

Management Services: A Magazine of Planning, Systems, and Controls

Volume 4 | Number 5

Article 3

9-1967

Pathway to Profit: The Management Information System

Bertram A. Colbert

Follow this and additional works at: <https://egrove.olemiss.edu/mgmtservices>



Part of the [Accounting Commons](#)

Recommended Citation

Colbert, Bertram A. (1967) "Pathway to Profit: The Management Information System," *Management Services: A Magazine of Planning, Systems, and Controls*: Vol. 4: No. 5, Article 3.

Available at: <https://egrove.olemiss.edu/mgmtservices/vol4/iss5/3>

This Article is brought to you for free and open access by eGrove. It has been accepted for inclusion in Management Services: A Magazine of Planning, Systems, and Controls by an authorized editor of eGrove. For more information, please contact egrove@olemiss.edu.

A company's information system should not be merely an internal mechanism for direction and control. Ideally, it should aid the company's response to all external events that could affect it, as well —

PATHWAY TO PROFIT: THE MANAGEMENT INFORMATION SYSTEM

by Bertram A. Colbert

Price Waterhouse & Co.

WHAT HAS information to do with profitability? Every chief executive knows it has a great deal to do with it. Information plays a major, usually a crucial, role in achieving profits—the profits which are one of the main indexes of successful business operations in our economy.

Obviously, the manager must understand and evaluate a wide range of information about his operations in order to reach sound, profitable decisions. Concise, complete, and timely management information thus forms the basis for effective planning, decision making, and control.

As the complexity and magnitude of business decisions have increased, the typical corporate manager has found that existing systems do not have the capability to deliver the significant data required at the time they are required. Too often the manager has found himself overwhelmed with masses of data or long listings of historical information which were of little help in the decision making and planning processes.

The need for a better way was clearly evident. Therefore, many companies, both large and small, are seeking ways to improve their information and data flow and its

end use—the generation of profit. The result has been the group of techniques called the management information system.

Let us consider some basic questions:

What is a management information system? How does it differ from such existing systems as accounting, sales, or production? Should you have one? What is its value? How do you obtain one or put one in a specific company?

This article attempts to answer these questions, to show graphically the management process and the part information plays in it, and finally to provide a frame of ref-

External information is needed to assure that management is aware of outside events . . .

erence within which each executive, by further analysis, can obtain more complete specific answers, tailored to his company's needs.

We may begin by noting the functions of management: to plan, to organize, to direct, and to control, as indicated in Chart 1 on page 17, and by illustrating the role which information plays in this process (Chart 2 on page 17). Information which is internal is necessary to provide communication in the management process. Information which is external is necessary to assure that management is aware of, first, the outside events which may influence the plan and, second, the effect of the operation on this outside world. As information is received, we may recycle through the management process: RE-plan, RE-organize, RE-direct, with the measurement in the control process.

To provide a framework for discussion, let us consider the organization of a typical company (Chart 3 on page 18). The company has five principal functions: administration, marketing, research and development, manufacturing, and finance. The relationship to the board of directors and the specific departments which we might find in each function are depicted in Chart 3.

Management information system

A management information system, simply, is an organized method of providing each manager with all the data and only those data which he needs for decision, when he needs them, and in a form which aids his understanding and stimulates his action.

Such a system

1. Considers the full effect of a decision in advance by supplying complete, accurate, and timely data for use in the planning and decision making processes

2. Eliminates from the planning and decision making processes the problems associated with the use of inconsistent and incomplete data by providing a means for preparing and presenting information in a uniform manner

3. Uses common data and methods in the preparation of long-range and short-term plans

4. Identifies, structures, and quantifies significant past relationships and forecasts future relationships through the use of advanced mathematical techniques in analyzing data

5. Merges financial and production data to produce significant measures of performance to facilitate control of present costs and to facilitate planning decisions with minimum processing of data

6. Recognizes the needs of all corporate units so that the requirements of each are met with a minimum of duplication while serving the corporation as a whole

7. Reduces the time and volume of information required to make decisions by reporting to each level of management only necessary degrees of detail and usually only the exception from the standard or norm

8. Utilizes personnel and data processing equipment effectively so that the optimum in speed and accuracy is achieved at the lowest cost

9. Requires that the data be presented to those responsible for

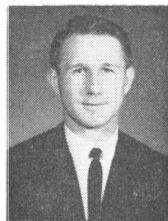
the decision making and planning processes in a form which minimizes the need for analysis and interpretation

10. Provides flexibility and adaptability to change.

The concept of management information is one that would be equally valid if the company were small or large or if the data were obtained and processed through the most simple manual means or through the most sophisticated computer. Management must, to design a system, select at each level of control only the data that are required. The data must be presented in a manner which facilitates understanding and action and provides a measure of the effectiveness of the action which has been and is being taken.

Most growing companies and many mature companies show certain symptoms or clear indications of what we can call "information hunger." Some of these symptoms may, of course, arise simply from poor management, even when the information system is adequate, but we have listed them here because they are so common and often so baffling even to competent managers. Many managers just do not realize that the information on which they are basing even their most routine decisions may be dangerously inadequate or misleading because their information system is not geared to the needs of their company. Let us turn to Chart 4 on page 18 and consider the 25 symptoms any or any combination of which may indicate an inadequate information system.

In the operational aspect of the business, they range from large inventory adjustments to a sterile R&D program; in the human aspect, from inability to note the significance of certain financial indicators to overloaded briefcases and poring over reports at midnight.



BERTRAM A. COLBERT is a principal in the Chicago office of Price Waterhouse & Co. In the past he has held positions as production engineer, production manager, and wage and salary administrator in the electronics

and metal manufacturing industries. Mr. Colbert is a member of the American Institute of Industrial Engineers and the American Management Association.

