8 Forecasting Methods

Introduction The Purpose of Forecasting Forecasting Methods

Chapter Checklist • You Should Be Able To:

- Discuss the importance of forecasting in relation to analysis, planning, and control
- Compare three basic methods of forecasting
- Describe why causal models are considered the most sophisticated type of forecasting method used today
- Explain what is meant by *trends*, *cyclical variations*, *seasonal changes*, and *irregular fluctuations*
- Describe what is meant by *smoothing the variations*
- Explain why judgmental forecasts are often used in conjunction with the other methods of forecasting

INTRODUCTION

Every day, at all levels of management within all segments of the air transportation industry, decisions are made about what is likely to happen in the future. It has been said that business action taken today must be based on yesterday's plan and tomorrow's expectations. Call them expectations, predictions, projections—it all boils down to one thing, forecasting. Forecasting is the attempt to quantify demand in a future time period. Quantification can be in terms of either dollars, such as revenue, or some physical volume, such as revenue passenger miles (RPMs) or passenger enplanements. Plans for the future cannot be made without forecasting demand. Planning also plays an important role in any aviation enterprise, but it should not be confused with forecasting. Forecasting is predicting, projecting, or estimating some future volume or financial situation—matters mostly outside of management's control. Planning, on the other hand, is concerned with setting objectives and goals and with developing alternative courses of action to reach them—matters generally within management's control.

A forecast of revenues is not a plan. There must be goals, strategies for attaining them, alternative courses of action, and a realistic fit with other market conditions. Thus, although forecasting is not planning, it is an indispensable part of planning, a management tool for deciding now what the company must do to realize its profit and other goals for the future.

Not only is forecasting done for a given type of demand independently, but forecasts of one type of demand may also be based on other forecasts. Thus, the projection of flying hours for next year is an element in the forecast of future demand for flight personnel, fuel consumption, facilities, and a host of other considerations.

THE PURPOSE OF FORECASTING

Each type of forecast serves a particular purpose. Thus, an airline might make a *short-term forecast* of total passenger enplanements between a particular pair of cities to provide a basis for determining station personnel and ground equipment needed, gate availability, and expenses related to these items. Short-term forecasts normally span a period of one month to one year and cover such day-to-day operations as staffing stations, evaluating current competitive situations in the market, and projecting short-term equipment needs.

Medium-term forecasts generally span a period of one to five years and involve such things as route-planning decisions. A *long-term forecast* spans a period of 5 to 10 years and might involve fleet planning decisions and long-term financial commitments. For example, a light-aircraft manufacturer might make a long-term forecast of demand for an aircraft specifically designed to serve the commuter air carrier market and then plan to meet the projected demand. The various forecasts are used by companies to carry out three important management functions—analysis, planning, and control.

A word of caution should be noted when forecasting. When obtaining statistical data, it is important to realize different sources have different reporting methods for the same outcome, meaning actual data might not be accurate. It is very important to use data from reputable sources and have a thorough understanding of how the data was collected especially when benchmarking against other sources.

Analysis

Every company must make choices among the many markets or submarkets open to it, in addition to deciding on the level of service to offer, the type of aircraft to fly on particular routes, and the type of aircraft to purchase. The choice is greatly facilitated by quantitative estimates of demand. The following situations demonstrate the role of forecasting in the analysis function:

A major air carrier is trying to decide whether to purchase the Boeing 787 or the A-350. An estimate of operating costs will be a guiding factor.

A regional carrier is trying to decide whether to introduce shuttle service between two cities. The company will be guided by its market research department's estimate of long-term passenger enplanements.

A light-aircraft manufacturer is trying to decide whether to develop a new commuter aircraft. The company will be guided by an estimate of potential sales in this market.

Planning

Every firm must make short-term decisions about the allocation and scheduling of its limited resources over many competing uses; it must make long-term decisions about rates of expansion of capital equipment and funds. Both short-term and long-term decisions require quantitative estimates of demand, as the following situations illustrate:

A line maintenance supervisor for a national carrier in Dallas wants to identify how many workers will be employed for the next calendar year and needs an estimate of the number of departures at his station by month.

The advertising director for a major carrier wants to promote a new low fare to selected cities and needs a short-term forecast of enplanements as a basis for assigning funds.

The board of directors of a medium-size regional carrier needs a long-term forecast of population growth and business expansion in a particular city to use as a basis for planning future expansion.

