SALES FORECASTING IN THE PLYWOOD INDUSTRY

by

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Date \underline{October 9, 1964}
This thesis presents a general review of sales forecasting literature with particular attention to the preparation of the sales forecast, the pre-planning activities and the review. In addition, forecasts are developed which show the expected sales of domestic softwood plywood to be realized by the plywood industry for the years 1964 and 1968. A procedure is then presented that Crown Zellerbach Company can follow in using the industry forecast to ascertain their share of the expected softwood plywood sales.

Sales forecasting is an essential prerequisite to company planning. Therefore, forecasts must be as accurate as possible because many activities within the firm are based on the sales forecasts. With the assistance of sales forecasts, vital marketing, financial and production plans ultimately emerge, together with their supporting schedules.

The person responsible for the forecasting task must acquire not only a detailed understanding of company activities but also a thorough knowledge of the characteristics of a sound forecasting operation.
The forecaster must be familiar with the various judgment, survey and statistical techniques available for developing forecasts and he must understand the necessity of carrying out numerous pre-performance and post-performance activities. The pre-performance activities must be dutifully carried out if the most useful forecasting method is to be chosen. Post-performance activities are equally important. A time-table for review and revision when necessary must be drawn up ahead of time if proper control is to be exercised over the forecast.

A simple regression equation and three multiple regression equations are developed with the intention of using one or more of them to forecast industry softwood plywood sales for the years 1964 and 1968. The three multiple linear regression equations are rejected because each of them possesses one or more unacceptable negative constants. The simple linear regression equation has an extremely high coefficient of correlation and a small standard error of estimate. Since this equation contains these desirable features and seems to incorporate no underlying fallacy, this simple regression equation is the one chosen to forecast industry plywood sales.
The share-of-market approach is used to determine the proportion of the industry sales to be captured by Crown Zellerbach Company. The total projected industry sales figures are multiplied by a percentage which represents the company's present share of the total market. The figures that result represent the anticipated plywood sales to be achieved by Crown Zellerbach Company for the years 1964 and 1968.

Crown Zellerbach should not depend solely on the technique developed in this thesis for forecasting plywood sales. They should continue to use the subjective or judgment technique that they have used for a number of years, but they would follow a better course if they used one or more statistical or survey methods in addition to the present method. A final forecast could be selected after an analysis had been made of the forecasted figures developed by the various methods.
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CHAPTER I
INTRODUCTION TO SALES FORECASTING

I. INTRODUCTION

If a business is to be run efficiently management must be cognizant of the present situation of the enterprise and must be aware of the direction in which the business is moving. In order to prepare for the future, firms customarily prepare an estimate of anticipated sales volume for the coming six months, year or several years. Actual sales in any current time period are compared with the anticipated sales for the same period. A study of the differences between and the similarities of the two sets of figures provides guidance in the control of production schedules, cost budgets and other commitments. An estimate of sales volume for a specific future time period is called a sales forecast.

The sales forecast is not the same as a general business forecast. The latter forecast is usually an effort to estimate trends in general business on a broad scale, and could be for the nation as a whole, or for a major segment, such as a forecast for all durable goods. Such a forecast is usually made by an economist. A sales forecast is narrower in scope, estimating the expectations of only one
company or organization. The sales forecast usually is developed to assist management in planning future activities and in evaluating actual sales when they are achieved. General business forecasts often play an important role in the developing of a sales forecast.

The sales forecasting task usually involves several stages. One stage involves a forecast or estimate of the trend of industry volume. A second stage involves an estimate of company sales. A third stage may involve further subdivision, as when sales within regional territories are estimated.

II. PURPOSE OF THE STUDY AND THE HYPOTHESIS

The first objective of this thesis is to assess the applicability, validity and reliability of the various forecasting methods. Some forecasting techniques are easier to use than others. The simpler ones can be employed by forecasters with limited training and experience. Other techniques require not only considerable experience but extensive training in such areas as statistics or mathematics. The forecaster may have little difficulty justifying to management the use of some techniques, but he may have great difficulty justifying the use of other methods.
The second objective is to prepare sales forecasts for Crown Zellerbach (Canada) Limited. The intention is to produce a forecast of the domestic sales of softwood, plywood by Crown Zellerbach Building Materials Limited, for the years 1964 to 1968.

This second objective is based on the hypothesis that one year and five year projections of domestic softwood plywood sales can be developed for Crown Zellerbach Building Materials Limited by using a linear multiple regression equation. The linear multiple regression equation arises from a statistical method of determining and measuring the relationship between sales and other independent activities. By forecasting the trend in these other activities, sales volume for the industry and the company can be forecast.

III. METHODOLOGY FOR THE ESSAY

In the majority of discussions on sales forecasting the subject has not been approached from the broad managerial point-of-view. Sales forecasting has been examined as a question of what technique or method will best forecast sales in any particular case. However, approaching the problem of sales forecasting from this narrow viewpoint will not lead to the best solution because there is no
such thing as a management function which requires only performance. From the management viewpoint there are pre- and post-performance activities that are just as important as the technique to be employed, so it is important that a proper setting be provided for the actual development of the forecast as well as for a discussion of the specific techniques which implement that performance. Since the pre- and post-performance activities in sales forecasting have been largely neglected, the theory underlying this area of forecasting has not reached an advanced stage. This essay endeavors to place suitable emphasis on the activities that should take place before and after the actual development of the forecast as well as on the planning of the actual forecast itself. The methodology used to achieve this goal is outlined in the following paragraph.

Chapter Two provides an introduction to economic, industry and sales forecasting. Planning and organizing for sales forecasting as well as the uses of sales forecasts are discussed in Chapter Three. The various techniques for forecasting are described in Chapter Four. In Chapter Five sales forecasting problems in the individual firm are presented. In Chapter Six the actual fore-
casts for Crown Zellerbach are developed. Chapter Seven contains the summary and conclusion.

IV. SOURCES OF INFORMATION

The information for this essay was obtained from many sources. Various aspects of this subject are discussed in a large number of books and in articles in journals. Crown Zellerbach (Canada) Limited and Weyerhaeuser Company provided information as did the British Columbia Plywood Manufacturers' Association and the Douglas Fir Plywood Association of the United States. Additional information was obtained from the Dominion Bureau of Statistics and the Agriculture Department of Oregon State University.
CHAPTER II
BASIC FORECASTS

I. INTRODUCTION

Every businessman forecasts constantly whether he realizes he is doing so or not. On his forecasts he bases decisions concerning the quantities of materials and parts he should order, the size of the staff he needs, the prices he should charge for his goods, the advertising and selling activities he must promote and the carrying out of innumerable other functions for which he is responsible.

In the past the businessman claimed that intuitive knowledge produced a more satisfactory forecast than did statistical and economic methods and there was a good deal of justification for his viewpoint. Now better statistical techniques have been developed and better statistical material is available in greater quantity, so an analysis based on statistical economic methods is far superior to a businessman's intuition. So much depends upon a good forecast that a businessman should avail himself of the modern methods and economic data now at his disposal in order to obtain the best estimates possible.

A forecast that is accurate cannot be guaranteed even when modern techniques and relevant material are used, but it will be far more reliable than a forecast without these benefits. If a businessman uses a poor forecast he stands less chance of realizing when business is about to go into a decline, or when recovery is imminent, and he could lose a great deal of money.

These ups and downs of general business affect every industry and every company in the industry. Although not all industries and not all firms are equally affected by changes in aggregate business activity, sales and net profits do move up and down with similar fluctuations in the total business output, while the costs of operation display movements similar to those in the general price level or in the price of raw materials and in the average hourly earnings of labour. This economic activity is not the only external factor that influences the progress of a business enterprise. Political regulatory factors also play a part in determining the success or failure of a firm. These external factors must be predicted if short and long-range plans are to be developed. "To the extent that forces over which management can exert little or no influence affect
sales, profits and the availability of credit and capital, management must have an appraisal of the future course of aggregate economic activity based on a national ordering of all available relevant quantitative and qualitative evidence." The sales forecaster can predict the movements of these forces by using the economic forecast.

