialist and that his entire approach to the computer had been in terms of greater use of the computer in the audit function.

Moreover, he said he believes this is the most fruitful area for the great majority of CPAs, but one that requires a great deal of study and tremendous effort.

Believing as he does that the CPA can best use the computer to expand the audit function, he and his firm have shunned the service bureau approach, Mr. Farmer said.

"I couldn't care less about selling payroll for twenty-three cents a line when someone is selling it for nineteen cents a line," he said. "I don't think this is the sort of competition I sought to engage in

"I believe there could be more assistance in the form of institutional advertising, to compensate for the direct solicitation [of computer business] by others. The public should be made aware that the CPA is a logical participant in computer work. The success of an individual CPA in the field is not sufficient . . ."

— Edwin T. Boyle

when I embarked on a professional career."

"Instead we oriented our programs toward the elimination of the detail which inevitably creeps into any auditing engagement and which discourages young men and disillusions them regarding the advantages of this very exciting profession," he said.

The computer at J. K. Lasser is used for preparation of adjusted trial balances and for preparation of extended work papers, balance sheets, income statements, consolidations, and analyses of special departmental costs. The 1120 corporate income tax return is prepared on it completely, with the exception of the bottom half of Page 3, which has not yet been adapted to computer print-out.

"Compared to people, the computer is available 365 days a year, it does not have emotional problems, it doesn't fall into or out of love, it doesn't take extended lunch hours, and it doesn't go on vacation."

— Jerome Farmer

Effective practice management

J. K. Lasser is now programing the computer to process the New York State corporation income tax return as a by-product of doing the 1120.

"So we can," said the speaker, "in one pass if we choose—and it wasn't easily accomplished—run a financial statement, branch out of the financial statement into the 1120, branch out of the 1120 into the New York franchise tax return, and do it all in a fraction of the time that it would normally take a skilled individual, doing it manually. We can also get a much better job, eliminate statistical typing, meet deadlines, and perform a variety of other functions.

"I'd like to point out that, compared to people, the computer is available 365 days a year, it does not have emotional problems, it doesn't fall into or out of love, it doesn't take extended lunch hours, and it doesn't go on vacation."

"I merely alluded to the extension of auditing procedures as one use for the computer," Mr. Farmer concluded. "Perhaps one of the greatest paybacks we've had is our ability to produce administrative reports that will enable us to manage our practice more effectively. The use of the computer to help you to administer your practice more effectively is one of the greatest things you can do for yourself."

"Fear" approach scored

Mr. Farmer added that he thought there had been too much emphasis on the fear approach —the theory that CPAs who do not become involved in automation will become passé, will have no clients.

"Well, it just isn't going to happen," he assured the audience. "You won't be wiped out. Everybody in this room could probably finish his career without being unduly affected by the computer. But if you are thinking of building an accounting firm, if you are thinking of capitalizing on the one major asset you have, the great intangible called good will and continuity of your firm, my suggestion is you'd better get with it, because you're not going to get the bright young men who are coming out of school. They have a greater background for this field than you have and a much greater capability for it, and if you haven't got tools that they've been working with, they're not going to work with you."

Another of the panelists, Mr. Halper of Leidesdorf, described the distinctive operation within his company, where he heads an EDP department that is in effect a service unit and consultant to both the firm's auditing staff and management services personnel. The EDP group reports directly to the firm's managing partners rather than to management services.

Primary responsibility is to auditing, while work for the management services division is done on a bid basis exactly as though the EDP unit were an outside service bureau.

"If we're good enough, we get the job," Mr. Halper said. "I'm not kidding when I say we lost several jobs because of our prices."

Direct service to clients is given on a very limited basis and is re-

stricted to certain selected jobs such as marketing, projections, and simulations, Mr. Halper continued.

Auditing quality paramount

But these interests are peripheral at Leidesdorf. Maintaining the quality of the audit work is always the main assignment of the EDP group.