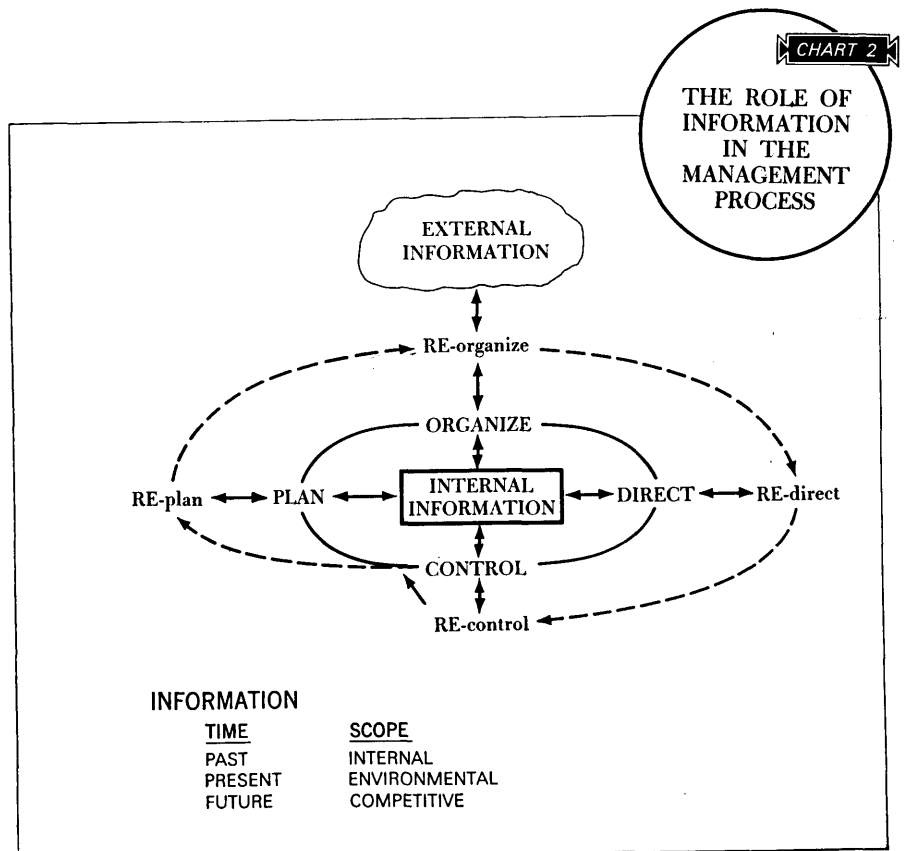
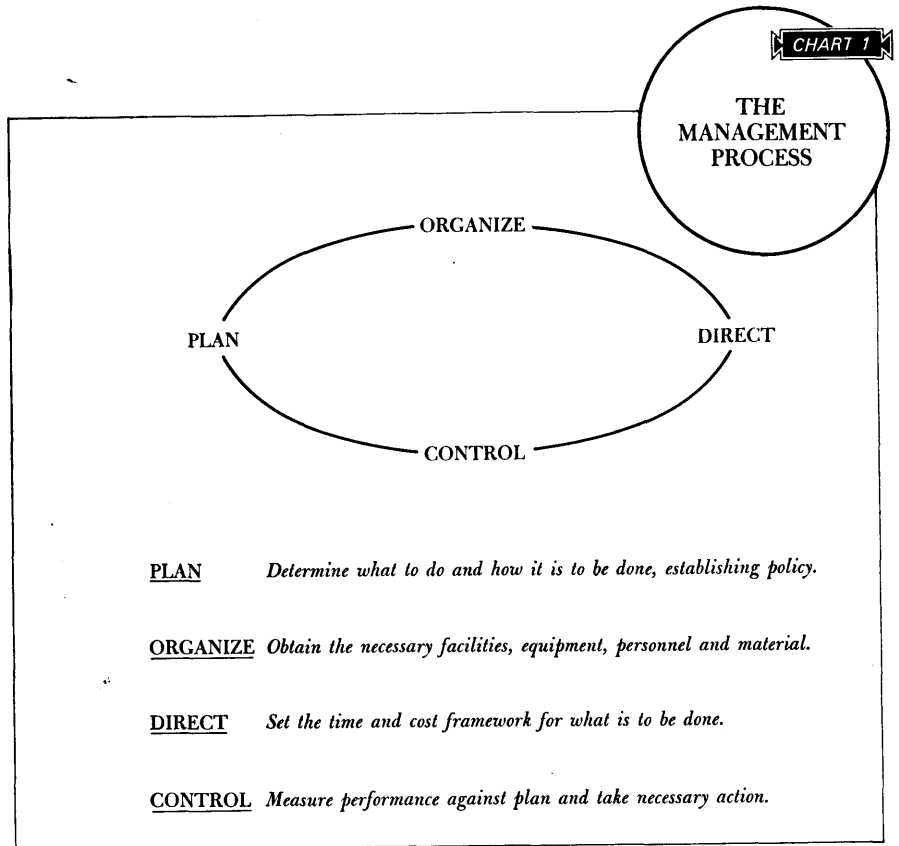
... which may influence the plan and the operation's effect on the outside world.

Any executive will do well to study these symptoms and note whether his organization exhibits one or more of them. A study of the present scope of management information in the typical enterprise (as shown in Chart 5 on page 18) and a comparison of the typical management informational efforts with the values to be received through each (shown in Chart 6 on page 18) show that in the typical organization management is either using its information facilities too narrowly or has not developed facilities of the necessary scope and significance to ensure the enterprise's future. As indicated, most managements devote 90 per cent of their efforts to obtaining information which will enable them to operate and control and only about 5 per cent of their efforts to obtaining the necessary information to meet competition and another 5 per cent to obtaining the information needed to meet future needs. These proportions do not make the organization adaptable to change and may lead to such stagnation or such poor preparation that a competitor's new product or a change in consumers' tastes and needs may knock the enterprise right out of the ball game.

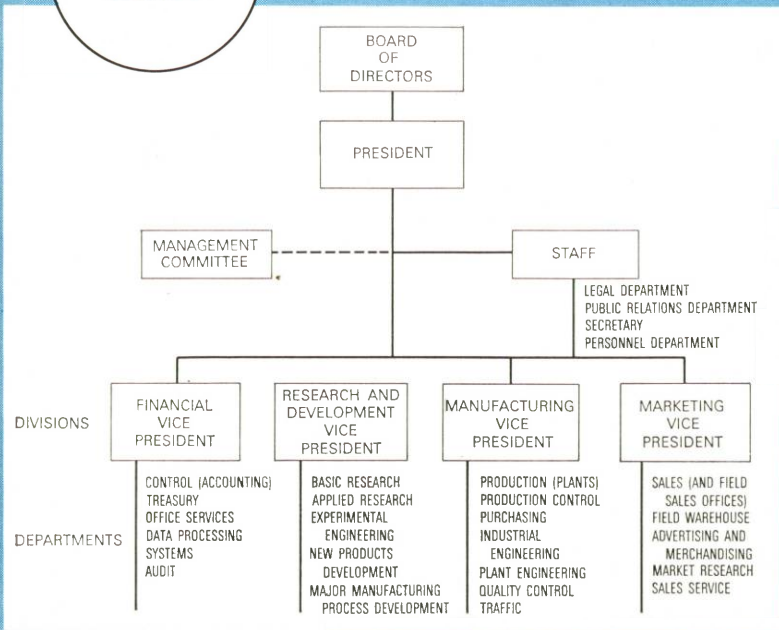
Kinds of information needed

What, then, are the kinds of information which managers need? They can be grouped into three major categories: information which various company executives require for operation and control, information required to assess future action, and information required to assess or compare performance by the company in competition or within the industry.