The welfare of a company depends not only on external factors but on internal ones as well. Internal factors are those over which management has relatively close control. They include the quantities of material ordered and processed, the methods of marketing, the personnel arrangements, the product mix, the allocation of costs to products, the organizational structure and the effectiveness of administration. These factors, too, must be predicted if the company is to be in a favourable position to carry on the planning and development of its operations.

II. ECONOMIC FORECASTS

Three types of forecasts - economic, industry and sales - are considered in this essay. An economic

forecast refers to a prediction concerning the future of business in general as well as the future of its major components and most essential processes. Included in economic forecasting are predictions of gross national product, consumer spending, business inventory, industrial production, employment, wholesale prices and the like.

There are several ways in which forecasts can differ. First, the end results differ in their detail. Second, the theoretical foundations of economic forecasts differ because forecasters hold different opinions concerning the operation of the economy. These differences in opinion account in part for the relative success or failure of economic forecasts. The forecasters who can best assess the balance of various forces will produce the best forecasts. The third difference is that techniques used in the construction of economic forecasts can vary. Forecasting techniques are basically mechanical in the application of a statistical technique


5. Oxenfeldt, Sales Forecasting, p. 10.
based on a fairly rigid model, or they are entirely subjective. Forecasters usually combine rigid tech­
niques with personal judgment and a consideration of qualitative factors. Different methods are sometimes used to predict different components of the economy.

Economic forecasts can be classified as short-term, intermediate and long-term forecasts. The short-term forecast usually covers a period ahead of no more than two years, the intermediate a period of two to five years and the long-term a period of five years and over. Forecasters in various industries have slightly varying opinions concerning the length of time that constitutes a short, intermediate or long-range forecast.

Various methods can be used to develop a short-
term economic forecast. Some of these methods are discussed in the following pages.

Opinion Poll

One of the techniques used in the development of a short-term forecast is the opinion poll. Its use involves asking many businessmen their opinions con­
erning the course of future business development.

From this "sample of many" there is developed a comp-
osite judgment which is accepted because of a feeling of "safety in numbers." Sometimes these polls are carefully planned and controlled by experts in government, business and private research organizations. Often, however, they are not properly planned and constructed, for insufficient attention is given to the questions asked and to the people interviewed. One of the criticisms levelled at this type of forecasting is that the sample of individuals interviewed does not constitute a scientifically drawn sample or at least is not a proper cross-sectional sample of businessmen. However, probably no sample, regardless of the method of selection, would produce consistently satisfactory results in the area of economic forecasting. This statement must be accepted as correct unless the forecaster can show that the general trend of opinion, for some demonstrable reason, actually foretells future events, and such an occurrence is unlikely. Nevertheless, changes in businessmen's opinions and expectations can often be ascertained through opinion polls.


Indicator Approach

Another technique used in short-term economic forecasting is the leading indicator approach. This approach is often adopted after attempts involving the opinion polling method have been unsuccessful. Key factors which appear to lead or coincide with general business activity are often used in forecasting future economic conditions. That is, changes in certain particular factors or indicators such as income, industrial production, government surplus or deficit, plant and equipment expenditures, and money supply precede changes in total economic activity. Leading indicators are usually chosen after comparisons have been made between the movements of potential indicators and movements in previous business activity.

Thus, an accurate general business forecast could be made if one or more indicators could be located and appraised. Considering the large number of key factors that are used obviously no indicator is considered entirely reliable. The most successful results are obtained when there is a definite lead-lag relationship between the leading indicator and general business.

When the indicator does not "lead" general business, the future movement of the indicator must first be predicted. The forecast of the indicator is accepted because it is usually considered easier to forecast the key-factor than to forecast business as a whole.

**Historical Analogy**

A third method, historical analogy, involves a logical refinement of the key-factor approach. For purposes of forecasting, the ideal statistical indicator would be one with an unchanging sequence that precedes turns in business by a fixed number of months and with an amplitude of expansion and contraction directly related to the extent of the upswing or downswing about to be experienced in total economic activity. An indicator as perfect as this has never been found. However, before World War II, W. Mitchell and A. Burns picked a set of twenty-one indicators from among the several hundred time series that the National Bureau of Economic Research had analyzed in its studies of business cycles. The twenty-one indicators chosen were readily available indicators of economic change and seemed to be the most trustworthy. After World War II, Geoffry Moore studied several hundred time
series and in 1950 he published a revised list of twenty-one indicators, Moore classified his business cycle indicators into three groups - leading, roughly coincident and lagging. They were classified according to their tendency to reach cyclical turns ahead of, at about the same time as, or later than business cycle peaks and troughs.

Moore then employed a diffusion index to summarize the movements of his three groups of series. This diffusion index provides an easy method for evaluating the direction of change in a group of indicators. The idea is merely to count the number of items in any group that are rising at any given time and to take this as a percentage of the total number in the group. This is the percentage of the total number of items in the group that are expanding. The percentage will be above fifty if more series in the group are rising than falling, but the percentage will be below fifty if more are falling than rising. The percentage is called a diffusion index because it shows how widely diffused the expansion movements are in the sector observed.

This method has not been used long enough to justify complete acceptance, however, any forecaster is wise to take notice when the NBER indicators signify a change in the direction of general economic activity. The basic weakness in this method, as the NBER specialists point out, is that an indicator that has successfully predicted in the past will not necessarily be successful in predicting in the future. Furthermore, no indicator has yet been found that has always been satisfactory in the past. We are not justified in assuming, therefore, that any indicator will be consistently reliable in the future.

"The historical analogy approach nevertheless does provide a convenient means for analyzing the current business situation with reference to past trends, and thus offers a basis for appraising differences as well as similarities between any immediate business situation and historical periods which may be deemed in some manner to be comparable." 11

Econometric Method

In order to describe and project the main economic factors active in the economy which are thought to influence the general trends of business, forecasters sometimes use the econometric approach which emphasizes the use of mathematical formulae. The objective is

to develop a number of mathematical equations which effectively describe previous changes in general business and then to use these formulae to predict future events. First, the principal determining factors are selected by extensive mathematical analysis of past relationships between seemingly important factors and general business. National income and national product series are often used in econometric models. When these factors have been selected and past relationships determined, the econometric formula or "model" is created. This is followed by placing the statistical data into the equation and using mathematical calculations to develop the forecast. The econometric model method may be considered a mathematical refinement of the historical analogy method because this technique is heavily dependent on historical relationships. While the econometric method of forecasting has been used fairly frequently in recent years, the results have failed to live up to previous expectations.

The single equation model has been widely used in econometric work but in many cases insufficient care


was taken to assure that this technique was the best one to apply to the problem at hand. Since this model resulted from developments in mathematical statistics its popularity is not surprising. A great deal has been written on econometrics and most of this literature has grown around the single equation linear model, discussing the assumptions to the analysis of economic data and the steps that can be taken if one or more of the assumptions is inappropriate.

The objectivity of the econometric method has been advanced as one of its favorable qualities. This opinion is open to question, however, because human judgment plays a significant role in the development of mathematical equations. The important aspect of this method is the insistence upon a controlled and regulated technique which necessitates the selection of factors that are vital and the achieving of results that are consistent. Despite the limitations previously mentioned the method has value because of the demand that the quantitative factors used in the forecasting process be managed methodically.

Gross National Product Approach

The final technique of short-term economic forecasting, the gross national product or cross-section analysis approach, is included only after some slight hesitation, because gross national product is the most common measure used for estimating the market value of the nations' output of goods and services. Since gross national product is the best estimate we have of the contribution of economic activity to our material welfare, the results of an analysis developed by any technique will probably, for comparative purposes, be stated in the context of this particular measure. The utilization of the gross national product approach requires consideration of the predominant economic forces at work in the country as well as a detailed sector-by-sector analysis of future expectations.