"Our main thrust now is toward educating our auditors in the role they have to play," the speaker went on. "In order to achieve this, we feel they must lose their fear of the computer; this can only be achieved by a dynamic education program with a minimum two-week training period for each auditor so they can communicate with us. The education work is on a full-time basis. Tomorrow we plan to have a conversational mode on line with our computer for our auditors. This will enable auditors by use of a console—whether in the staff room where it is presently being worked on or at our other offices—to communicate directly with the computer in a problem-solving environment."

Some clients will be linked directly to the Leidesdorf computer so that they can be audited continually, he said.

"We hope to upgrade our equipment, to provide further capacity for simulation techniques in the management science area," Mr. Halper concluded. "This will apply whether we simulate our clients' environment, which we do for auditing purposes, or do work for them in network analyses and various other things."

What about cost of computer installations, especially for the smaller firm?

Mr. Boyle had some concrete words on the subject. He divided the majority of CPAs now involved with computers into four categories: those with third generation electronic equipment; those with less expensive, relatively primitive machines; those who have computers on order or plan to order them in the near future; and those who are working through service firms and have no current intention of getting computers of their own.

The cost of large, modern computers is almost prohibitive for a small firm, he said. "Computer hardware in this category rents in the neighborhood of seven to eight thousand dollars a month. Personnel and other collateral costs normally are higher than the cost of the hardware, so that we're talking in budget terms of two hundred and fifty thousand dollars up a year."

Competition from banks, computer service centers, and other management consultants is also intense, he pointed out.

Time serious cost factor

Another main problem, in his view, is the amount of time that must be devoted to electronics if one is to become deeply involved in computers.

"And the time involved in this is spent, must be spent, by our top-level personnel—no-charge time at that," he went on. "Adding up all of the above factors, we must conclude that very few small to medium-size practitioners can afford this league. They must seek other alternatives." These alternatives may include associations with other CPAs, use of service centers, buying of "block" time, or other non-hardware involvement.

The second category of CPAs, those with slower and less sophisticated equipment, is handicapped because of the equipment, he said. Many of them are talking of data collection centers, with remote station terminals at their own locations. But this in turn presupposes moving into a more expensive league and facing much the same problems that affect firms in Category One.

It was here that Mr. Boyle advocated the doctors' hospital approach mentioned earlier. Such an answer, he pointed out, would begin to solve most of the problems faced by firms falling into both of the categories.

". . . if you are thinking of building an accounting firm, if you are thinking of capitalizing on the one major asset you have, the great intangible called good will and continuity of your firm, my suggestion is you'd better get with it [EDP] because you're not going to get the bright young men who are coming out of school. . . . if you haven't got tools that they've been working with, they're not going to work with you."

—Jerome Farmer

what people are writing about

BOOKS

Using Information to Manage by ARTHUR B. TOAN, JR., The Ronald Press Company, New York, 1968, 157 pages, $5.

This book outlines, for the manager of a typical manufacturing company of "modest" size, what information he needs to run his company, where to get it, and how to use it after he gets it.

No two companies have exactly the same information needs, of course. Yet, despite the many differences that result from differences in size, product, and the like, management needs for information have much in common, Mr. Toan points out.

That is because the underlying questions that must be answered are essentially the same. "Within reasonable limits one can contend that while information may differ in order and complexity between the great and the small, the worldwide and the local, the commercial and the governmental, it is all essentially similar in purpose and in kind."

On this assumption, Mr. Toan goes on to review the basic kinds of information that every executive must have to keep his business out of trouble and to get it out of trouble if problems arise. The business "of modest size" and its executives are used as a frame of reference, but, the author emphasizes, "most of what is said has wide application."

The two basic questions with which every executive must be concerned are, "How am I doing?" and "Where am I going?" So the first two chapters of the book are devoted to evaluation of current results and to planning and budgeting.

Mr. Toan cites four basic uses of current information: a better, more factual basis on which to

make decisions on short-term actions and longer-range plans; a better and faster indication of when things are not going right; a stimulus to take action when it should be taken with a better basis for deciding what should be done; and an incentive for making better plans.

Information criteria

He also lists five criteria for evaluating information: It should deal with the vital aspects of the business; be reliable enough to serve its purposes; be timely enough to enable management to act; be intelligible; and be accompanied by an appropriate basis of comparison.