Control

A company's actual performance (physical volume or revenues) in the market takes on meaning when it is compared to forecasts. The use of these demand measurements for control purposes is illustrated in these examples:

A commercial aircraft manufacturer is disappointed with sales to national carriers. The market research department is asked to develop a new forecast of company sales potential in this market.

A regional sales manager of a light-aircraft manufacturer wants to subdivide a sales territory in which sales are unusually high. The salesperson for that territory objects, arguing that the territory has only average sales potential but that she has penetrated the market to a greater degree than her counterparts have. The sales manager asks the research staff to come up with a sales forecast for the territory.

The vice-president of flying for a major carrier asks the administrative staff to reestimate the number of pilots who need to be trained on the B-737 over the next three years because the former number appears to be too large in view of delays in delivery schedule since the original forecast.

FORECASTING METHODS

The choice of forecasting methods should be based on several factors, including availability of data, accuracy of available data, management sophistication, intended forecast use, and availability of electronic data processing. Sophistication in forecasting methods can easily run ahead of data quality and management ability to use the results. Forecasting passenger enplanements for a one-year period on well-established routes, for example, possess a fundamentally different forecasting problem than estimating enplanements on a new route, and forecasting methods must be chosen accordingly.¹ Annual forecasts are provided by various organizations, such as the FAA, IATA, ICAO, aircraft manufacturers, and so on. The following review of forecasting methods is far from exhaustive, but it suggests the range of methods available.

Causal Methods

Causal (model) forecasts are based on a statistical relationship between the forecasted (dependent) variable and one or more explanatory (independent) variables. There need not be a cause-and-effect relationship between the dependent and the independent variables. A statistical correlation alone is sufficient basis for prediction or forecasting. **Correlation** is a pattern or relationship between the two or more variables. The closer the relationship, the greater the degree of correlation.

In general, a causal model is constructed by finding variables that explain, statistically, the changes in the variable to be forecast. Such variables must have the following characteristics: (1) they must be related statistically to the dependent variable, (2) data on them must be available, and (3) there must be some way of forecasting them, or their relationship to the dependent variable must be lagged (must follow the dependent variable by several months).

Most forecasting methods are based on the assumption that existing patterns and historical relationships will continue in the future. Because this assumption usually holds only for the short term, however, most forecasting methods can provide reasonably accurate forecasts for periods of only one or two years. In the case of aviation, the events of 9/11 led the industry into a very unpredictable era. Historical data once used for forecasting no longer has the same credibility because, essentially, the industry has started over.

The statistical relationship is estimated and verified using statistical analysis. The selection of variables depends on the imagination and resources of the researcher. With the aid of a computer, dozens of candidates can be tested, easily and quickly, once the structure — that is, the mathematical form — of the model has been decided. This, too, may be selected by trial and error.

¹For a good explanation of the factors affecting the selection of forecasting method, see N. K. Taneja, *Airline Traffic Forecasting* (Lexington, Mass.: Lexington Books/Health, 1978).

The availability of data on the variables—or, more specifically, their specific values is largely determined by the time and resources the researcher has available. Data are the key to specifying the model. Prominent independent variables used in forecasting various segments of the air transportation industry include gross national product (GNP), disposable personal income (DI), and consumer spending on services. Dependent (forecasted) variables might include such things as revenue passengers enplaned, RPMs, and passenger revenues. In the general aviation sector, the level of corporate profits in the economy as a whole correlates well with total business aircraft purchases. Some very sophisticated mathematical models might use 20 or 30 independent variables to forecast a particular set of dependent variables.

For example, let's say we developed the following hypothetical formula, using statistical analysis and based on data covering a 15-year period, that shows the relationship between GNP and the number of active general aviation aircraft in the United States:

Y = 8.14 + 0.152X.

The value of the GNP (*X* in the equation) is expressed in billions of current dollars, and the resulting estimate of the fleet (*Y* in the equation), is in thousands of active aircraft. Figure 8-1 demonstrates the closeness of the fit between the forecast model and the observed historical data over a 15-year period.

Once the formula has been established and a high correlation demonstrated, the equation can be used for forecasting purposes. The next step is to obtain current forecasts of the independent variable (GNP in this case). The FAA aviation forecast uses economic forecasts from Chase Econometrics; Data Resources, Inc.; Evans Economics, Inc.; and Wharton Econometric Associates.² These are all highly reputable sources for forecasting major economic aggregates. The forecasted active general aviation aircraft fleet is then determined by plugging in the values for the forecasted GNP over the time period being forecast.