III. ELEMENT OF JUDGMENT

Statistics for the past and statistics for the present furnish the foundation upon which future short-term forecasts are made, but another element also enters into the picture. Future economic developments

depend upon economic and non-economic forces whose direction of development cannot necessarily be ascertained from past and present occurrences. A decision concerning to what extent these past and present statistics will be reflected in the future depends upon the judgment of the forecaster, so the value of the prediction depends to a large extent upon the quality of the forecaster’s judgment.

Innumerable sources provide information and a good deal of misinformation concerning the business situation so that there is wide scope for the forecaster to use his judgment. There is too much information to enable it all to be handled effectively, so the forecaster must decide from which sources he will gather information. Further, he must decide which information is relevant to the specific problem facing him and which factors will exert more influence than others. He must decide also which statements are factually correct. Anyone who provides data about business is influenced by his own personal opinions and prejudices and the forecaster must be able to take this into account when he is using

the information he has gathered, and evaluate the significance of the various statements.

The forecaster himself will probably have his personal prejudices and he should be aware of them in order to minimize their effect. He should not have the burden of additional prejudices placed upon him by his environment. He should not have to adopt a political bias if he is employed by the government and he should not have to assume that prices will remain stable or that prices will rise continuously because his employer has a conservative or inflationary viewpoint. He must also try to free himself from the prejudices of others in his own profession. The forecaster is most effective when he is aware of his prejudices and when he makes every effort to be as objective and detached as possible. Therefore, good judgment is an integral part of the forecasting process.


IV. RELIABILITY OF ECONOMIC FORECASTS

Economic forecasting has changed greatly since the pre-war days. In pre-war days so little information was available that the professional forecaster was handicapped to the point where his forecasts were often as inaccurate as the forecasts of amateur forecasters. Today conditions are quite different. A vast array of information is now obtainable, so the forecaster must be trained to make adequate use of the information. He also must be a statistician and he must be capable of analyzing and interpreting the data. As a result, the nature of forecasts has changed for they are more detailed than they used to be. Some economists also believe that forecasts are more accurate than they formerly were. J.A. Livingston, an American business writer, criticized forecasts produced from 1946 to 1952 as being inaccurate and unreliable, but he stated in 1954 that since 1952, forecasts had become much more accurate. Unfortunately, business forecasts have not been analyzed to the point where a statement can be made concerning their accuracy.

in recent years. We do not know what matters forecasters can most accurately predict, nor what they most conspicuously fail to foresee. We do not know which minor business changes have been predicted accurately, nor which major changes have eluded prediction altogether. Present forecasting skill is judged on the ability to forecast accurately during a period of mild inflation because since World War II, business cycles have been of a minor nature. If major business cycles had occurred during that period, forecasters might have been nearly unanimous in their predictions.

So long as our cycles continue to be of a minor nature, forecasters will not likely agree, therefore we cannot expect to know with certainty what the future of business will be. Consequently, businessmen must be prepared not only to take action based on the forecast but must be prepared also to take alternate action if the forecast proves to be inaccurate. While preparing alternate courses involves additional effort, this action is a desirable form of insurance for the company.

V. SELECTION OF AN ECONOMIC FORECAST

The statement has been made (p. 8) that management must have an economic forecast on which to base the sales forecast. Economic forecasts can be obtained from sources outside the business or they can be developed by the firm's forecaster before he starts the sales forecast. If the sales forecaster plans to use an economic forecast not his own he should look for certain qualities in the forecast. The chosen forecast should be explicit about what is expected, and the underlying assumptions should be clearly stated. Preference should be given to a forecast with good records. There is a greater safety in choosing predictions of forecasters who have been previously successful, avoiding the predictions of those who are given to sensationalism. Those forecasts should be selected in which the forecasters define clearly the degree of confidence that they place in their predictions.

One of the most important reasons for obtaining or making a general economic forecast is to have a

22. Oxenfeldt, Sales Forecasting, p. 16.
firm foundation on which to predict the company's sales volume. The company's sales forecast must be based on the general economic forecast because nearly every company's sales are affected by the condition of general business. There have been instances in the past where some firms have increased their sales during a general economic downswing, while on the other hand some firms' sales have fallen during a general economic upswing. In the first case, the firms' sales would have been even better if business in general had been rising, while in the second case, the firms' sales would have fallen still more if the general economy had been falling.

The great majority of industries show the same general fluctuations as the general economy but at the same time they display individual differences. Changes in business generally affect individual industries in varying degrees and with varying speeds. Therefore management should compare the timing and intensity of changes in its own industry's activity with changes in general business. This relationship will be found to be relatively stable over a period of time.

Because most industries fluctuate in a manner similar to the general economy, the economic forecast is a required first step in preparing a firm's sales forecast. The next step is usually a forecast of the industry's total sales. With this forecast, the firm's future sales can then be projected by employing the share-of-market method.

VI. INDUSTRY FORECASTS

The preparation of the general economic forecast must precede the preparation of the industry or the company forecast. Such basic economic factors as gross national product, personal income, construction activity, and price and production indexes must be related to the individual industry forecast being studied. One of the basic steps in preparing an industry forecast is to compare the movements in the industry with the movements in the general economy in order to understand the past relationships between the two. The knowledge of this relationship enables the forecaster to make use of the economic forecast when developing the industry forecast. An easy way to determine this past relationship is to chart on graph paper the data for the past five or ten years,
so that the relationship, if present between the industry and various economic factors, can be seen. Relationships can be determined by simple visual comparison or by complex statistical techniques.

Management has considerable confidence when dealing with data on industry sales trends, but finds that forecasts on the general economy are difficult to use and of questionable reliability. Therefore if a general economic forecast can be made that is fairly reliable, translating such an estimate into probable industry sales can be managed much more easily.

When the industry forecast is being prepared the factors that determine industry volume must be studied. There is no single correct way to identify and analyze the crucial factors. If the sale of a product is influenced largely by the amount of disposable consumer income available, then it is most important to review the economic forecast of personal disposable income and adjust the expected industry volume for the product accordingly. If the forecast for new construction

indicates a decline, then the potential industry volume of a product employed in the construction industry must be adjusted downward. The influence of competitive products also must be considered when industry volume figures are being determined.

Other factors must be recognized when industry sales forecasts are being developed. National and even international political situations often play a major role in influencing the outlook of certain industries. For instance, anticipated changes in tariffs can influence forecasts in the forestry industry. Technological changes must be considered, for new materials and new machines are constantly being developed, and they can have a profound influence on the market. Prices must be taken into account in the preparation of an industry forecast. If the product is sold to farmers and farm produce prices are expected to drop, the industry will probably be unable to maintain past volume, much less increase the output.


Even weather forecasts can influence the expectations in some industries.

Industry Data

Industry data for use in forecasting can be obtained from a variety of sources. Government departments such as the Dominion Bureau of Statistics and the Department of Trade and Commerce publish and make available for public use a great deal of industry data. Trade Associations collect data on their own industries, and publish some of this information at regular intervals. Unpublished information can often be obtained from these associations. In some instances trade associations are the only available source of data. This information, when broken down into detailed segments by type or size of product as well as by geographical area, can be of particular value.

A company must be critical when using trade association data. Great care must be taken by the individual firm if comparisons are to be made between industry and company data in order to evaluate the relative efficiency of the company. Some members of an industry may not belong to the association so the association

should make an effort to keep itself informed of the total sales of the non-members. Only in this way can the member-firms of the association determine their share of total industry sales.

**Effects of New Materials**

Long-range industry forecasting must take into account new methods, new materials and changes in material acceptance and preferences. An industry may represent a particular material end-use or competitive product but the forecaster should not assume that such a situation will continue unchanged. If an industry sees that competitors are introducing new materials, or that another industry is using new materials that the first industry's competitors may use, that industry should make a complete market study, if necessary, in order to ascertain the advantages of introducing the new material itself.