Let us look first at information required for management operation and control. A great deal has been written on this subject, and most organizations of any size or



ORGANIZATION OF A TYPICAL COMPANY



OPERATIONAL	PSYCHOLOGICAL	REPORT CONTENT
Large physical inventory adjustments	Surprise at financial results	Excessive use of tabulations of figures
Capital expenditure overruns	Poor attitude of executives about usefulness of information	Multiple preparation and distribution of identical data
Inability of executives to explain changes from year to year in operating results	Lack of understanding of financial information on part of nonfinancial executives	Disagreeing information from different sources
Uncertain direction of company growth	Lack of concern for environmental changes	Lack of periodic comparative information and trends
Cost variances unexplainable	Executive homework reviewing reports considered excessive	Lateness of information
No order backlog awareness		Too little or excess detail
No internal discussion of reported data		Inaccurate information
Insufficient knowledge about competition		Lack of standards for comparison
Purchasing parts from outside vendors when internal capability and capacity to make is available		Failure to identify variances by cause and responsibility
Record of some "sour" investments in facilities, or in programs, such as R & D and advertising		Inadequate externally generated information

CHART 4

SYMPTOMS OF AN INADEQUATE MANAGEMENT INFORMATION SYSTEM

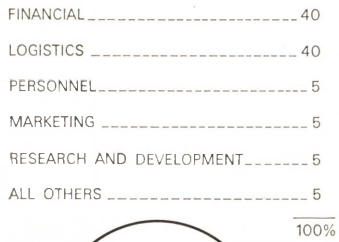
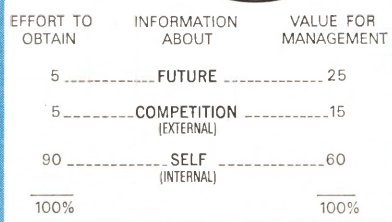


CHART 6

TYPICAL MANAGEMENT INFORMATION EFFORTS VERSUS MANAGEMENT INFORMATION NEEDS



PRESENT SCOPE OF MANAGEMENT INFORMATION

CHART 5

MANAGEMENT INFORMATION SYSTEMS MAJOR INFORMATIONAL REQUIREMENTS

FINANCIAL	
Cash and working capital positions, forecasts, analyses	Sources and availability of capital
Current ratios	Short-term requirements
Line of credit utilization	Money market developments
Temporary investment opportunities	Stock
Accounts receivable turnover, age, collection status, problem accounts	—ownership changes
Inventory investment analysis	—prices and P/E trends
Debt to equity status	—analyst opinions
Adequacy of reserves	Lease obligations
Analysis of surplus	Financial guarantees and other contingent obligations
Long-term spending requirements	Adequacy of insurance coverage
—R & D	Tax situation
—new products	Internal accounting control situation
—capital assets	

RESEARCH AND DEVELOPMENT

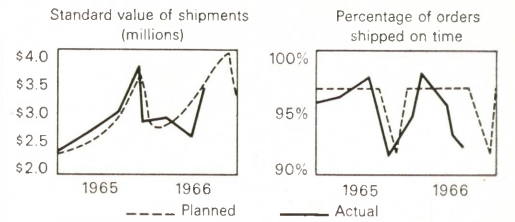
- Knowledge of research discoveries and advances in existing knowledge
- Research opportunities
- Research goals and balance of effort
- Research proposal evaluation
 - product improvements
 - new products
 - new materials
 - process improvements
- Research projects
 - status—technically
 - status—cost
- Research personnel
 - qualifications
 - experience
- Scientist support
- Research space/person
- Research cost as % of sales
- Historical evidence of value of research to company

PERIODIC MANUFACTURING REPORT

PERFORMANCE HIGHLIGHTS

Shipments increased as expected this month. However, Herron Manufacturing Co., one of our principal motor suppliers, was on strike until four weeks ago. Accordingly, we were not able to build inventory as planned in preparation for the added shipments. As a result, we had to go to a partial third shift for the assembly department and add a number of new employees throughout the plants this month. The inexperience of the new employees and the lack of adequate supervision on the partial third shift led to decreased delivery performance and labor productivity, particularly in the machining department. These problems have been largely corrected and we expect improved performance next month.

KEY INFORMATION



YEAR TO DATE EXPENDITURES (millions)	ACTUAL AS PERCENTAGE OF		
	Actual	Plan	Last year
Operating—controllable	\$15.61	102%	122%
Operating—uncontrollable	\$ 5.95	101%	109%
Capital	\$ 1.10	104%	81%
% OF TOOLS PASSED INSPECTION			
Month	97.6%	98%	99%
To date	99.4%	99%	100%
% OF LABOR PRODUCTIVITY			
Month	91.5%	93%	94%
To date	98.1%	101%	103%
INVENTORY TURNOVER	3.9 times	98%	100%

CHART 9

MANAGEMENT INFORMATION SYSTEMS MAJOR INFORMATIONAL REQUIREMENTS

CHART 7

EXAMPLE OF A KEY ITEM MANAGEMENT INFORMATION SYSTEMS REPORT

sophistication have developed fairly good and reliable information-generating systems for operations (production, inventory, efficiency). Where they often fall down is in the selection, organization, and processing of this information. The best method of employing such information is that of rigid selection by need—that is, sending key information to executives, information processed purely for the management requirements as indicated and requested by the recipients. A system called *Key Item Control* (described in *MANAGEMENT SERVICES*, January-February, '67, p. 21) gives a detailed discussion of such a method.