As a matter of fact, the book is full of useful checklists. One tabulates the principal accounting reports and ratios and indicates whether it is appropriate to compare each with the present, the past, a plan, a potential, or competitors. Another lists the basic information needed for sales forecasting and appropriate sources. The appendix, along with a glossary of business and information terms, offers a three-page list of the major information requirements of a manufacturing company.

Needs and sources

A chapter on costs, prices, and profits discusses both the standard financial reports and the uses of special analyses. Chapters on marketing, production, and cash management stress the kinds of data needed and their sources; less emphasis is put on the use of the information—since this is, after all, a book about information rather than about management itself.

One of the most interesting chapters, also full of check lists, tells how to evaluate a management information system. Mr. Toan is an experienced consultant; he is partner in charge of management advisory services for Price Waterhouse & Co. (as well as a former member of this magazine's board of editors); and his description of how to look critically at a management information system enables the management reader to put himself in the role of a consultant and take an objective look at his own information flow.

The style of the book is simple, concise, and nontechnical. Many of the chapters are presented in the form of hypothetical case studies, with personalities and dialogue.

Although this book is not profound, it provides a lot of information about information. Nearly any manager could learn something from it, even if his company is of more than modest size.

Mathematical Applications of Accounting by A. WAYNE CORCORAN, Harcourt, Brace & World, Inc., New York, 249 pages, $4.50 (paperbound).

Although this book was written as a college text, it would be very helpful to any accountant who feels ill equipped to cope with the current surge of interest in mathematical techniques for management and accounting use.

These days nearly every accountant is under pressure to use —or at least understand—mathematics. Many of them "have difficulty," as Professor Corcoran notes with delicate restraint. His book was written to "help them in their struggles."

This book assumes a familiarity with basic algebraic equations, factoring, the laws of exponents, and logarithms. However, for those who lack it, a review chapter is supplied.

The basic topics covered in the book are time series mathematics, calculus, probability theory, matrix algebra, and linear programing. These are applied to such problems as capital budgeting, mortgage calculation, sinking funds, pension funds, depreciation, cost estimation, inventory theory, and the like. Anyone to whom that sounds intimidating probably needs this book.

Briefly listed

Results Management in Action by BURT K. SCANLAN, Management Center of Cambridge, P.O. Box 185, Harvard Square, Cambridge, Massachusetts 02138, 132 pages, $7.95.

A specialist in management training offers what he calls a "'how to' approach to effective leadership." Topics covered include motivation, setting job objectives, coaching and developing subordinates, and decision making.

How to Change Your Position, Executive Register Inc., Executive Division, Colonial Building, New Canaan, Connecticut, 12 pages, no charge.

Although admittedly a promotion piece for the Executive Register (a "clearing house" for executive positions), this little booklet contains some useful suggestions for the middle-level or top executive job hunter.

How to Slash the High Cost of Business Postage by D. B. HORTON, MSS Industries, 828 Sterick Building, Memphis, Tennessee 38103, 7 pages, $2 (mimeographed).

This little booklet offers fairly obvious but often overlooked suggestions for saving on postage bills.

The Acquisition Profile, Thomas Thompson Associates, 8600 Main Street, Buffalo, New York 14221, 33 pages, $25.

This set of forms was designed as a tool for analyzing the strengths and weaknesses of prospective corporate acquisition candidates in relation to the acquirer's needs. Management can also use it to analyze a company's own opera-

tions and develop objectives. It is now being employed, according to its publisher, by 22 companies.

MAGAZINES

Profit Responsibility in Soviet Enterprise by BERTRAND N. HORWITZ, *Journal of Business*, January, 1968.

This article reviews the Soviet economic reforms of 1965 and the conditions that led to them.

In 1962, after Soviet economic growth slackened and consumer dissatisfaction intensified, Professor Liberman severely criticized prevailing management practices. His basic assumptions, contrary to those of the government, were these: Each manager has a better grasp of his plant's capabilities than the central planners, and managers perform better with financial incentives than with none. As a result, certain economic reforms came about.

