

STATISTICS IN PROFESSIONAL MANAGEMENT*

by

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During the last decade, there has been an increasing recognition by business, industry and government of the importance of statistics as a basis for arriving at decisions.

Our economic society has grown vastly more complex and competition in business and industry has become very keen. Consequently, statistics has proved to be an indispensable tool in effective and sound planning, whether it be on a vast scale undertaken by government or on a modest one by private business.

The conduct of modern business is no longer a hit-and-miss affair; it has become a science that relies heavily on facts. To survive under conditions of fierce competition in business, management has to be guided by cold and hard facts and facts consist of statistics.

The term statistics, which is familiar to members of the Philippine Statistical Association, is discussed in this article in its broad sense, including its treatment as a science or a scientific technique. In order to appreciate the importance of statistics and the statistician to management, let us discuss the meaning of management.

Louis A. Allen, a management expert, in his discussion of "The Role of a Manager" at the Manila Hotel on June 14, 1960, defined management as a body of systematized knowledge based on general principles which are verifiable in terms of business practice. There has been a long evolutionary process in application of general principles which later became the current basis of the knowledge which we now call professional management.

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STATISTICS IN PROFESSIONAL MANAGEMENT

Management has therefore developed into a profession like medicine, law, accounting or statistics. Hence, a person who practices the profession of statistics is a statistician, that of management, a manager.

Allen differentiates a manager from a leader. He thinks that a leader is one who guides and directs other people and that not all the work he performs is management work. On the other hand, a good manager must be an effective leader, although many outstanding leaders have been exceedingly poor managers. A manager limits his efforts to those he cannot effectively spread down to his subordinates by delegating authority and responsibility. In short, in management leadership, the leader restricts himself, as much as possible, to efforts which only he, because of his organizational position, can perform effectively.

Frederick Winslow Taylor, as early as 1900, saw the need for a systematic and scientific approach to industrial management. He proposed that managers bring order and system to their work in the form of "scientific management."

A Frenchman named Henri Fayol also contributed to the modern concept of management from his long and successful career as a manager in the French coal industry. Fayol made the conclusion that all work done in business enterprises may be divided into six groups: technical activities, (production, manufacture, adaptation); commercial (buying, selling, exchange); financial (search for and optimum use of capital); security (protection of property or persons); accounting (stock-taking, balance sheet, costs, statistics); and managerial or administrative (planning, organization, command, co-ordination and control).

Allen concluded that in an integrated concept of management, the professional manager performs the following work in guiding and directing the efforts of others:

1. Planning (forecasting, objectives, policies, programs, schedules, procedures and budgets).

2. Organization (identification and grouping of work, definition and delegation of responsibility and authority, and establishment of relationships).

3. Coordination (balancing, timing and integrating).

4. Motivating (selection, communication, participation, appraisal, counseling, coaching, training, compensation, direction and dismissal).

5. Controlling (performance standards, measurement, interpretation and corrective action).

PLANNING

In order to understand the role of statistics in professional management, it may be helpful to examine the work of a manager in planning and controlling.

Planning has been recognized as an important function in management. It refers to the determination of a line of action in order to achieve specified goals. Management planning involves the development and application of forecasts, objectives, policies, programs, schedules, procedures and budgets.

Forecasting

Forecasting is a systematic process of determining probable future situation by inference from known facts. Forecasts provide a base for management decisions. In modern business where free competition is keen, the success of the company depends largely on the quality of forecasting work.

Forecasting demand for a product is essentially forecasting sales. No one method of sales forecasting can be applied to all companies. Similarly, not all factors that establish a sales forecast can be supplied by one individual or even one statistical department. Finalized sales forecasts are generally the

STATISTICS IN PROFESSIONAL MANAGEMENT

result of the contributions of many men of varied experience, including those from different departments of a company.

E. H. MacNiece, special representative in Europe of Johnson and Johnson, has said that basic data for sales forecast are usually developed by combinations of techniques. Although there are many methods or techniques of sales forecasting, he suggested the following: (1) opinion; (2) estimates by salesmen, (3) statistical sampling, (4) historical background and statistical projections, and (5) regression or correlation analysis.

(1) Opinion — This is perhaps the oldest and most simple type of sales forecasting. It is merely a broad guess, made by managers in charge of business. Such forecasts are made quickly and at little expense, but they lack scientific validity and can be deceptive or even disastrous when considered without supporting facts.