Control, of course, is obtained by comparing actual performance for each given activity with pre-established goals set at each level. The principal value of presenting key items to management using exception techniques is that it focuses management attention on the important areas of operation which require action. A typical operating report of this type (Chart 7 on page 18) shows how the tabular information normally presented in a company could be re-presented to enhance understanding and provide data for decision. This is done through a blending of narrative, graphic, and tabular techniques of presenting information. The overall highlights of the operations are given in a narrative summary. Graphs present comparisons of present performance with planned performance in the framework of trends to provide current perspective, and tables provide key figures of detail information.

Let us now suggest the kinds of information which should be generated in two key areas, financial and research and development (Chart 8 on page 18 and Chart 9 on page 18). Some 23 items are suggested in the financial area in Chart 8, and 15 in the R&D area in Chart 9. It can be seen that the data vary widely from an analysis of sources and availability of capital in the financial area to a research personnel analysis in the

R&D segment. Nevertheless, top management must consider all the kinds of information its operations require and then turn to the task of processing this information to achieve maximum use from it.

The financial information available to management is usually quite complete. Often, however, the accounting data are not as integrated with operating control information as would be practical or desirable. Frequently the chart of accounts provides information for audit, internal control, or tax purposes but not specifically for management control. Often major improvement would result from integrating operating management information with cost management information. In this approach, the source documents used to provide information for operating statistical purposes would provide cost and financial management information as direct products.

Techniques of improvement

Substantial improvement in most companies' management information would result from the following:

1. Increased use of ratios to provide improved understanding of the effects or results of operations, including graphic presentations of the ratios to provide analysis of both short-term and long-range trends. The data would also provide an improved basis for forecasting probable future events, particularly in the cost area.

2. Use of information developed from using work sampling, work measurement, and work simplification techniques. This would provide improved measures of the effectiveness of personnel in the clerical and production groups. In addition, these techniques would permit costs of specific operations to be determined and would enable management to determine the most efficient and least costly way to perform them. A further benefit of using such techniques would be the development of cost data which would be integrated with operat-

ing statistical data and thus improve management information.

3. Increased use of network techniques of presentation. Specifically, this would place in focus all of the events that would be involved in a particular management activity and would define their relationship to each other. This technique could be of great value in determining the chain of events which must take place in order to implement a management decision which was made on the basis of improved management information. It would also provide understanding of the time and personnel which would be involved in such an implementation.

4. Increased use of PERT techniques in the cost system. The PERT technique places cost information in relation to the event occurrence. This approach would incorporate the principles of flexible budgeting.