Given unlimited amounts of data, causal models can be constructed that explain almost any market phenomenon. Unfortunately, unlimited amounts of data are rarely available. Shortages of time, money, and personnel; limits on the accessibility of data; deficiencies in measurement techniques—all impose serious constraints on data availability. Often, researchers must be content with secondary data, substitute variables, outdated observations, and inaccurate information. The result is usually an imperfect model, although not necessarily a useless one.

Forecastability, or a lagged relationship with the dependent variable, is essential, because it does little good to construct a forecasting model if the future values of the explanatory variables are as difficult to estimate as those of the dependent variable. The only alternative is to use independent variables whose present values determine the dependent variable's future values.

Causal models are unquestionably the most sophisticated type of forecasting method used today, as well as the most frequently used. However, as mentioned previously, companies use these forecasted data in developing forecasts of their share of the industry (forecasts used for other forecasts). Although causal models are used quite extensively by the FAA, ATA, GAMA, NBAA, and other industry sources, it is important to recognize their limitations:

² FAA Aerospace Forecasts, Fiscal Years 2001–2012 (Washington, D.C.: U.S. Government Printing Office, 2001).

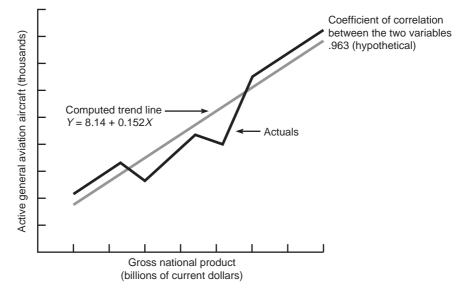


FIGURE 8-1 Hypothetical correlation between GNP (independent variable) and number of active general aviation aircraft (dependent variable).

- 1. It is sometimes difficult to quantify all of the variables, even though the researcher is aware that these variables have influenced the dependent variable in the past and might continue to do so in the future.
- 2. It is often assumed that it is easier and more accurate to forecast the explanatory variables (GNP, DI) than the dependent variable (passenger enplanements, cargo/ton-mile). This is important because the forecasted variable is no better than the forecast of the independent variable.
- 3. It is often assumed that a functional relationship that existed in the past (and upon which the model was built) will exist during the forecasted period.

No one during the mid-1960s boom period in aviation foresaw the magnitude of the recession that occurred in late 1969 and extended through 1972. All indicators pointed to continued expansion throughout the 1970s. Jumbo jets were ordered based on the mid-1960s forecasts; a major airport expansion program was undertaken; and manufacturers in both commercial and general aviation geared up for a major expansion. And then the bottom fell out. Despite its inadequacies, the science of model building for forecasting purposes has grown increasingly more sophisticated over the past 20 years as a result of the use of computers. Nevertheless, unusual weather conditions, international tensions, labor–management troubles, and a host of other unforeseen factors can disturb an established relationship between variables.

Time-Series or Trend Analysis Methods

Another reasonably sophisticated statistical method of forecasting is **time-series analysis**, the oldest, and in many cases still the most widely used, method of forecasting air transportation demand. In some situations, this method is referred to as **trend extension**. It differs from causal model forecasting in that less causation is embodied in the time series.

Time-series models show the dependent variable as a function of a single independent variable, time. This method is used quite frequently when both time and data are limited, such as in forecasting a single variable (for example, cargo tonnage) for which historical data are obtained. Like the causal models, time-series models are based on a statistical correlation that does not necessarily reflect a real cause-and-effect relationship between the dependent and the independent variable.

Aviation is certainly not static: new-aircraft sales, prices, revenue passenger miles, cargo tonnage, profits, flying hours, on-time performance, and number of departures all fluctuate over time. Time-series or trend analysis is simply a sequence of values expressed at regular recurring periods of time. It is possible from these time-series studies to detect regular movements that are likely to recur and thus can be used as a means of predicting future events.