The multiplicity of goals for management was reduced. Not only would management have fewer goals, but the emphasis would be shifted from accomplishing targets of physical production to estimating "sales as evidenced by cash receipts." Sales would become more important than production, because "realization signifies the acceptance by society of the product." Enterprises would be able to negotiate directly with each other and make their own decisions about their product mix, in order to increase their efficiency.

As a measure of the enterprise's success, profitability would be stressed. Profit formulas would be specified. First the "balance profit," which may be equated with net profit before tax in the United States, would be determined. From this "balance profit," financing charges would be deducted to get "accounting profit." The management would receive a bonus on "accounting profit" according to the following formula: If P_t is the accounting profit at time t; K_t is total assets, which include fixed assets at gross historical cost plus normal (planned) working capital at time t; and α and β are centrally determined coefficients, both being positive and less than one, the rate of the bonus for time t would be:

$$\lambda_t = \alpha\left(\frac{P_t - P_t - 1}{P_t - 1}\right) + \beta\left(\frac{P_t}{K_t}\right)$$

The total bonus for time t would be the bonus rate (as determined above) times the wage fund.

Advantages

A bonus computed in this way apparently has two advantages, namely, it emphasizes a rising rate of profit and it pressures management to accept additional investment as long as return on additional investment is positive, i.e., $(P_t - P_{t-1}) > 0$. The whole incentive scheme has been designed to lead to an optimum size of investment in an enterprise without prejudice as to the size of the enterprise. With the use of the first derivative, the article shows how the optimum amount of investment K_t can be attained under the new bonus maximization plan.

Professor Horwitz goes on to examine the effects of the new bonus plan on replacement decisions. Because under the new bonus scheme the management will consider the effect of replacement on both accounting profit and also on the book value of gross assets, one consequence might be an earlier replacement of assets under the new bonus plan than without such a bonus.

Pricing

These incentives should have an important effect on pricing policy, transfer pricing, and the pricing of the final product. Russian planners do not appear to be very clear on this point except to reaffirm the Marxist thesis that a price should reflect the "socially necessary expense of labor involved in producing an article." There does not appear to be any evidence that prices reflect the interplay of demand and supply for a commodity; they appear to be administered centrally.

The effectiveness of these Russian economic reforms is as yet unknown. One notes that the key elements in the new bonus and incentive fund formulas—the α and β coefficients and the charges on fixed assets, wage funds etc.—are still determined centrally. It looks as if the Soviet central planners find the effectiveness of the monetary incentives of the West appealing but as yet are not prepared to relinquish all of their present market controls.

GYAN CHANDRA
The Ohio State University

Minimizing Response Errors in Financial Data: The Possibilities by E. SCOTT MAYNES, *Journal of the American Statistical Association*, March, 1968.

The author reports on an investigation of response errors in reports of savings account and debt balances conducted by and within the Bureau of the Census. The influence of the following factors upon reporting accuracy was tested in the study: record consultation, rounding, size of balances, number and nature of transactions in the account balance, and length of the recall period.

Out of about 2,900 accounts of the Census Federal Credit Union, owned by about 2,200 people, 1,241 accounts were selected by the Census Bureau for a study of reporting accuracy. These 1,241 accounts consisted of 10 per cent of all accounts with balances under $100 and all accounts with balances of $100 or more. The analysis for savings account balances was based on 701 accounts for which responses were obtained to a mail questionnaire; the analysis of debt

balances was based on 229 accounts. The relatively high response rate of 56.5 per cent for a no-follow-up mail survey may be attributed to favorable sponsorship of the study by top executives of the credit union.

In order to explicitly measure the effect of record consultation on reporting accuracy, randomly selected halves of the sample were instructed respectively to consult their records or not to do so in providing reports of savings account and debt balances. The investigators had access to the accounts so that errors due to mismatching of persons with accounts or to the existence of several accounts for the same person are negligible. Accordingly, response error assessment is highly accurate.