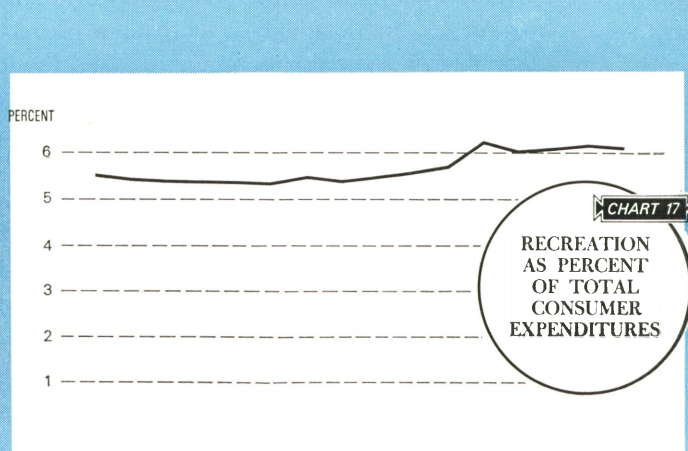
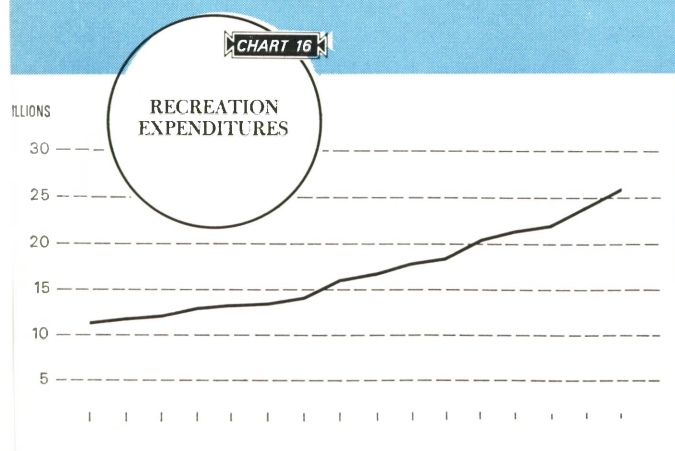
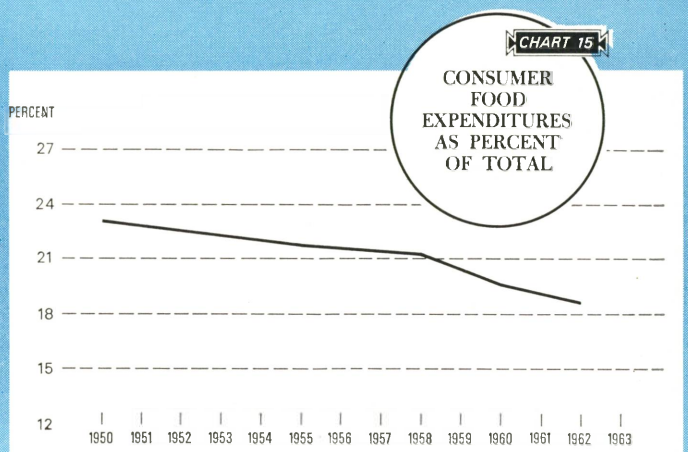
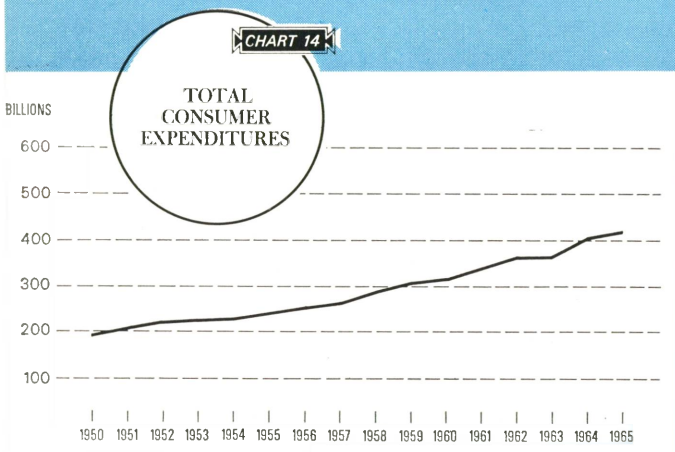
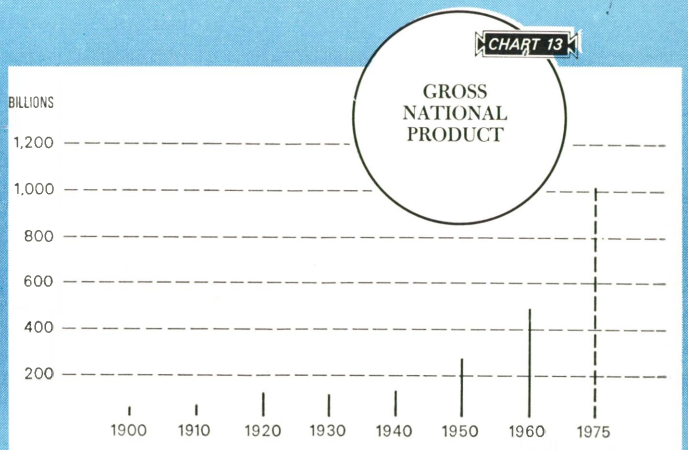
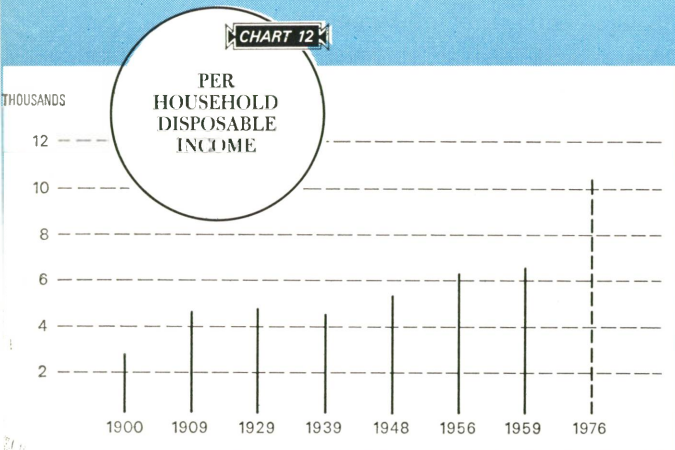
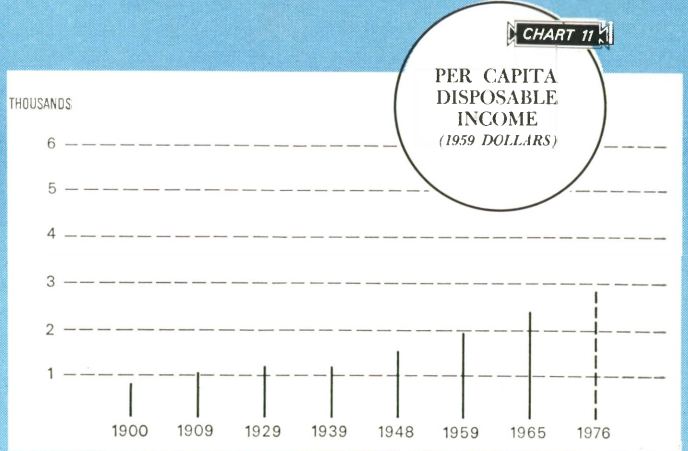
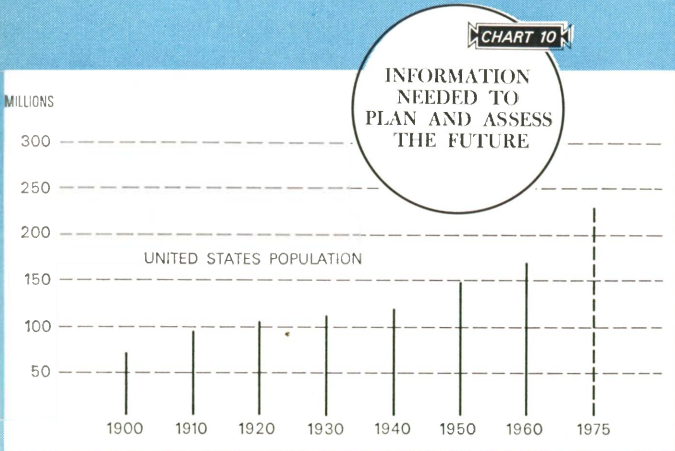
5. Increased use of incremental cost concepts. These would improve the decision making related to costs of operating facilities at various production levels. This cost concept would provide management with an improved tool for determining the cost effect of operating a given facility at different specific levels or volumes of production by measuring the cost effect in major steps or increments rather than only by an average slope or trend.

6. Increased use of data processing equipment as the means of securing vital data in a timely and effective manner to implement the new concepts involved.

7. Increased attention to the development of a stimulating incentive which would serve as a motivation to management to take action on the basis of the information provided by an improved management information and control system.

Range of information

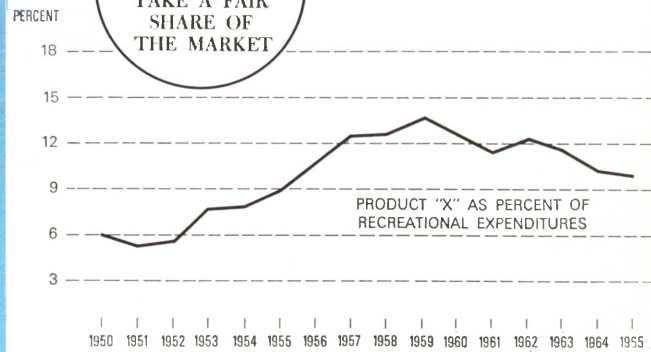
Each chief executive represents a different company of different size in a different location. To a large extent, his problems are individual. He does, however, oper-