Forecasting by time-series or trend extension actually consists of interpreting the historical sequence and applying the interpretation to the immediate future. It assumes that the past rate of growth or change will continue. Historical data are plotted on a graph, and a trend line is established. Frequently, a straight line, following the trend line, is drawn for the future. However, if certain known factors indicate that the rate will increase in the future, the line may be curved upward. As a general rule, there may be several future projections, depending on the length of the historical period studied. Airlines keep numerous records of data of particular concern to them (departures, enplanements, flying hours, and so forth), and when a forecast is needed, a trend line is established and then projected out to some future time. The accuracy of forecasting by historical sequence in time-series or trend analysis depends on predictions of changing factors that may keep history from repeating itself.

The values for the forecasted (dependent) variable are determined by four time-related factors: (1) long-term trends, such as market growth caused by increases in population; (2) cyclical variations, such as those caused by the business cycle; (3) seasonal phenomena, such as weather or holidays; and (4) irregular or unique phenomena, such as strikes, wars, and natural disasters. These four factors induce the following types of behavior in the dependent variable: (1) trends, (2) cyclical variations, (3) seasonal changes, and (4) irregular fluctuations. These types of variations are found throughout the literature of market and economic forecasting. An example of each is given in Figure 8-2, along with a composite they might produce.

Trends. A trend is a long-term tendency to change with time. A variable's trend is a reflection of its statistical relationship with time, exclusive of cyclical, seasonal, and irregular disturbances. Trend functions are described by growth curves, which express, both graphically and mathematically, the underlying pattern of time-related changes. This pattern is usually brought about by such factors as population, GNP, industrialization, changes in technology, and long-term shifts in tastes or preferences. A trend can be inherently positive, such as total air carrier passenger revenues. It can be negative, such as the phasing out of fuel-inefficient aircraft from the airline fleet. Or it can be erratic, as in the case of airline pricing in recent years.

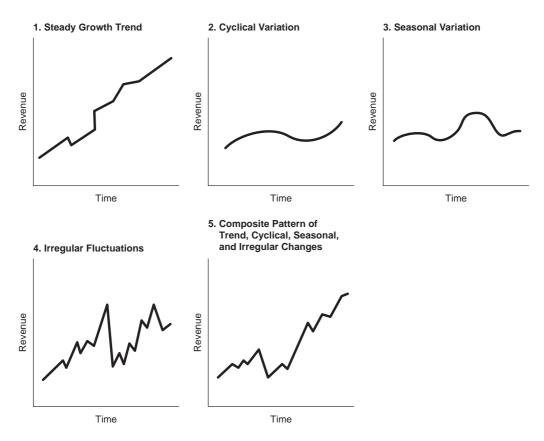


FIGURE 8-2 Time-related changes in a dependent variable (revenue).

The time period specified for a particular trend varies considerably. Economists frequently define it as any period in excess of that required for a complete business cycle (approximately five years). Airline marketers tend to specify a trend period as equivalent to the approximate lifetime of the service. This can vary from a few months (in the case of some in-flight promotional services, such as two-for-one drinks or special meal service) to a couple of years (for such items as an advertising theme) to an indefinite period (for an essential, such as fuel).

Cyclical Variations. Cyclical variation is the variation of the forecast variable due to the business cycle. The business cycle is the wavelike fluctuation in the level of economic activity that has been associated with the economies of the developed nations since the early years of the Industrial Revolution. The business cycle has never been fully explained by economists, adequately controlled by governments, or satisfactorily predicted by businesses. However, the phenomenon is apparent if any of the common economic indicators (such as GNP, employment levels, stock prices, corporate profits, or capital investment) are plotted over time. The length of individual cycles varies, although they usually last well beyond a couple of years measured from peak to peak or valley to valley. In the United States, cycles range from 1 to 10 years, with 4 or 5 years the norm. The magnitude of the fluctuations, measured vertically from peak to valley (or vice



versa) varies tremendously and thus far has defied precise forecasting, to the chagrin of most aviation industry analysts.

The business cycle has a significant effect on all segments of the air transportation industry. The level of air travel for business or pleasure purposes is affected by upturns and downturns in the economy. Economists refer to the air transportation industry as being *income elastic*; that is, airplane sales, RPMs, and so forth are very responsive to changes in economic aggregates such as disposable income, personal income, and national income.

Seasonal Variations. Seasonal variation is the variation of the forecast variable associated with the time of year. It is appropriately named, for it is a function of both the weather and the social customs associated with the four seasons (for example, in Florida, the heavy tourist season from Thanksgiving through January 1 or college spring break from March through April). Seasonal fluctuations in the demand for such things as motel rooms, rental cars, and airline travel are quite pronounced.