**VII. COMPANY SALES FORECAST**

The first step in preparing a forecast for the individual firm is to prepare an economic forecast, the second step is to prepare an industry forecast.

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29. Beise, *Sales Forecasting*, p. 27.
and the third step is to prepare the individual company sales forecast. The sales forecast is a statement of the segment of the potential total industry sales that a company can reasonably expect to secure. Many companies have collected industry data on past sales over a period of years. With this information the company realizes what proportion of total industry sales were previously obtained as well as the trend in this proportion. Estimates can then be developed for a future period.

Many factors must be considered in addition to industry data if a satisfactory company sales forecast is to be developed. Consideration must be given to the relative quality of the product, the promotional budget, the efficiency of the sales force, existing plant capacity and measures necessary to increase production. Therefore, the businessman must face the question of what can be done to secure a larger proportion of the total expected sales of the industry, and whether production possibilities are such as to make available the volume of goods needed.


Sometimes no data on past industry sales are available. Companies in this position proceed directly from a general business forecast to a sales forecast. Such companies may make shrewd estimates as to their relative positions in the industry and they may be aware of the influence that a change in general business could have on the industry as a whole and on their companies in particular in which case their sales forecasts may prove quite satisfactory for their needs.

Comparison of General Business Forecast with Sales Forecast

The difference between a general business forecast and a sales forecast should now be clarified. A general business forecast predicts trends in general business activity. These can be trends for the nation as a whole or for a major segment of the economy. A general business forecast is one of the elements utilized in developing a sales forecast. A sales forecast is more limited in scope than a general economic forecast. A sales forecast deals with the sales expectations of an individual company and is used as a guide when management plans future activities as well as when it evaluates the sales that are actually realized.

The sales forecast is considered easier to prepare than a general business forecast. Since the influences affecting future sales are more limited in number than those affecting general business conditions, sales forecasts are likely to be more accurate than economic forecasts. In some situations, especially in the early stages of a sales forecasting program, sales forecasts are fairly inaccurate because of the lack of necessary data or the lack of experience on the part of the forecaster. However, some kind of sales forecast must and will be made, and experience has shown that "forecasts based on an extensive search for, and a study of relevant facts are far more accurate than those which lack such a factual base."

Comparison of Industry Forecast with Sales Forecast

A noticeable difference in accuracy often occurs between sales forecasts and industry forecasts, the latter usually being more accurate. Shifts are constantly occurring of the individual company's competitive shares within the industry volume figure.


34. Crisp, Sales Forecasting, Uses, Techniques and Trends, p. 22.
A large increase in sales by one company in an industry may reduce the volume and competitive shares of all other firms in that industry. Most firms are unable to determine in advance what their competitors' future strategy will be, although this may not apply where there has been a change in competitive strength in the preceding period. A significant price-cut by a competitor or an important new product development by a competitor can lead to a great error in any forecast. In fact, one of the most frequent reasons for errors in sales forecasts can be underestimation of the competition. Thus we see that a sales forecaster must always work with one large, influential, unknown and uncontrollable variable -- competition; and so long as competition cannot be predicted, sales forecasts will not be reliably accurate.

Market Share for Forecasting

We know that the forecaster first predicts total industry sales and then the company's share of the industry market. Industry sales are usually beyond the control of a single company, and are largely the result of vast impersonal economic forces over which the company has little control, unless, of course, that company enjoys a predominant proportion of the total
industry sales. The company does have some control over the percentage of industry volume that it achieves. Past marketing activities, such as pricing, advertising, number of salesmen, and number of outlets affect the present and future percentage, or share-of-market, and variations in these activities will influence future company share. The company's future share-of-market can be changed to an even greater extent by deliberately altering present marketing activities.

Share-of-market concepts of demand are generally useful for forecasting purposes in mature, well-defined industries whose products are relatively homogeneous. In such industries, market shares are relatively stable and in these cases the projection of market shares may be a very useful forecasting device. Conversely, where market shares in the industry fluctuate widely and unevenly, the projection of market shares cannot be used with any confidence.

If market shares change very slowly, it means that strong forces perpetuate the established division


of total industry business. These strong forces may consist of such factors as close personal ties between buyer and seller, or the possession of supplies and repair parts for one brand only. Other factors may be a belief that one particular brand gives a higher trade-in value than any other, or loyalty to a certain brand based on nothing more than familiarity and a desire for security in using what is known and tried. When a purchaser changes his arrangements to adjust to the characteristics of a certain brand, he helps to maintain the established division. When the company's share-of-market is stable, management should not expect to change this share much or quickly. Efforts to do so are almost certain to involve costs that could not be economically justified.

Care must be exercised in using a share-of-market approach to company sales forecasting. If a company is maintaining, or even increasing, its share-of-market, it does not necessarily mean that the company is in as enviable a position as would at first appear, because the total industry sales may be falling.

rapidly. Therefore, the forecaster must know not only the company's share-of-market but the trend of the industry as well.

VIII. SHORT-, MEDIUM- AND LONG-RANGE FORECASTING

We know that forecasts can be made on three levels: the general economic, the industry, and the firm level. Forecasts can also be classified according to time span: the short-term, the intermediate and the long-term. Short, medium and long-range forecasts can be used when developing a general economic, an industry or a company forecast.

The short-term forecast, which predicts no more than two years into the future, enables the company to develop plans reasonably well ahead and thus to adjust more easily to an indicated higher or lower volume of sales. The short-run forecast must take into account such factors as the level of outstanding consumer credit or rapid changes in inventories. This forecast is not particularly concerned with the stock of physical capital or the rate of population growth, because, although they are important, they are not likely to alter sufficiently over a short
period to have much effect on short-run fluctuations.

One of the difficulties in short-range forecasting is the problem of determining when a change is about to take place. Indeed, the forecaster sometimes has difficulty knowing when a change has already occurred. The simplest forecast to make is the one in which the next time period acts in much the same way as the previous period. If business improved during the preceding period, the forecaster appears safe in predicting that business in the next period will improve, for he will be right more often than wrong. He will be wrong only at a turning point. However, one of the most important reasons for making a short-run forecast is to determine when a change is imminent, so a method that does not predict the turning points is of little value. Because this simple type of forecast cannot predict the turning points, it is not used by professional forecasters. They employ more complex techniques which attempt to predict the turning points. If the turning points are predicted, then short-run


40. Meredith, Sales Forecasting, Uses, Techniques and Trends, p. 95.
forecasting provides management with rationally ordered information and a sounder basis for decision making.

The intermediate-range forecast covers approximately two to five years and is a poorly developed area of prediction. The forecaster cannot obtain surveys of consumer and business intentions for this period of time. He cannot project realistically the long-term trends nor is he in a favourable position to evaluate the significance of qualitative factors. If a relatively accurate intermediate-range forecast could be made, an appraisal of this type would be especially valuable in formulating a capital expenditure program and the related financial plan for research and product development. Intermediate forecasts are the proper place to consider the problems of cyclical fluctuations. If this is not done, the forecasts are meaningless. Judgment plays a dominant role in the intermediate-range forecasting. The forecaster must select from all available material those elements in the situation that will be most significant in shaping future business during the next five years, and this is a formidable task.

Long-range forecasts cover a period of five or more years into the future, and are used for the purpose of presenting a rough picture of prospects in the future, a picture that has some empirical foundation. The long-range forecast should point the direction of the most probable outcome of future business activities. Long-range aggregate projections are usually set in a gross national product or gross national expenditure framework. When the direction of future economic activity has been determined, consideration must be given to the size of future industry sales and then to the size of company sales. The knowledge gained from these forecasts assists in determining the need for product development and diversification, for additional channels of distribution and for additions to the staff. A long-range forecast may demonstrate the desirability of preparing for heavy investment in plant and equipment. Long-range projections are made

"1. To provide a basis for making a choice between alternate courses of action when this choice itself will not significantly affect the economic projection and the objective is to adapt internal programs to external economic forces beyond the control of the decision making unit, as in decisions of an individual firm in a competitive market, and
2., to provide a diagnosis of possible future economic development as a basis for decisions which will alter, or can be expected to alter, the course of economic events so as to invalidate the original projection." 42

There are a number of difficulties encountered in long-range forecasting because these projections extend past present economic relationships into the future, and over a period of years the changes that take place can assume major proportions. Many factors must be considered in respect to this time element. As Kuznets pointed out, future economic conditions are determined not only by present economic conditions, but by growth in technology, population and the number of workers, as well as by government changes, institutional habits, international conflicts and exhaustion of natural resources. Thus long-range forecasting becomes an extremely complex operation.