THIRD CATEGORY OF INFORMATION

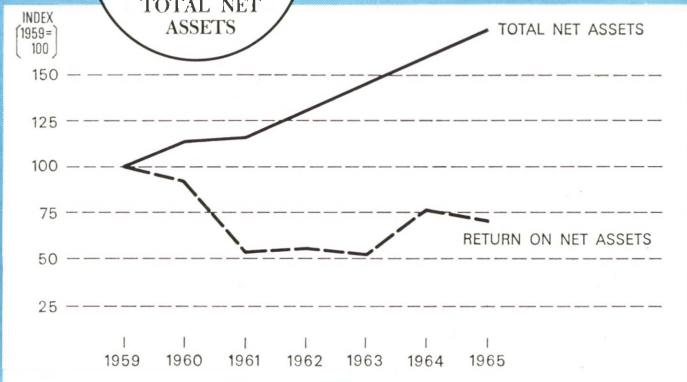
CHART 18

INFORMATION NEEDED TO COMPETE AND TAKE A FAIR SHARE OF THE MARKET



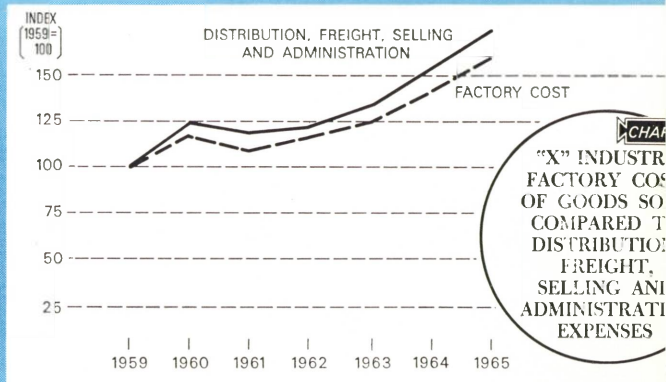
"X" INDUSTRY TOTAL NET ASSETS COMPARED TO RETURN ON TOTAL NET ASSETS

CHART 19



DISTRIBUTION, FREIGHT, SELLING AND ADMINISTRATION

CHART 20

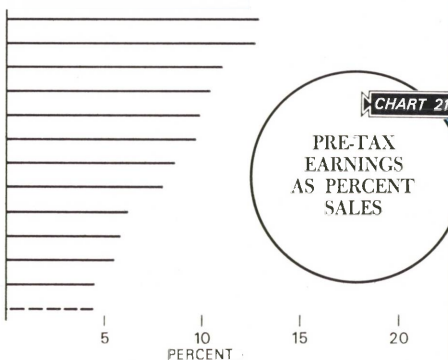


"X" INDUSTRY FACTORY COST OF GOODS SO COMPARED TO DISTRIBUTION, FREIGHT, SELLING AND ADMINISTRATIVE EXPENSES

- INSTRUMENTS
- MOTOR VEHICLES AND EQUIPMENT
- PRIMARY NONFERROUS METALS
- METALWORKING MACH. AND EQUIP.
- PRIMARY IRON AND STEEL
- STONE, CLAY, GLASS PRODUCTS
- DURABLE GOODS
- ELEC. MACH., EQUIP., SUPPLIES
- OTHER FAB. METAL PRODUCTS
- FURNITURE AND FIXTURES
- LUMBER AND WOOD PRODUCTS
- AIRCRAFT AND PARTS
- "X" INDUSTRY

CHART 21

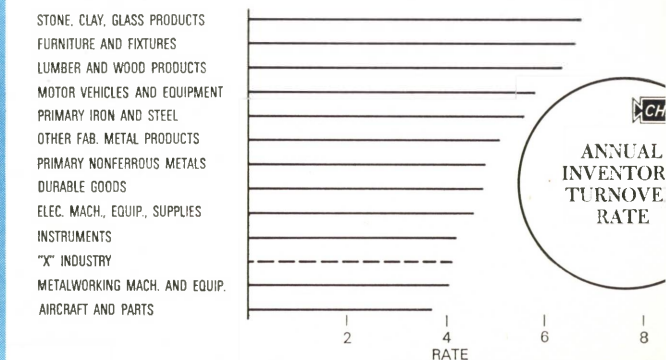
PRE-TAX EARNINGS AS PERCENT SALES



- STONE, CLAY, GLASS PRODUCTS
- FURNITURE AND FIXTURES
- LUMBER AND WOOD PRODUCTS
- MOTOR VEHICLES AND EQUIPMENT
- PRIMARY IRON AND STEEL
- OTHER FAB. METAL PRODUCTS
- PRIMARY NONFERROUS METALS
- DURABLE GOODS
- ELEC. MACH., EQUIP., SUPPLIES
- INSTRUMENTS
- "X" INDUSTRY
- METALWORKING MACH. AND EQUIP.
- AIRCRAFT AND PARTS

CHART 22

ANNUAL INVENTOR TURNOVER RATE



- PRIMARY IRON AND STEEL
- METALWORKING MACH. AND EQUIP.
- INSTRUMENTS
- PRIMARY NONFERROUS METALS
- OTHER FAB. METAL PRODUCTS
- "X" INDUSTRY
- DURABLE GOODS
- MOTOR VEHICLES AND EQUIPMENT
- ELEC. MACH., EQUIP., SUPPLIES
- FURNITURE AND FIXTURES
- LUMBER AND WOOD PRODUCTS
- STONE, CLAY, GLASS PRODUCTS
- AIRCRAFT AND PARTS

CHART 23

NET SALES PERCENT CHANGE YEAR 1965 VS PREVIOUS YEAR

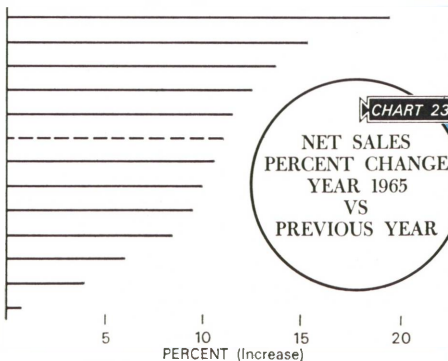
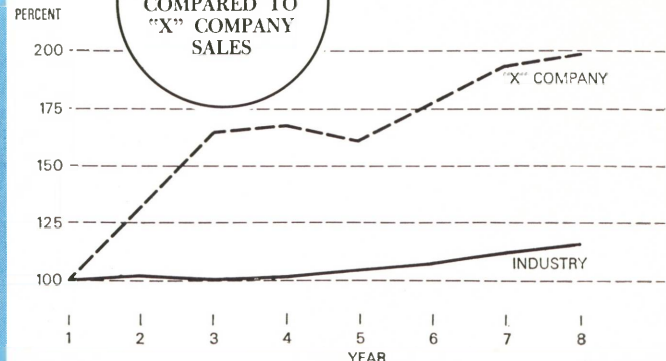


CHART 24

INDUSTRY SALES COMPARED TO "X" COMPANY SALES



ats with the framework of a certain industry and can make decisions based on analyses of the data in a specific industry.