Irregular Variations. Irregular variations are erratic, nonrecurrent events such as strikes (for example, the air traffic controllers' strike in 1981), blizzards, riots, fires, wars or war scares, price wars, bankruptcies, and other real-world disturbances. Although the disturbance factor is easily identified and the magnitude of its effect can normally be estimated, it seldom can be forecast.

Smoothing the Variations

Cyclical Variations. Cyclical variations can be removed by the forecaster by performing a couple of tasks. The first, and most difficult, task is to estimate the relationship between the forecast variable and the business cycle. The forecaster selects an appropriate index, such as GNP or the Dow Jones stock average, to represent the business cycle. Then, either subjectively or through various mathematical approaches, the forecaster estimates the elasticity (responsiveness) of the forecast variable with respect to the business cycle index. The objective is to determine how much of the fluctuation in the variable was induced by the business cycle. For example, if the index drops 10 percent, how much will the forecast variable change? Once this is determined, the observations of the forecast variable-the values (volumes or financial data) that make up the composite curve—can be adjusted. The forecaster then simply subtracts the cyclical variation, computed for each point in time, from each observation. What remains is a time series or trend line free of cyclical variation. An alternative is to leave the cyclical variation in the data. However, the result is a forecast that reflects the cycle. Depending on the purpose of the forecast, this might, in fact, be the more realistic approach, in that it reflects the uncertainty induced by the business cycle.

Seasonal Variations. The primary reason for removing seasonal variations is to reflect the actual situation more accurately. For example, if Easter week falls in late March one year and in early April the next, increased passenger enplanements, RPMs, revenues, and so forth will appear in the first-quarter statistics one year and in the second-quarter statistics the next year. Unless this is taken into consideration in the forecast, planning for the two quarters will be inaccurate.

Seasonal variation is eliminated by a process called *smoothing*. The most common instruments for this purpose are freehand lines, semi-averages, and moving averages.

Freehand lines are a convenient way of smoothing out fluctuations in data, but they are obviously imprecise. Using *semi-averages* to smooth out a curve is only slightly more rigorous than using freehand lines. The forecaster simply divides the time series into two equal parts—its first and second halves—and then computes the arithmetic mean (average) of each part. The two means are plotted and a straight line is drawn through the two points to represent the smoothed curve. This line can be expressed mathematically, but the function cannot be evaluated by statistical testing.

The *moving average* is computed by finding the mean of the adjoining observations. This average then replaces the observations used in its calculation. A 12-month moving average would drop the observed data for the first month in the time series when data become available for a new month in the series. The correct number of periods used for a moving average depends on the length of the seasonal cycle and the frequency of the observations. Most seasonal variations have a one-year cycle. If monthly observations are recorded, then a 12-period moving average will remove seasonal variation.

Irregular Variations. Irregular variations are introduced by a major event such as severe weather conditions or a strike and can usually be identified and measured, or at least estimated, with reasonable accuracy. Either an adjustment can be made in the observed values or the observations taken during the event can be deleted. For example, an evaluation of the long-term trend in passenger enplanements, load factors, and the like would take into consideration the air traffic controllers' strike during the summer of 1981, when service was cut drastically for a period of time.

When forecasters make adjustments or deletions, they should note the fact. Management should be made aware of the effect of these events and the probability of their recurrence. When the effects are severe, such as abnormally harsh weather over several years, and there is a possibility that they will recur, management can sometimes make provisions for them.

The usual order of removing unwanted variation is to remove first fluctuations caused by irregular events, then cyclical variation, and finally seasonal variation. The residual is a true trend. These data can then be plotted and an appropriate curve drawn through, or fitted to, the actual points (scatter points) in what is referred to as a *line of best fit*. Figure 8-3 demonstrates a composite time-series curve after smoothing has been accomplished.

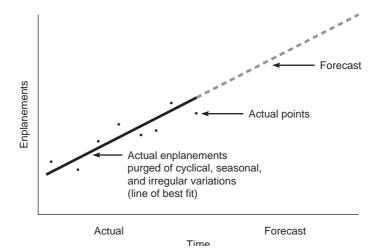


FIGURE 8-3 Composite time-series trend line used for forecasting purposes, after smoothing has been accomplished.