Record consultation and response accuracy: Of the record-consultation subsample 85 per cent of respondents reported their savings account balances within ± 1 per cent of the actual balance and 91 per cent within ± 5 per cent; differences in means of balances were not statistically significant at the 5 per cent level. Of the non-record-consultation subsample only 49 per cent of respondents reported their savings account balances within ± 1 per cent of the actual balance and 70 per cent within ± 5 per cent. A tendency toward small, persistent understatement of account balances by respondents appeared in this subsample.

Rounding and response accuracy: Rounding was measured as the number of terminal zeros in a reported balance. In the non-record-consultation subsample it was found that non-rounders (no or one terminal zero) reported 60 per cent of the balances exactly, while the comparable estimate for rounders was only 10 per cent. Similar differences were observed for the record-consultation subsample. Rounders tended to under-report somewhat, regardless of which subsample they were found in, while non-rounding record consulters appeared to report the most accurately of all groups.

Account size and response accuracy: Six hypotheses were tested in this context: average man hypothesis (reports of "small" values overstated and reports of "large" values understated so as to be viewed by others as "average man"); hypothesis of random response errors; hypothesis of persistent under-reporting; permanent balance hypothesis (there exists an underlying normal distribution of "permanent" account balances, which owners regard as desirable in the long run, and a person's reporting of his current balance is influenced by his recollection of his permanent balance); lag-in-cognition hypothesis (rising balances are over-reported, and falling balances are under-reported); and effect-of-change hypothesis (change, regardless of direction, yields inaccuracy, and no or small change yields accuracy). The data provided no support for the average man, permanent balance, or lag-in-cognition hypotheses. Instead, they appeared to show the effects of both random errors and persistent under-reporting, with no consistent trend toward under- or over-reporting as the size of balances increased. The data did support the effect-of-change hypothesis.

Transaction activity and response accuracy: The data did not support the hypothesis that respondents with more active account balances (as measured by the number of transactions recorded in the six months prior to the reference date) will tend to report more accurately.

Length of recall period and response accuracy: It was hypothesized that the longer the period over which the respondent had to recall his account balance, the less accurate the report of the balance would be. The time elapsed since the last non-interest-crediting transaction was taken as an approximation of the length of the recall period. Again, the hypothesis received no support from the data of the study.

Debt balances: The pattern of response errors for the reporting of debt balances did not significantly differ from that of savings account balances. Because of the smaller number of available cases (229), the lag-in-cognition, effect-of-change, and transaction activity hypotheses were not tested for debt data.

Since this questionnaire survey was conducted under near-ideal conditions, the results indicate the maximum degree of accuracy that one may expect to attain in sample surveys of a financial nature.

HEINZ A. BURGSTALLER
University of Illinois

"Dirty Pooling—How to Succeed in Business Without Really Trying" by ABRAHAM J. BRILOFF, *Barron's,* July 15, 1968.

In the lead article of this national business and financial weekly, Professor Briloff publicizes instances involving the pooling-of-interests method of accounting for business combinations that have made him "desire to see this accounting practice discredited and disowned." The cases he discusses involve the firms of Gulf & Western, Whittaker Corporation, and LTV Ling Altec, Inc.

Professor Briloff has written about instances of "dirty pooling" before (*Accounting Review,* July, 1967). Now, only two weeks after J. S. Seidman's public condemnation ("Pooling Must Go," *Barron's,* July 1, 1968), Professor Briloff cites actual cases (in contrast to Mr. Seidman's use of hypothetical examples) since ". . . the moral can best be pointed up by reference to such individual companies."

In the case of Gulf & Western, Professor Briloff correctly points out that G & W's reported 1967 net income was greater than what it would have been had the acquisition of Paramount Pictures been treated as a purchase. This was because G & W's 1967 amortization charges were based on the original cost of Paramount's film library rather than on the "true" cost to

G & W. However, in his zeal to condemn pooling, the author discusses certain other accounting procedures that are unrelated to the purchase vs. pooling controversy (e.g., the timing of revenue recognition from film rentals) with the implication that these "distortions" are somehow caused by the use of pooling. In fact, it is suggested that the increase between 1966 and 1967 reported earnings for G & W's 1967 pooled acquisitions is solely the result of "the distortions which are permitted, if not encouraged, by pooling-of-interests accounting." Here, Professor Briloff has clearly overstated his case; since asset carrying values (and hence depreciation bases) remain unchanged before and after acquisition where the pooling approach is used, this method avoids the very "distortions" that would hinder the comparability of reported earnings between the two years.