To illustrate the range of information which might be significant to the management of a typical company, let us now turn to a study of information of the second category: information required to assess future action. For our purposes let us call our illustrative company Company X (although they do not make the well known "Brand X"). This company markets a product in the consumer industry and is affected by consumer patterns of spending. What kind of information would management review to plan and assess future action? Let us consider the following data:

Population growth effect

First, management might look at the effect of growth in population (Chart 10 on page 20). In 1910 the population of the United States was about 90 million people. The population now is close to 200 million; the population has doubled in less than the lifetime of most managers. As you can see from the projection for 1975, population is expected to increase another 30 per cent to 40 per cent in this shorter time. We are in an era of rapidly changing, rapidly increasing population.

This growing population has very interesting characteristics for our Company X. Perhaps the most significant is shown in Chart 11 on page 20. This is a measure, since 1900, of per capita disposable personal income. Income for the individual has gone from less than \$1,000 per person in 1900 to almost \$3,000 per person and is rising at an increasing rate; it is expected to approach \$4,000 by 1980. Such predictions have often proved to be conservative. We have a rising population which is living better.

Now Company X management might consider the effect of this increase in per capita income and the additional increase in the working population as reflected in

per household disposable income (Chart 12 on page 20). As noted, this income has gone from \$4,000 to \$6,000 per household since 1939 and is expected to exceed \$10,000 in ten years. Gross national product, which has nearly tripled since 1950, is likely to pass the \$1,000-billion mark by 1975 (Chart 13 on page 20). Next, management of Company X can note that, in the period since 1950, our total of consumer expenditures in the United States has gone from \$200 billion to \$400 billion (Chart 14 on page 20). The population in this period has not doubled, but our per capita income has just about doubled.

What does this mean for Company X? It means people have much more money to spend individually and, therefore, in total. One of the most interesting things is that, with this income, expenditures have become more discretionary. People have more money, but they have begun spending it in different ways even in the short span of ten to fifteen years. Chart 15 on page 20 indicates that in 1950 our population was spending almost 23 per cent of its total income for food. By 1962 this had dropped to 19 per cent. This growing population which has more money is spending it increasingly in areas other than for food — spending it for clothing, shelter, transportation; for moving to suburban areas of larger homes where people have an average of almost two cars per family; spending it on increased recreation—on better living.

Recreation expenditures

Perhaps the most significant characteristic of the economy for the industry in which Company X operates is shown in Chart 16 on page 20, which charts the expenditures on recreation. This chart indicates that these expenditures have increased from about 12 billion to 27 billion dollars, more than doubling in the past 15 years.

As Chart 17 on page 20 indicates, in this period the consumer ex-

We now come to that third category of information—the information needed to compete in an industry and to obtain a fair share of the market.

CHART 25

RATIO OF NET PROFITS ON SALES
(INDUSTRY-
"X" COMPANY)

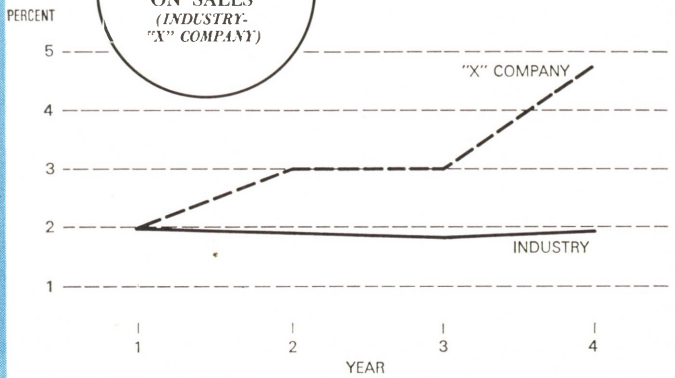


CHART 27

RATIO OF CURRENT ASSETS TO CURRENT LIABILITIES

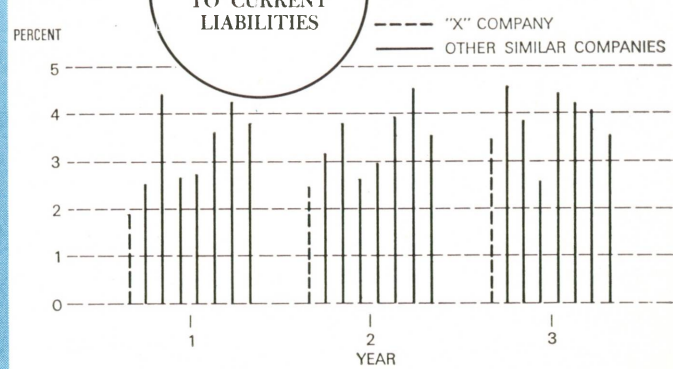


CHART 26

RATIO OF NET PROFIT TO INVESTED CAPITAL
(INDUSTRY-
"X" COMPANY)

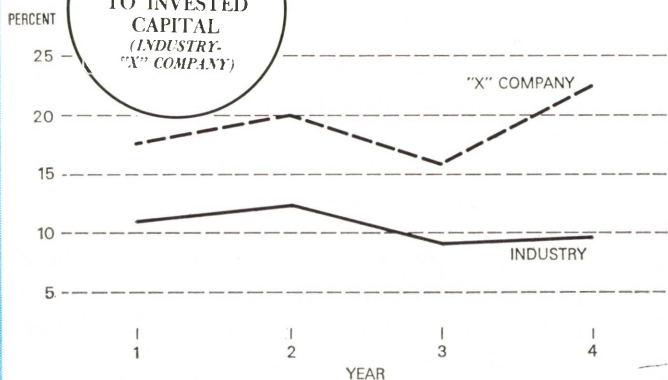
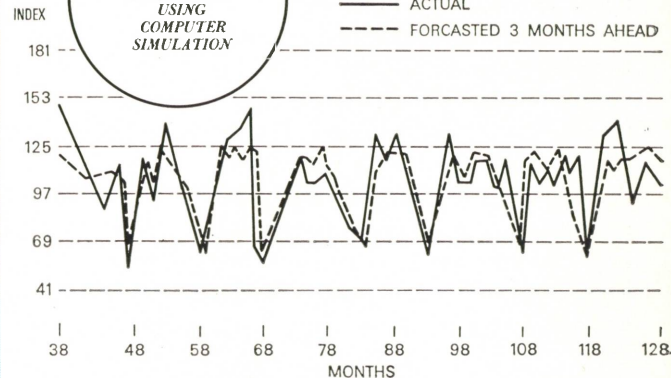