Accuracy of the Causal Models and Time-Series Forecasts

Short-term forecasts are generally more accurate than long-term forecasts because the underlying determinants and the relationships between variables tend to change less in the short run than in the long run. However, short-term forecasts are vulnerable to seasonal variations that, if unaccounted for, can make them unrealistic.

A long-term model is really a trend model, affected only by irregular variations. Developing a trend model is generally the primary objective of the forecaster, because management is interested primarily in the growth or contraction of a particular service.

Forecasts for the economy as a whole usually are more accurate than those for a particular industry within the economy. Consequently, forecasted revenue for the airline industry typically is not as accurate as forecasted GNP. Likewise, an individual company's forecasted share of the industry total usually is less accurate than that of the industry as a whole. And, going one step farther, a general aviation aircraft manufacturer's forecast of revenue for a particular model of aircraft generally is less accurate than a forecast for a category of aircraft, such as turboprop aircraft. The reasons for this are basically twofold: (1) the numbers become smaller and less statistically reliable as the forecast becomes more finite, and (2) the number of variables increases as the forecast becomes more finite.

Judgmental Methods

Judgmental forecasts are educated guesses based on intuition and subjective evaluations. Although they are the least rigorous types of forecasts, they are frequently a powerful factor in decision making. Intuition often is the only tool the researcher has, and it can be very accurate. Judgmental methods can be used when either no information or very little historical data exist. They can also be used to adjust forecasts developed by causal models or through time-series analysis. For example, the preface to *FAA Aviation Forecasts*, 2001–2012, states that "FAA aviation forecasts employ projections of key economic variables...-. These projections are combined with projections of aviation variables and professional judgment."³

Acceptance or rejection of a judgmental forecast depends mostly on the reputation of the forecaster, because there are no statistical ways to evaluate it. Very often, a strong leader can push through recommendations based on such forecasts. For example, a vicepresident at Cessna felt strongly that there was a significant unexploited demand for a twin-engine airplane with its engines mounted in tandem instead of laterally, as in conventional designs. (This would prevent asymmetric, or out-of-balance, thrust, thereby reducing the hazards of flying with one engine out.) Although his judgment conflicted with forecasts made by more rigorous methods, the company committed itself to the idea. When the product was introduced, sales fell far short of the level the vice-president projected. Instead of backing down, however, the executive insisted that his analysis of demand, and hence of potential sales, was correct and that the fault lay in the design of the aircraft. He won his point, and the model was not dropped. An alteration in the design (the incorporation of retractable landing gear) made the product acceptable to the market, and sales rose to the level he forecast. The model became, for a time, the most successful product in the firm's line.

As was the case with the Cessna example, judgmental forecasts usually require the backing of a leader because, in the absence of supporting data and objective analysis,

³FAA Aerospace Forecasts, Fiscal Years 2001–2012 (Washington, D.C.: U.S. Government Printing Office, 2001), p. i.

they seldom can stand on their own. They are based on experience and partial (usually qualitative) knowledge; their analytical tools are intuition and common sense. They are frequently poorly received, especially when they suggest a future that is substantially different from the present or involve a radically different product or promotional scheme. Aviation is filled with examples—Bill Lear when he first proposed a business jet, or whoever first suggested serving liquor aboard commercial airliners (the president of United Airlines at the time was quoted as saying something to the effect of, "No way, we're not going to become flying taverns").

Judgmental forecasts can be obtained from a number of sources, including expert opinion, sales force opinion, and polls.

Expert Opinion. Expert opinion can come from within or outside the company. Forecasts may be developed by simply drawing on managerial experience within the company. For example, a prediction of next year's cargo tonnage may be obtained from the vice-president of cargo sales. Companies can also tap outside experts for assessments of future market conditions. Various public and private agencies issue or sell periodic forecasts of short- or long-term business conditions for different industries. Leading spokespersons, sometimes referred to as "visionaries," from banking or investment houses report on the status of and outlook for the industry.

An interesting variant of the expert opinion method is used by Lockheed. As a manufacturer of airframes and missiles, the company deals with a relatively small number of customers, each of which accounts for a relatively large percentage of sales. Therefore, Lockheed's forecasting problem is to predict what each particular customer will order during the forecast period. The market research group works up a preliminary forecast on the basis of surveys and causal models. Independently, various Lockheed executives pose as major customers and, in a hardheaded way, evaluate Lockheed's offering in relation to its competitors' offerings. A decision on what and where to buy is made for each customer. The purchases from Lockheed are totaled and reconciled with the statistical forecast to form Lockheed's sales forecast.