(2) Estimates by salesmen — The basic data here come from estimates by district salesmen on expected sales in their respective districts for the period being forecast. These estimates are reviewed by divisional managers, who may make changes that may seem necessary, tabulated by items and months, totaled and sent to the regional or sales manager. After review and evaluation of data at this level, the data are sent to an executive in charge of sales who, together with his associates in management, review the figures in the light of general economic conditions and other modifying factors, after which the final forecast is prepared. The result of this screening process, according to Niece, "is a body of information that becomes a fairly reliable forecast as it goes through the hands of managers and executives in the central office."

(3) Statistical sampling — In order to save time and money, or when salesmen lack time to gather figures, sampling can be used to develop total sales estimates.

(4) Historical background and statistical projections — Companies with long and complete historical sales data can

analyze trends in their sales by statistical treatment of sales data to reveal growth or decline. Moving averages may serve as sensitive indicators of trends. Statistical treatment projects the probable continuation of trends by calculating and plotting their fitted curves.

(5) Regression or correlation analysis — As industrial and business indexes become refined, it is possible that sales of certain products show a remarkable relationship to one index or a correlation between others. For example, sales of gasoline are related to automobile registrations.

Objectives

According to Allen, an important phase of planning is the setting up of objectives. These are goals designed to guide the efforts of the company. Effective management is that which is guided by objectives. Objectives can provide a constant guide to channel the operations of the company into most productive avenues. They are spelled out in terms of sales volume, share of market, profit and profit margin, return on invested capital, and other pertinent factors which can be worked out with a skillful use of facts available from forecasts. In other words, after forecasts have been established, the objectives or goals are laid down for the company.

Policies

As a general rule, policies are established for smooth management. They are variously known as "principles" or as "rules for action." Policies must not be confused with objectives. Allen thinks that a policy refers to a continuing decision which applies to repetitive situations. Wise policies are promulgated and established after statistics have been analyzed, evaluated and interpreted.

Programs and Schedules

After the overall objectives of the company and objectives for each major division or unit have been established, programs are set up. The program gives a sequence of activities designed

STATISTICS IN PROFESSIONAL MANAGEMENT

to implement policies and accomplish objectives. Programs are used as a base for setting up work schedules which give a timetable for achieving desired goals. The preparation of those schedules by the manager may require the assistance of a statistician who would consider all relevant factors emanating from those who prepared the forecasts and objectives.

Budgets

Budgeting refers to the development and application of a definite financial plan for internal operations that is systematically coordinated with the conditions that are expected on the bases of forecasts and objectives. Budgets may be stated in time, money, materials, or other units required to perform work and accomplish objectives. It is important, however, that such budgets should be convertible to monetary units.

Budget preparation is a function of every manager of whatever level of responsibility. The company budget is an integrated product based on budgets prepared by second-line or departmental managers for their respective departments. By the very nature of the work involved, the manager will be engaged in the correct use of data. The top manager may require the assistance of a qualified statistician in order to integrate the various budgets into a sound company budget.

"The most significant aspect of the budget preparation is the activity that precedes compilation of figures representing anticipated needs," Allen said, "Before a manager can develop a budget, he must think through the objectives he is trying to achieve and the program he will follow."

CONTROL

In management, control of the quantity and quality of the work performed is a very important function and responsibility of a manager. To achieve this, performance standards, such as objectives, policies' programs, schedules, procedures and budgets, must be established.

But there is another performance standard that must be added — that involving standards of quality of goods produced. This kind of control is termed quality control.

Control in management must not be confused with simple command or giving of orders. Control as function of management means to guide the work in the direction set up by objectives.

Allen gives four specific activities in the work of the manager in exercising control in management. These are: (1) establishing performance standards (2) measuring work in progress, (3) interpreting results, and (5) taking corrective action.

A manager must see to it that there are established standards of measurement which are clearly understood by those who execute the work or those who supervise the performance of the work. These standards are based on company objectives, policies, programs, schedules, procedures and budgets.

In measuring the work in progress, a systematic and highly efficient method of recording the work accomplished is very essential. The measurements are then compared to the established objectives, production schedules or budgets. The measurement of quantitative data thus gathered is then statistically tabulated and analyzed so that management may be able to interpret the results. Evaluation and interpretation also involve the determination of discrepancies or variations and an analysis of them in order to determine the significance of the variances.

The last step in control which, according to Allen, must remain a prerogative of the manager himself is taking corrective action. Results of the interpretation and evaluation of variances in the actual work accomplished against a set of standards will reveal certain directions in which corrective measures will be necessary. A manager having a fairly good foundation in statistics or a statistician assisting in the manage-

ment function must be able to resolve clearly the measures that must be undertaken.