CHART 28

PRICE INDEX
(1/53-6/63)
FORECASTED USING
COMPUTER
SIMULATION



penditures on recreation as a per cent of total expenditures have risen from 5 per cent to over 6 per cent as a result of the shift in consumer interests.

We now come to that third category of information—the information needed to compete in an industry and to obtain a fair share of the market. Here we present some of the kinds of information in this category and show how the managers of our Company X might use it to place themselves in the industry.

We can start with some calculations for Product X made by our company showing the expenditures for Product X as a per cent of total recreational expenditures (Chart 18 on page 21). This ratio indi-

cates that, while there was a rise from the 1950 to 1959 period, there has been a downward trend in the past six years, with a reduction from 12 per cent to 9 per cent, or almost a 25 per cent change in the ratio. For planning purposes in this industry, this should be a significant area of concern.

One of the measures of profitability of a company is that of return on net assets. It reflects the return on this portion of the investment in the company. As shown on Chart 19 on page 21, the return from the period of 1959 to just recently has definitely gone down about 30 per cent in a period where the net assets themselves were rising over 50 per cent. This indicates weakness in cost control,

a key requirement in remaining competitive.

Another measure which might well affect competitive position is the change in cost of goods sold as compared to selling, distribution, and administrative expenses (Chart 20 on page 21). This analysis indicates a significant increase exceeding 50 per cent for the period, with the trend increasing for the overhead costs in relation to factory costs. This indicates a need for review of manpower utilization and distribution cost controls.

A third measure might be the pre-tax earnings as a per cent of sales for the "X" industry compared to twelve major industries for the past year (Chart 21 on page 21). The chart indicates that in relative

ranking, the "X" industry has the lowest per cent of earnings.

Fourth, management might look at the annual inventory turnover rate for the same group of industries (Chart 22 on page 21). The desirability of management action to improve its cash position as indicated by this measure of performance is clear.

Next let us observe the measure of sales change from 1964 to 1965 (Chart 23 on page 21). The chart indicates that "X" industry is average as compared to the group.

Moving out ahead

Up to now we have been speaking generally about industry averages. Perhaps the most significant item noticed in Company X's relationship with companies in its industry is the effect of individual management ability and action. One can go along with the crowd. A company can become profitable as its industry becomes profitable, or it can lose money as the industry loses money if it acts only as the average company does. There have been dramatic instances which show that when management of a specific company takes dynamic, aggressive action, it can (despite what has happened on the average to the industry in general) make its company more profitable than average. It can use the information in an improved management information system for management action.

Let us then consider the case of Company X as an instance of this kind of action. To protect the identity of our illustrative company, we will not identify specific years or the specific industry.

Let us look, however, at this actual industry and Company X. Chart 24 on page 21 shows industry average sales for a recent eight-year period compared with sales for Company X. The industry sales increased through the period as shown in previous charts, rising 20 per cent in the eight-year period. The sales of Company X doubled in the same period as a result of

the policy that it had adopted. Turning to the ratio of net profits on sales for a recent four-year period in Chart 25 on page 23, we note that industry profit on sales has stayed generally about 2 per cent, declining slightly as shown in earlier charts. Profit on sales for Company X, however, rose from 2 per cent to almost 5 per cent in the same period as a result of the individual actions which management in that company had taken.

In the ratio of net profit to invested capital (Chart 26 on page 23), the industry in the recent four-year period has shown a rate of about 10 per cent and slightly decreasing. The profit picture of Company X is considerably more attractive than the industry average, increasing from 17 per cent to almost 25 per cent in the same period.

With regard to the ratio of current assets to current liabilities (Chart 27 on page 23) for a recent three-year period of Company X as compared with eight individual companies representative generally of companies in the industry, the ratio of assets to liabilities for the companies in the industry has changed very little, while in the three-year period Company X has rapidly increased its ratio to a more and more attractive figure.

These charts show clearly the effect when individual management takes action, based on information available through its information system—when a company does not merely follow the trends in the industry, but makes its own trend. There are many factors to consider in improving profits. By itself, no system, no data processing installation, no plant modernization can do the whole job. Each must, to be effective, operate within the framework of good management, and good management always and everywhere depends on good information.

The manager in industry operates in the present in influencing his profit picture. Knowledge of past and present operations, as shown in our charts, is one of his

basic tools. However, the manager must plan for the future to assure continuity of profits. To do this, he needs a good forecast of future demands on materials, labor, facilities, and capital, and good forecasting again requires good information.

In recent years, tools for prediction have been greatly improved. The use of mathematical techniques for quantifying and analyzing probability have provided important contributions to the management decision making process. Increasingly, the use of computers for rapid solution of mathematical "models" of business problems has provided a tool which can increase profitability of operations.

To illustrate, in Chart 28 on page 23 results are shown which were obtained from forecasting using a simulation technique recently developed by a Price Waterhouse & Co. mathematician, J. L. Ray. The solid line shows the actual price index for the 128-month period from 1953 to mid-1963. The dotted line shows the price index forecast by the model three months in advance of the actual month.

The computer program is designed so that, for example, at month 40, the computer reviews the predicted price index for month 40, the actual price index reported for month 40, the deviation from prediction for month 40, and the deviation pattern for each previous month of actual to forecast. The program then calculates the best prediction for month 43 based on all past history. This forecast simulator is a general purpose tool which has proven to be remarkably effective in a wide variety of predictions. It provides the manager of today a technique for improvement of his decision making.

In summary, the profit picture in any company in the future will be to a significant extent a result of the gathering and intelligent use of good information. Each company should be concerned that it is providing its managers with the kind and quality of information they need to do their job well.