The use of expert opinion has several advantages and disadvantages. The primary advantages are that (1) the forecasts can be made relatively quickly and cheaply, (2) different points of view can be brought out and balanced in the process, and (3) there may be no alternative if historical data are sparse or unavailable, as in the case of new products or services. The primary disadvantages are that (1) opinions are generally less satisfactory than facts, (2) responsibility for the forecast is dispersed if various managers' opinions are used and if good and bad estimates are given equal weight, and (3) the method is usually more reliable for aggregate forecasting than for breakdowns by region, customer groups, or service categories.

Sales Force Opinion. Sales force estimates have the advantage of coming from those individuals who are closest to the marketplace. Because they work in the field, salespeople generally have a fairly good idea of their company's image with travel agents in their territory and the expected business to be generated from these sources. They also have a good feel for the amount of cargo tonnage shipped by freight forwarders and businesses that have been using their services. They are in daily contact with the carrier's major customers and can offer valuable information to the home-office forecaster. Sales representatives are often the first to learn of a competitor's strategy at the local level and may have more knowledge of or better insight into developing trends than any other single group. This grass-roots approach to forecasting can be helpful in breaking down sales by territory, customer, and sales force.

However, forecasting by the sales force is not without its problems. A salesperson's forecast can be biased, and individual salespeople may be overly pessimistic or may go from one extreme to another because of recent revenue setbacks or successes. Also, a salesperson is often unaware of larger economic developments and of company marketing plans that will shape future sales. Consequently, few companies use the salesperson's estimates without some adjustments.

Poll Forecasts. Poll forecasts are based on the expressed intentions of members of the particular target market, who are polled using one of the conventional survey techniques — mail questionnaires or telephone or personal interviews. A poll is a collection of judgmental forecasts from the market sampled in the survey.

Poll forecasts are susceptible to a number of errors, including poor judgment, ignorance, and uncertainty among the respondents. The respondents' judgment, especially with respect to future events such as purchase behavior, can be quite suspect. Further, the respondents may not be the ultimate decision makers regarding the product in question, and plans may change because of company circumstances and general economic conditions.

In the case of polls or surveys of potential business aircraft purchasers, there may be a reluctance to disclose buying intentions. Such a request could be regarded as an invasion of company privacy. Nevertheless, polls are used quite extensively by all aviation firms as a means of developing data for designing new products and services, as well as for forecasting purposes. Polls, if properly designed and used, provide useful estimates about the target market.

Usefulness of Judgmental Methods

The usefulness of expert opinion, sales force opinion, or polls depends on the cost, availability, and reliability of these types of data. For cases in which buyers do not plan their purchases carefully or are very erratic in carrying out their intentions, or in which experts or the sales force are not particularly good guessers, a poll or survey of buyers' intentions is preferable. A poll or survey also is generally more desirable in forecasting the market for a new product or for an established product or service in a new territory. When a short-term forecast of likely buyer response is desired, an expert opinion may be called for.

KEY TERMS

forecasting causal (model) forecast correlation time-series analysis trend extension judgmental forecast

REVIEW QUESTIONS

- 1. How does forecasting differ from planning? What is the purpose of forecasting? Give an example of a short-term and a long-term forecast.
- 2. Describe how forecasts can be used by firms for analysis, planning, and control purposes.

- 3. What is meant by a *causal*, or *model*, *forecast*? Define *dependent* and *independent variables* and *correlation*. What are the three characteristics that variables must have to be used in building a model? What are some of the limitations of causal models?
- 4. How do time-series or trend analysis methods differ from causal models? Define *trend, cyclical variation, seasonal variation,* and *irregular variation.* What is the purpose of smoothing the data? Describe several methods of smoothing seasonal variations. Why are short-term forecasts generally more accurate than long-term forecasts? Why might a forecast of the GNP be more accurate than a forecast of revenues for a particular model of aircraft?
- 5. What are judgmental forecasts? Give several examples of forecasts by expert opinion. What are some of the advantages of using expert opinions or sales force observations? What are *poll forecasts*, or *surveys*?

WEB SITES

http://www.AirlineMonitorWeekly.com http://www.ny.frb.org http://www.rati.com http://www.faa.gov http://ntl.bts.gov/faq/financstats.html

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