CHAPTER III

DEVELOPMENT OF A SALES FORECAST

The sales forecast plays an important role when management uses the estimates to plan the future course of the organization. When forecasts are made and are reviewed by executives, there is a looking into the future, a thinking into the future and a providing for the future. Forecasting, by concentrating attention on the future assists in bringing to organizational planning a singleness of purpose that cannot be attained easily in any other way. Forecasting also may reveal areas where there is a lack of adequate control and where there is a need for control in order to ensure the efficient operation of the business. Sales forecasting may help to bring unity and co-ordination into plans and so assist in developing this control.

A discussion of sales forecasting should not commence with a consideration of the techniques or methods that will be of greatest assistance in a given situation. A setting is needed for the actual

performance of the sales forecast because there are pre- and post-performance activities and decisions that are just as important as the actual developing of the sales forecast.

I. PLANNING THE SALES FORECAST

The sales forecasting program can be broken down into several stages, the first of which is planning. In this planning or pre-performance stage the firm must decide if a forecast is needed and if a forecast can be attained. The company also must decide if the potential profitability of the predictions warrants developing a forecast. If a forecast is to be developed the company must decide whether the resultant figures will be accepted without alteration, or whether the figures will be raised or lowered. The sales figures to be used in the forecast then must be selected and company policies that are to be adhered to must be decided upon. When these steps have been taken the actual developing of the forecast can begin.

The first step in planning is to decide if a forecast is necessary. This decision rests upon the internal needs of the company. For example, careful
scheduling of operations is necessary for control of production and estimating of future income and expenditures is required for budgeting. If these needs can be met by developing a forecast, the decision is made to go ahead with the other steps of the planning stage.

The step that follows the decision to forecast is that of finding if the forecast is possible to attain. Some businesses are unable to estimate future sales because of some important variable such as the development of new products or government regulations that cannot be determined in advance. Data on past activities in the field may be lacking, without which sales forecasting cannot be undertaken. Management should make sure that a sales forecasting program has a reasonable chance of success before commencing such an undertaking.

Even if the possibility of attainment is reasonably assured, management should attempt to determine if the expense involved justifies continuing with the program. Only when anticipated benefits are expected to outweigh the costs of forecasting.

2. C.M. Crawford, *Sales Forecasting: Methods of Selected Firms*, University of Illinois, 1955, p. 15.
should the program be established. In some firms costs would actually exceed benefits, but many firms that do not forecast only think costs would not be justified; they have not really made a great enough effort to find out.

When the first three steps have been taken and management has decided that a program of sales forecasting is advisable, possible and profitable, the fourth step is taken. This is the selection of the degree of expectancy, because the forecast can be stated and used as a guide on three different levels regardless of the type of forecast developed. This term, degree of expectancy, is not used in a statistical sense, where a forecast may be stated as $1,000,000 plus or minus $100,000, but refers to a statement of the deliberate distortion of the predicted figure. Management may use the figure that is given, or, on occasion, raise or lower the figure. A raised figure provides a goal which the salesmen are urged to strive for. However, even with greater effort this goal may not be reached. A lowered figure provides the financial officers of

3. Crawford, Sales Forecasting, p. 16.
the company with protection in the form of an estimate of minimum sales. This practice of distorting the figure is not common, but some managements find the operation valuable.

The fifth step in planning the sales forecast is to decide which sales figures to select. This is not a simple matter. There is an endless variety of figures that may be used, but sufficient variation can usually be achieved by using six breakdown bases, especially where several bases are used concurrently. These six bases are time period, product unit versus dollars, geographical area, product characteristics, type of customer and channels of distribution. A common combination is a forecast of sales, in dollars, by time periods and by geographical areas. This is done in order to satisfy the needs of sales and finance. Another combination is a forecast by time periods and product units. This is done to satisfy production and allied needs. Usually both of these separate sets of estimates are broken down on the basis of different products. With so many possible combinations, determining which combination will be most beneficial


to the company is a complex problem. The decision is often made by comparing the needs of the various individuals in the company for the information with the cost of the forecasting. Some sales forecasters probably base their decisions on guesswork more often than on knowledge, for measuring the cost or profitability of making sales estimates is a difficult thing to do.

We now come to the sixth step in the planning stage, a step that is too often ignored. An effort should be made to formulate broad company policies that are conducive to successful sales forecasting. The first thing needed is the planning of a general policy of operations. Some companies do not plan such a policy, they merely repeat the same procedure again and again because the tradition has been established. Next, management should provide the sales forecaster with an organizational environment that encourages the interdepartmental flow of information and co-operation. The forecaster should engage actively in trade association programs that provide for an exchange of information. Furthermore the sales forecaster should be informed of the restrictions placed upon him; that is, he should be told whether he is a collector of data, an interpreter, or one who
is completely in charge of the preparation of the forecast. Marketing plans should also be stated before the forecast preparation period commences. The policies just mentioned do not necessarily guarantee accurate forecasts but they will reduce and perhaps eliminate unnecessary mistakes and expenses.

II. QUALITIES OF A USEFUL SALES FORECAST

A sales forecast that is to be useful to top management should possess certain definite qualities. Some of these qualities are discussed in the following paragraphs.

1. The industry or market forecast is an essential part of the total forecast. What is commonly called a sales forecast is really a market forecast plus a sales goal in the expected market that depends upon carrying out successfully a sales plan for acquiring a desirable and feasible segment of the market.

2. The underlying assumptions of the forecast should be stated briefly and precisely. The assumptions

should be concerned with specific future events or developments which cannot or should not, as a matter of policy, be forecast. Assumptions should also deal with developments that would affect the forecast greatly and in a certain specific way if they occurred. These could be a strike, the outbreak of war or a major political development. Although we may not recognize the fact, every forecast contains many assumptions. They should be written down, for doing so often helps to clarify where assumptions end and forecasting begins. Committing the assumptions to paper helps to clarify thinking because the statements must be clear and concise. Management can then check the basic concepts behind the forecast and change an assumption that is unacceptable and the forecaster may alter his forecast accordingly. Another important advantage results from writing down the assumptions. Recalling opinions held in the past is difficult. The only safe way is to write them down. At a later time, differences between assumptions and realities can be studied and an effort made to learn the extent to which any differences between assumptions and

actualities were responsible for differences between forecast and actual results.

3. When the assumptions have been stated, the forecast should be put in authoritative form. A forecast couched in terms of uncertainty is of little help to management. The forecaster may believe that he is safeguarding himself if he avoids making definite statements, but since management is fully aware that in the final analysis the forecast is based on judgment, the forecaster should be decisive, promise only what can really be accomplished and accept responsibility for whatever forecast he makes. After all, management is interested in only one basic fact. Is business going to change, and if so, in what direction and how much? Management does not want the answer clouded with innumerable qualifications.

4. A forecast should not be changed too frequently. At the same time, the forecaster should be ready to revise his forecast when there is a change in basic conditions. Sometimes feelings of optimism or pessimism permeate a business or even a community. A forecast can often be used to counterbalance these emotional

reactions. To be usable, a forecast must be based on fundamental factors which are seldom changed suddenly or frequently, and the forecast should be adhered to so long as those fundamental factors exist. A forecast that is adjusted too frequently is not worthy of the name of forecast, it is just a reflection of the current mental outlook of the business community. If, however, fundamental factors actually do change the forecast must be adjusted accordingly because in fairness to the company the forecaster must use the best and most up-to-date information available. Use of such information means that the forecast will be utilized to the best advantage.