Niece said that in productive process a great deal of care and patience must be exercised in comparing and evaluating production against the corresponding established schedules and standards. He suggested some bases of control, such as: (1) control limits, (2) 85-15 concept of control, (3) sensitive control indicators, and (4) quality control.

Control Limits

In production for purposes of supplying current sales requirements or filling current orders, and in stocking an inventory, there must be limits, both upper and lower, beyond which the stock inventory should not normally exceed. These limits should be carefully established, taking into consideration the working capital required and the services demanded by customers.

The 85-15 Concept of Control

This is an arrangement by which about 15 per cent of the high sales volume products are given closer attention and better facilities than the remaining 85 per cent of low sales volume and value items. For instance, some companies that manufacture different varieties of products are often confronted with highly complex problems of production control. Some products have high and others have low sales volume. Giving equal attention and the same size of production lots to both high and low sales volume items will result in excessive inventories for raw materials and working process. This will tie up unnecessarily working capital in the inventories of low sales volume products. The 85-15 concept emphasizes attention to high sales volume items. Narrow stock limits for high volume items and wide stock limits for low volume items can often reduce working capital requirements and improve manufacturing cost.

Sensitive Control Indicators

Management requires some units of standard with which to measure the effectiveness and efficiency of planning and control. A daily comparison of actual production and schedule, and a monthly comparison of production with schedules and sales forecast will provide some sensitive control indicators. Some managers include ratio or percentage covering personnel effectiveness, planning effectiveness and inventory turnover as indicators. A familiar comparison to statisticians is a presentation of a comparison of operations of today, previous month today, this day last year and last year month today.

Quality Control

Production schedules may correctly provide the goal in production upon which actual production is compared for purpose of control. But actual production may fall far short of the needed quantity because the quality fails to meet specified standard. There are two approaches in the control of quality of the final product: (1) control of level of quality of raw materials put in production; (2) control of quality of the finished product in the productive process.

In determining quality levels of raw materials, the statistical method that is usually employed is acceptance sampling. This is a process by which an inspector decides the disposition of a group of items on the basis of evidence supplied by the examination of a portion of the group.

Another method in quality control is the so-called sequential analysis which was suggested by the late Abraham Wald, for some time professor of mathematical statistics of Columbia University. This is a method of statistical inference whose characteristic feature is that the number of observations required by the procedure is not determined in advance of the experiment. The decision to terminate the experiment depends, at each stage, on the results of observations previously made. Its merit, as applied to testing statistical hypo-

thesis, is that test procedures can be constructed which require, on the average, a substantially smaller number of observations than equally reliable test procedures based on a predetermined number of observations.

Quality control reduced to its simplest term is the control of quality during the manufacturing process. It discovers the causes of variability of the characteristics of production and indicates adjustment by which these variations may be controlled. Eugene L. Black, professor of economics of engineering of Stanford University, suggested that the essential tool in statistical quality control is the Shewhart control chart.

Since quality control would be a major subject of discussion in the seminar of the Philippine Statistical Association in August, no attempt is being made to elaborate on the subject. However, it may be reiterated that quality control is economic in its purpose, objective in procedure, dynamic in operation and helpful in treatment of operating difficulties. Therefore, it is a very important tool to a successful management. Niece said that with increasing use of automation in production, the necessity of controlling the quality of production has increased with the use of finer instruments to assist in the control.

It is clear, therefore, that the finer techniques of statistics are more and more in demand if management is to be come more effective and efficient. Forecasting, setting up of objectives, establishment of policies, determination of programs, schedules, and budgeting — all of which contribute to effective management — are largely dependent on statistical methodology. Management success is the primary economic objective of an organization and control, which is largely statistical in scope and technique, contributes heavily to that success.

The existence of economic controls and of stringent government regulations in the Philippines have made successful

forecasting in business difficult. Because of the enormous influence of politics in management affairs, managers would want to be guided by forecasts in the political fortunes of their candidates in an election. Here, Dr. Enrique T. Virata has pioneered with sample surveys of voters' preferences. Professional management welcomes and will buy such forecasts.

Commenting on increasing role of statistics, Dr. Shewhart said: "The long-range contribution of statistics depends not so much upon setting a lot of highly trained statisticians into industry as it does in creating a statistically minded generation of physicist, chemists, engineers and others who will in any way have a hand in developing and directing the production processes of tomorrow."

In professional management, there is a need for creating and stimulating statistically minded professional managers. In a large organization, it may be necessary to create a reasonable unit of research and statistics which will integrate its efforts with the rest of the units of the organization. Smaller companies may not be able to afford a research and statistics unit, but consultation with and guidance by independent statisticians will prove to be more profitable to the management in general.