Misleading comparisons

Professor Briloff criticizes both Whittaker Corporation and LTV Ling Altec for comparing in their 1967 annual reports 1967 pooled sales and earnings with unpooled figures for the prior year, a procedure which is now in official disfavor with the Securities and Exchange Commission. He further investigated the acquisition of Allied Radio by LTV Ling Altec and concluded that "regardless of any justification for pooling-of-interests accounting generally, [this acquisition] should never have been accounted for as such a pooling." His reasons for this conclusion are impressive: (1) Through some legal maneuvering, "Ling Altec enjoys a tax basis (for certain assets) essentially independent of, and undoubtedly much higher than, that which prevailed for Allied." (2) Ling-Temco-Vought Inc. guaranteed, after a waiting period of four months, the previous stockholders of Allied Radio a specified sales price on 80 per cent of the stock they acquired in the LTV Ling Altec and Allied Radio combination. This right was exercised "in early April, 1968—just about the time when the 1967 financial statements were being mailed. . . . Clearly, the corporation (and its auditors) knew (at this time) that there would be no continuity of Allied's ownership—a standard required (by ARB 48) for accounting for the combination as a pooling of interests."

Proposal

Professor Briloff regards these examples as "being merely symptomatic of the myth-reality dichotomy which is all too prevalent in our professional pursuit." He then advocates having the independent auditor "assume the absolute responsibility for determining which of the alternative accounting principles are most or best appropriate in the circumstances." He "would require this really independent auditor to maintain a continuing responsibility, unless and until superseded by a vote of the shareholders, for the disciplining of all financial data released by management at any time; furthermore, he should be constrained to inform the SEC and/or the exchanges on which the shares are traded of any disagreement he might have with management's disclosures."

Documented examples

Although this article can scarcely be regarded as either comprehensive documentation for Professor Briloff's position that management's prerogative of selecting from among generally accepted accounting principles be turned over to the independent auditor or as an indication that the practice of pooling is undesirable on balance, it does provide real-world examples of how the pooling-of-interests method can be and has been employed in individual instances so as to produce misleading implications for the unwary.

James E. Parker, CPA
Michigan State University

Apportionment of Overheads — The Problem of Reciprocal Service Departments — Mathematical Solutions — I and II by Geoffrey A. Holmes, *Accountancy*, December, 1967, and January, 1968.

In this series of articles the author explains the technique of using matrix algebra to solve a simple set of simultaneous equations.

The first article serves to demonstrate the existence of a basic matrix algebra technique to solve the problem of apportionments when it is stated in terms of simultaneous equations. The second article discusses a specific algorithm, Gauss-Jordon Scheme, which can be used for matrix inversion.

Basic technique

To illustrate the matrix algebra approach, the author creates a medium-size manufacturing company with a single plant. The company has four reciprocal service departments; building, personnel, power house, and transport. The apportionment of the costs associated with these departments is represented in terms of four simultaneous equations.

The author describes how these relationships can be expressed in matrix notation. In the process of this description he defines matrix, vector, matrix-vector multiplication, and the method used to identify individual cells of the matrix. Afterwards, he introduces the unit matrix and the inverse matrix.

The standard procedure of manipulating the coefficient matrix and the inverse matrix to obtain the solution to a system of simultaneous equations is demonstrated for a set of two equations and a set of four equations.

Specific algorithm

The second article demonstrates the routine nature of the Gauss-Jordon elimination scheme. This scheme is useful in solving a system of simultaneous equations of a high

order because the algorithm can be readily programed for a computer.

The author's explanation of matrix algebra and some of its uses is simple enough to be understood by readers who are not particularly skilled in mathematics and who have had no previous exposure to matrix algebra.