5. A statement should be given of the precise period covered by the forecast. In a short-range forecast the period covered may be obvious, but in a long-range forecast this is not always true. Not only should a statement be made concerning the year or years to which the forecast refers, but the expected position in the business cycle should be assumed and stated. The forecaster must determine whether he is

going to predict on the basis of a normal level, a peak level or a base level.

6. Most managements prefer that details and techniques be omitted from the forecast. The forecasting organization must use all available valid techniques, gather as many facts as possible, go into great detail and use every care, but should consider the techniques as tools to be kept available if management requires them, not as details that must be entered into either the oral or written presentation of the forecast. Should management require information on the details or techniques, a specific request can be made.

7. Forecasts should always be checked against what actually occurred. A good forecaster will always insist on determining the main reasons for significant differences between his forecast and the actual results. This is the only way by which he can make each forecast better than the last. In addition, checking of this kind enables the forecaster to gain some insight into the probable reliability of the


forecasts he is providing.

III. USES OF A SALES FORECAST

The basic management function of any business organization is to co-ordinate sales and production in order to achieve certain profit objectives. These profit objectives are usually allied with sales volume. This makes the sales forecast the basic tool for indicating the future trend of business. If all functions of an enterprise are to co-operate in an effort to attain the decided goal, then all departments concerned should be completely familiar with the future prospects. This can best be accomplished by use of the sales forecast.

The sales forecast can be useful in many ways. The forecast estimates the goods that will be sold during a specific time period. The period may be a short-term or a long-term one. This discussion covers both types unless specific mention is made otherwise. Furthermore, the sales forecast is assumed to be sufficiently accurate to be useful to top management in predicting future operations. Sales forecasts can be used in the planning activities of the production department when plant operations are scheduled,
expansion requirements considered and traffic management detailed. They are useful to the personnel department and to the purchasing department when the latter considers requirements of raw materials and other supplies. The finance department can use the sales forecasts when calculating the cash inflow, the profit position and capital requirements, and the sales department can utilize sales forecasts to adjust to changing trends, to emphasize profit items and to plan advertising and promotion campaigns.

The success of a manufacturing business depends largely upon the co-ordination of two important functions -- production and sales. The production department, therefore, should find a wealth of useful information in the sales forecast, in fact, this department should be able to use the sales forecast as a production schedule.

The extent to which the production department uses the sales forecast depends largely upon the type of business involved. In a job-order shop, an order is necessary for everything produced and the level of plant operations depends upon the backlog of orders, so a sales forecast is not important.
In those larger businesses where demand is cyclical, the firm must know if business will increase or decrease as well as the time and duration of the expected change, so in this case a forecast is essential. Information regarding the depletion of warehouse stock can be obtained from the sales forecast and the necessary steps can be taken to bring this stock up to a proper level. When a firm deals in seasonal goods which have different inventory levels at different seasons and which have different production runs at different seasons, the employment of the sales forecast becomes essential. If the firm has several warehouses throughout the country and several producing plants the complexity of operations emphasizes still further the indispensability of the sales forecast.

The co-ordinating of production with sales is done on a short-term basis but long-term estimates are necessary for other operations. The scheduling of production requires detailed accuracy in a sales forecast that the long-term forecast is usually unable to provide. However, when production capacity is measured against sales demands in determining any required expansion of facilities and in projecting
the competitive situation, the long-term sales forecast is vital. This forecast may indicate that production economies or product improvements are mandatory if the firm's position in the industry is to be maintained.

Another use the production department can make of a sales forecast is in the area of traffic management. Today, transportation costs form a large part of the cost of distributing products. A company that moves a large volume of product finds traffic co-ordination a big problem. If the sales forecast is used by the traffic department as a means of keeping informed concerning sales expectations, the transportation function can be co-ordinated more efficiently with production and sales. These expectations include not only changes in volume but changes in the geographical areas of the market which include consideration of a different type of transportation, as well as changes in destination and other related problems. The most useful sales forecasts are usually those that are broken down into geographical areas.

As levels of operations increase or decrease, so

do personnel requirements and personnel managers are better prepared to meet shifts in demand where they have the use of accurate sales forecasts. A long-term forecast can show the need for additional personnel and indicate the size of the hiring and training programs that may be required in order to reach anticipated objectives. If substantial expansion in the size of a business is planned, the long-term sales forecast is obligatory.

Purchasing departments can make extensive use of sales forecasts. Armed with figures concerning probable sales and production, the purchasing department is better able to maintain stocks of raw materials and supplies adequate for insuring uninterrupted production. Overstocking, with possible loss due to declining prices, deterioration and obsolescence can be minimized and warehousing and carrying costs can be kept under control. A long-range forecast of requirements enables the purchasing department to plan far enough ahead to take advantage of favourable prices, at the same time lessening the danger of over- or under-stocking. These advantages are

increased when markets for raw materials and supplies are unstable. The purchasing department should assist the forecaster by keeping him informed of changes in the price and supply situation of important inputs because such changes would affect the price and thus the demand for the product.

The financial department which supervises the disbursement of money can make use of the sales forecast to determine the expected cash inflow. Every business must know how much money is being received or is expected in order to estimate its operations and this cash flow is fundamentally dependent upon sales. This department also uses the sales forecast to estimate cash requirements and to plan short and long-term financing. The assumed level of production and sales serves as a basis for the development of standard costs and for the preparation of operating budgets. Many companies report that without the assistance of reasonably accurate sales forecasts, their finance departments could not serve the company adequately.


Another responsibility of the finance department is to determine capital requirements and again the department turns to the sales forecast. This information is especially necessary at a time of rapid expansion when long-term plans must be developed in some detail. Cash inflow and expenditures are compared to determine the relative area of profitability, and policy decisions to pay dividends, or to increase or decrease them depend on the profits. All of this information is allied to the sales forecast.

The sales forecasts influence the policy planning of all departments directly concerned with sales. These departments use forecasts in various ways. Policy must be planned in regard to changes in trends when those changes are of major proportions. Sales departments must use long-range forecasts that indicate major changes in trends in order to persuade the company to diversify its products.

When the sales forecast indicates the probable size of the market in the period ahead, the projection provides a goal for the sales force. Frequently, the forecast is broken down into quotas for products, for regions and often for individual salesmen. Salesmen and sales managers will exert themselves to meet

these quotas if they are valid and realistic, which is unlike their attitude towards the "fifteen percent more than last year" method which often discourages salesmen when they see no chance of achievement.

Sales quotas based on the sales forecast are often the foundation of a sales compensation plan. When this approach is used, the past accomplishments of salesmen are ignored and the true potential of each area is measured. Salesmen can then compete for recognition and large incomes upon an equitable basis. Adjustment must be made in regard to those factors which are beyond the salesman's control but which may affect greatly his performance.

Sales forecasts have been useful in indicating if sales territories are properly established. A study of the sales forecasts reveals which territories are too large to be handled adequately by the number of salesmen assigned to them and which cannot provide sufficient volume to guarantee a fair return.

Sales forecasts are helpful when they can be used as a basis for directing the efforts of salesmen. Areas where the company is performing efficiently in

17. Thompson, Forecasting Sales, p. 38.
relation to competition and areas where performance is not satisfactory are revealed by the sales forecasts. With this information, sales executives can direct increased effort to the areas where it is needed. There is no need to increase promotional or sales costs in areas where the company's position is so strong that improvement is unlikely and sometimes promotional and sales costs can be lowered, all of which means increased profits for the company.

Prices are largely dependent upon costs, costs are influenced by volume and volume is affected by price. A company that wishes to establish selling prices and at the same time make a reasonable profit should have an idea of potential sales volume. The prices can be based upon the finance department's standard costs and they in turn can be calculated on an assumed rate of production and this rate may be based on the sales forecast. By following this procedure prices can be set at a profitable level.

There are some products where slight price fluctuations will not have a noticeable effect upon volume and other products where limited changes in the rate of output will have little effect on costs.
But there are other cases where volume is highly sensitive to price changes and where costs are closely allied to volume. Here a reliable sales forecast can be utilized in the setting of prices that will assure a high volume and a reasonable profit.

Sales forecasts are indispensable in the advertising and sales promotion fields. The sales forecast is usually prepared on the basis of the total market and is broken down by employing the share-of-market technique. In most companies, the amount of money spent on sales promotion has a significant effect on total sales realized. For this reason, the advertising and sales promotion departments must be thoroughly familiar with all details of the sales forecast if they are to co-ordinate their efforts with the activities of the sales department. Failure to do this may result in failure to achieve anticipated sales.

Forecasts showing potential markets for new products have been found to be effective tools for aiding management in directing the activities of

18. Dodge, Sales Forecasting -- Uses, Techniques and Trends, p. 85.
industrial research laboratories. Before a company undertakes the expensive processes of creating, developing and distributing a new product, studies are made of estimates of the potential profits to discover if production is advisable. In this way, costly errors can be kept to a minimum.

The sales forecast as initially produced by the sales forecaster can be used only by the sales and production departments. If it is to be used by other departments, something must be added in broad terms to make the forecast of interest to other departments, but each department must make detailed interpretations for itself. This results in the most efficient co-ordination around an accepted projection of future operations.

IV. ORGANIZATION OF A SALES FORECAST

In the planning stage of the sales forecast, many and varied decisions were made. The need for a forecast was decided, the attainability of the forecast was considered, the potential profitability was calculated, the degree of expectancy was settled upon, the figures to use were selected and the
company policies were defined. When this task is completed, management has to consider the second stage of the program. Here, management must specify the type of organization that will be of most use to the forecaster. In the past little attention was given to organizing for sales forecasting, but some companies recognize that consideration must be given to this phase of the task.

There are three aspects to the organizational problem that are attracting the attention of businessmen today. Business executives are considering the advisability of a separate department for sales forecasting and allied activities. They wonder who should be made responsible for forecasting, and to what extent he should be held responsible, and they speculate as to where the forecasting activity should be formally placed in the organizational structure.

In the past, sales forecasting was done most frequently in the sales department, in the accounting department or in the finance department, but today some firms are placing the function in a separate department. Formerly, a person primarily responsible for other duties was given sales forecasting as a
secondary activity. Since the Second World War all managerial aspects of business have been undergoing intensive reconsideration and sales forecasting has received some thought. Most executives in both large and small companies who have studied the situation carefully and weighed the advantages and disadvantages, believe that forecasting should be placed in a separate department whenever possible.

The factors favouring a separate department for sales forecasting can be expressed in terms of general management principles. First, the organization of a company should provide for functional specialization. Sales, production and finance activities are becoming so complex that separate departments are now common for such services as personnel, traffic and sales promotion. This division of labour makes best use of the abilities of each individual, resulting in greater efficiency, and enables each person to develop skill that increases his effectiveness by allowing him to concentrate in a limited field. In addition, persons doing the same kind of work, or all persons whose work requires similar abilities may be grouped


together into a single administrative unit. In such cases, the work of the staff members as well as that of the executive is specialized.

Any activity that is designed to serve as a check on another activity should be under the control of a separate executive. Since sales forecasts provide a means of determining the efficiency of many activities within the firm, forecasting should occupy an independent position. Top management naturally compares actual results with estimated results at the end of the forecasted period. Discrepancies call for an explanation. The closer the actual results are to the forecast, the less likely will a line executive be called on to explain the discrepancy. If the forecaster is not independent from line executives he may feel compelled to alter his forecast so that the estimates will be more in line with the actual results achieved by the line executives. To avoid this situation, forecasting should be placed in an independent department.

If a certain activity is particularly important to the success of a company, that activity deserves

special recognition. Businessmen are realizing to an ever increasing degree that careful organizational planning is absolutely necessary, and because sales forecasts are an integral part of this planning, forecasting is becoming an indispensable operation. For this reason the status of forecasting should be considered. When a forecaster occupies a position of low status in the organization he will be unable to get the co-operation of executives in higher positions. The greater the prestige the company wishes forecasting to have, the higher in the formal structure should the activity be placed. Only in this way can the forecaster obtain the co-operation the company feels he should receive.

Forecasting is so important to the success of a company that adequate attention should be given to the function. If a highly placed executive is responsible for forecasting in addition to his other duties he cannot give top priority to all his tasks and he may even neglect one or more of them. Forecasting may be one of the duties neglected. If the activity is the only or primary responsibility of

an executive, that person at least will bestow upon forecasting the necessary attention.

Because a forecaster is concerned with the total operation of his company he should have a general knowledge of the activities of the company rather than of one special department, and he should be aware of opinions concerning the company and industry both inside and outside the firm. Different departments within the organization have different goals, different ideas and different tasks as well as varying degrees of optimism concerning the industry's outlook. Persons outside the firm also express diverse opinions regarding the future business outlook. From an appraisal of these diverse opinions, the forecaster must evolve a set of estimates that will serve as a basis for all departments, and for this task he is best equipped if he is not involved with the affairs of one special department.

One of the axioms of present day management is that in this day of highly specialized functions one individual should be responsible and have authority for one function. Where there is responsibility there must be authority and for every task that is
undertaken authority must rest on someone. Authority gives an executive power to undertake assigned duties and responsibility demands that he use this authority to accomplish them. The forecaster, unfortunately, finds that this concept does not always apply to him. Some firms define the responsibilities and authority of the forecaster precisely, stating what should be done and by whom, but many firms include so many persons in the forecasting activity that responsibility and authority cannot be centered in any one individual. The firms that have stated clearly what sales forecasting should include and have allotted the responsibilities and authorities carefully are generally those firms which place the function in a separate department.

Despite the advantages of placing forecasting in a separate department, there are circumstances where this may not be desirable. In the first place, there must be assurance of full time work for the forecaster. In some companies forecasting does not require full time application so the function is added to a person such as marketing research director or

sales manager. In a few firms the marketing research department has been raised to staff capacity at the top management level and has been made responsible for several areas of business research including sales forecasting. Where there is such an arrangement, forecasting is a logical function of such a department.

Expense must be considered when there is a separate department for sales forecasting. The creation and maintenance of a separate department costs money. More office space is usually required, more executives and secretarial help are needed and additional services usually must be provided. When a choice is to be made between departmentalizing and not departmentalizing one of the factors to consider is the number of executives and staff personnel required and their respective salaries. If the less expensive arrangement is also the less effective one it may not be the better choice, but if the more costly arrangement is chosen the additional benefits should very clearly exceed the additional expense.

The expense involved may provide the major reason why a separate department is not established for

forecasting. In setting up a separate sales forecasting department management may be able to determine, with some degree of accuracy, the financial benefits to be realized. Unfortunately, the burden of additional red tape and inflexibility which should be included as part of the expense is almost impossible to measure in financial terms. One of the most difficult decisions of management is to determine to what extent the enterprise is justified in setting up a more elaborate and specialized form of organization.

Departmentalization is known to increase the complexity of a firm's organization, which in turn adds to the difficulty of maintaining clear-cut lines of authority and responsibility. The whole problem of organizational complexity is a difficult one to deal with, but the problem is there with sales forecasting as with other functions.

Finally, we must note that basic organizational principles cannot be applied indiscriminately to all firms. Some companies have proved that a separate sales forecasting department is successful. Others

may not have the necessary talent at their disposal to handle such a department and buying talent for a high executive position may cause widespread dissatisfaction throughout the firm. On the other hand, some men already in the firm may have the necessary talent to supervise sales forecasting in addition to some or all of their other duties. Generalizations assume away the peculiarities of company personnel, but the operating executive must take them into account.