G. R. Bruha
Northwestern University

Accounting for Debt and Costs of Liquidity Under Conditions of Uncertainty by Harold Bierman, Jr., and Seymour Smidt, *Journal of Accounting Research,* Autumn, 1967.

Two weaknesses in the contemporary accounting treatment of bond liabilities, contend the authors, are inaccuracy and incompleteness. To correct the improper valuation of the debt that results from these faults and to permit simplified and meaningful interfirm comparisons, Professors Bierman and Smidt propose a modification in the present value concept as it is currently applied to bond liabilities.

The current practice of discounting the flow of contractual payments (principal and interest) by using the effective rate of interest does not properly consider the possibility of default by the debtor or the importance of this factor in determining the market price of the bonds. Therefore, the authors contend that the liability is necessarily misstated. For example, two corporations can float bond issues, alike with respect to principal and maturity, and if the effective rate of interest equals the nominal rate for each company, they will report equal liabilities even if one has to yield a rate of interest twice as large as the other. Surely, the authors argue, the amount of the debt is not the same in this situation, and the liability is similarly misstated in less obvious cases. Because of this accounting weakness, interfirm comparisons are unnecessarily complicated. Thus, they feel, the solution to the problem lies in using the same time value of money for the computation of all bond liabilities—a default-free rate of interest.

Government bond rate

By recording the liability as the sum of the contractual payments at its present value by using a default-free rate of interest, the debtor would show the gross liability that would exist if there were no uncertainty about its ability to meet contractual obligations. Moreover, the authors maintain that the effective rate of interest on United States government bonds of a like maturity can be used as the true default-free rate for a given bond issue. The result of this practice would be the recording and reporting of bond liabilities on a more meaningful basis that would permit the users of accounting information to reliably compare the capital structures of different corporations.

Expected value calculation

The difference between the gross liability, which shall be termed L, as computed by using the default-free rate, and the market value of the bonds, M, results from two factors. In a theoretical model presented by the authors, a probability of default, d_i, is presumed to be known. As such, an expected value of the contractual payments, E, exists, which equals the probability of payment, $(1\text{-}d_i)$, times the present value at the default-free rate, again L. The relationships among the three values are as follows:

- $L - E = d_iL$ = the expected amount of default, which the authors term the "expected monetary value adjustment";
- $E - M$ = the amount necessary to induce investors to hold the corporate, rather than government, securities, or a "risk adjustment"; and, of course,

$$L - (L\text{-}E) - (E\text{-}M) - M = 0.$$

Although, in reality, d_i is never known, the authors submit a practicable solution. (L-E) and (E-M), together, represent the monetary value necessary to compensate investors for the expected amount of default and to induce them to hold the corporate bonds. Therefore, let

$(L\text{-}E) + (E\text{-}M) = A$ = the "expected monetary value and risk adjustment" so that $L - A = M$, and $L - A - M = O$.

The accounting procedure for the issuance of the bonds consists of debiting "cash," which equals M at this point in time; debiting "expected monetary value and risk adjustment"; and crediting "bonds payable," which is L. Once again, the double entry relationship is

$$M + A = L.$$

This unique proposal also involves adjusting the gross liability when the default-free rate of interest changes and recognizing gains and losses resulting from changes in the effective rate of interest of the corporate bond issue. Consequently, the authors suggest that a net liability, L − A, be shown in published statements so that the debt will be reported at its current market value.

Underlying assumptions

To evaluate the authors' proposal, it is necessary to examine some of the underlying assumptions involved. In developing their proposal, the authors made the following assumptions:

1. The difference between the effective rates of interest on corporate bond issues is due to differences in risk.
2. The difference between a corporation's effective rate of interest and the default-free rate is due to a risk factor.
3. The market rate of interest on government securities with like maturity dates can be

used as a default-free rate, and this is what the default-free rate should be.

Although it is true that financial soundness and effective rates of interest are inversely related, it seems that other factors are involved in determining effective rates. Consider a hypothetical case of two equally sound corporations. If one was well known to the public while the other was located in Alaska, the Alaskan firm might have to yield a higher rate of interest on like bonds. Such factors as geography and name, or corporate image, are certainly important. And as long as other considerations besides risk determine the effective rate of interest, the entire difference between the effective and default-free rates is clearly not due to risk.

Effect of patriotism

Similarly, the difference between a corporation's yield and the default-free rate assigned by the authors is not entirely due to a risk factor. If a corporation were somehow in the same financial position as our federal government with respect to soundness and unlimited funds, it seems that a percentage of the investors would favor the government securities over the corporation's securities simply, for example, because they would feel that they were aiding the government. Celebrities often attest to the "tingling sensation" that they get when they invest in the future of our nation.

Default-free rate

The most important question is whether or not the assigned default-free rate of interest is what the default-free rate should be. It seems that other factors do not allow such an equality. The imperfect market and the practice of investing in government securities because of their market stability are two indicators of this point. And the mentioned patriotism factor is a third. That is, if various human elements enter into the determination of the effective government rate of interest, it is unlikely that this rate equals the "actual," or theoretical default-free rate. Therefore, it seems that the true default-free rate, which should be the government rate plus some unknown accounting for the advantages of government over corporate bond issues, lies somewhere between the effective rates of our government and a given corporation. In relationship to each other, not to the market, the corporate rate is too high, and the government rate is too low. Since the true default-free rate is between the two known rates, which of the two is a better indicator of the true rate? In some instances where a very sound, stable, and well known corporation is issuing bonds, the effective rate of the bond issue may well be a better indicator than the effective rate of government bonds with the same maturity. The point is that no one can know the true default-free rate and that the authors' appointed time value of money is not the rate that they purport to use.

Worthy goal

Nevertheless, the authors' goal of more informative reporting is worthy. Interfirm comparisons, which seem to be their major concern, can be simplified and made more informative through improved disclosure practices. If the intelligent user of accounting information is given the maturity date and the nominal and effective rates of interest in the financial statements, it seems that he can make reliable comparisons and decisions. Another alternative, which involves the reporting of two liabilities, one for the principal and one for the interest payments, has been proposed by Hector R. Anton in the September, 1956, issue of *The Journal of Accountancy*, and it certainly deserves consideration. The accountant should always be prepared to adapt to the needs of his environment and to improve the practices of his profession. However, even though this article is most interesting and should be read to grasp its argument and proposal in entirety, to suggest changing accounting practice from the use of the known effective rate of interest to the use of an unknown, theoretical default-free rate currently appears to be an unstable objective.

LEE LEAVITT
The Ohio State University

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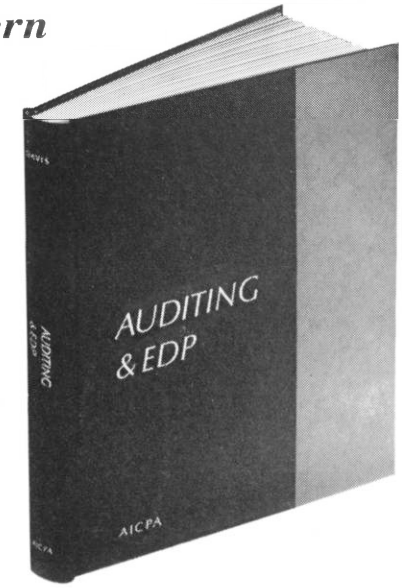

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By Gordon B. Davis, CPA, Ph.D.

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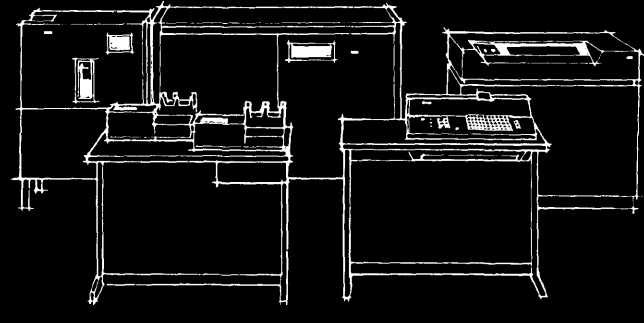

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