V. RESPONSIBILITY FOR SALES FORECASTING.

Whether forecasting is done in a separate department or not the responsibilities entailed should be carefully stated and assigned. In forecasting, as in most jobs, only one person should have over-all responsibility for the work, and the extent to which he is responsible should be clearly stated. There are several reasons why this should be done but the main reason is that someone must be held accountable, not only because the job of forecasting must be done, but because it must be done on schedule and also because the task involves co-ordinating the activities of various members of the firm. When responsibility is not fixed, the burden of co-ordination falls on a busy top executive.
When responsibility for forecasting is to be placed in an individual, there is general agreement among forecasters concerning which executive officers would be suitable, but there is no such agreement concerning the placing of responsibility for the final estimates. The officers usually considered for the position are the sales manager, the controller, the marketing research director and the head of a separate sales forecasting department or top-level research unit. Most forecasters agree that any of these individuals could do the job if his responsibilities were clearly defined and if top management valued the function.

There is little agreement, however, on exactly what responsibilities should be included in sales forecasting. The following tasks are generally considered necessary: the forecasts should be prepared, they should be distributed to the people concerned, they should be studied carefully to insure the highest degree of accuracy possible and they should be altered if and when necessary. There is agreement on the fact that someone should be responsible for


continuously studying all sales forecasting arrangements with a view to improving them if possible, as well as agreement on the fact that some conclusion must be reached concerning the extent to which the forecaster will be blamed for errors in the final estimates. However, identifying the causes of errors is not easily done.

Errors may be due to a lack of data, to uncontrollable variables or to poor judgment, and as a result management may be unable to pin-point responsibility. To make the situation more difficult the forecaster usually has to engage the assistance of other executives to help prepare the forecasts or to approve them, and some of the errors may be partly due to them. Forecasters generally agree that they should be held accountable for errors due to their own poor judgment, but agreement probably never will be reached on the question of how much responsibility should be attached to the senior executive who places his stamp of approval on the forecast prepared by a subordinate.

Once the responsibilities for sales forecasting have been determined, management can proceed to study the problem of where to place the activity on the organization chart. Several possibilities are avail-
able. The first of these is found in many medium-sized companies where an individual or a department is responsible for marketing research activities including the development of periodic sales forecasts. In many small firms the sales manager or a senior executive is held accountable for sales forecasting.

The second method is to set up a business research department directly accountable to the executive vice-president and the sales forecasting would then be one of the responsibilities of this department.

A third alternative is a complex development of the second. Production planning and sales planning departments are set up and their heads report to the executive in charge of operations planning and research. This executive has an advisory staff relationship to the executive vice-president. This arrangement is desirable when the planning activities of the executive vice-president are so important to the success of the firm that adjustments are made in the organizational structure to enable him to receive every assistance with his co-ordinating and

organizational activities. The production and sales planning departments provide the information necessary for intelligent planning and effective co-ordinating by the executive vice-president as well as by other executives. The sales forecast is an example of the type of information that can be provided by the sales planning department.

VI. PERFORMANCE STAGE

With the completion of the first two stages in the forecasting program, planning and organizing, the third stage is embarked upon. This stage, which we shall call the performance stage, can be broken down into a series of steps that differ but little from steps followed in performing other management activities.

The first step in the performance stage is choosing the individual who will direct the forecasting procedure. He should possess certain general qualifications. One of these is sound judgment, for he must be capable of evaluating the significance of changes; another is a knowledge of general business conditions and another is the capacity to

command the respect of the senior executives. He should also be familiar with basic modern business statistics. Management does not know precisely which qualities and how much knowledge the forecaster needs to be successful, so it is not surprising that various management have widely different opinions regarding the qualifications that they consider desirable in a forecaster.

Making the forecast is the second performance step. This includes such activities as delegating duties, scheduling activities, collecting and analyzing the data and then stating the final forecast. The completed forecast is usually forwarded to senior executives for appraisal and acceptance or rejection. The techniques that can be used to develop the forecast are described in the following chapter.
CHAPTER IV

METHODS OF SALES FORECASTING

The most difficult and most important aspect of sales forecasting is deciding which technique to use. There are innumerable techniques to choose from and forecasters have different opinions concerning the merits of the various methods. Even today new techniques and adaptations of old techniques are constantly being developed.

The methods employed by forecasters are difficult to describe in general terms because forecasters adjust the techniques to suit the particular features of the situations confronting them. Techniques can, however, be classified arbitrarily as follows:

1. those based mainly on personal judgment, 2. those based on surveys and 3. those based on statistical methods.

No technique has yet been devised that does not require the use of some degree of personal judgment and there is little likelihood that a technique in which judgment plays no part will ever be found. Although all forecasting commences on a judgment basis the forecaster uses various techniques in an effort
to reduce his dependence on arbitrary judgment, and if this is not possible, at least to enhance the quality of his judgment in order to increase the accuracy of his forecast.

I. HAZARDS OF FORECASTING

The degree of accuracy attained and the types of problems encountered in forecasting vary from product to product, from company to company and from industry to industry, but there probably is no area where problems are so insurmountable or accuracy is so unattainable that forecasting of sales is absolutely impossible. Problems that contribute to the difficulties of accurate forecasting arise in various ways.

The extent to which accuracy can vary is usually related to the per unit cost of the product. If a single unit costs several hundred thousand dollars the accuracy of the forecast can depend on obtaining or losing one order. On the other hand the sale of a mass-produced product costing only a few dollars can vary by a few thousand units and the forecast would not be unduly affected.

The forecasting of company sales is easiest and most accurate when consumption is rapid and purchasing is regular. If the purchase of a product can be deferred the forecasting task becomes difficult, and the longer the purchase can be deferred the more difficult the estimating becomes. When there is a possibility that consumers will turn to substitute products the same problem arises.

The very factors that increase the hazards and limit the accuracy of forecasting are the same factors that make forecasting essential. The presence of a noticeable time interval between the purchase of the raw material and the sale of the finished goods to the consumer increases the difficulties of forecasting but also increases the value of forecasting to manufacturers, wholesalers and retailers who produce, stock and sell products in anticipation of consumer demands.

II. SALES FORECASTER

When one individual is placed in charge of sales forecasting and is given some independence in his position, he finds that the position carries with it

2. Thompson, *Forecasting Sales*, p. 2.
certain advantages and disadvantages. He will have a comprehensive view of the company as a whole so he will not make the mistake of emphasizing the problems in one area and ignoring the problems in another. He may find it easier to get information from the various departments than do other executives, and through experience he may do a better job of analyzing and interpreting data than would an executive who had other duties in addition to forecasting. Having one person in charge of forecasting is inexpensive, usually fast, and avoids interrupting the work of others.

Weaknesses in the forecaster's position are apparent if the forecaster alters his judgment to more nearly conform with the sales objectives that he knows others hold. His position is a weak one if he lacks status in the company or if he lacks the experience necessary to evaluate the effectiveness of his company's planned operations.

The forecaster should be capable not only of making good forecasts but of enlisting the confidence and co-operation of the company's executives.

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3, E.W. Grunow, "The Role of Consulting Services in Forecasting" in Materials and Methods of Sales Forecasting, American Management Association, no. 27, p. 58.
because the information, advice and judgment they contribute to the forecast may have much to do with the successful conclusion of the program.

When a sales forecaster is a staff specialist he usually reports to the senior sales executive or to the executive vice-president, and is thus given an excellent opportunity to add the judgment of this executive to his own. Other senior executives can be called upon to evaluate the estimates of the forecaster, or a committee may be formed of as many as ten executives who meet to evaluate the forecaster's estimates. When estimates are being made general economic expectations or anticipated behaviour in major segments of the economy may also be taken into account. The firm's own sales executives are often consulted concerning the effectiveness of planned marketing activities.

III. TECHNIQUES BASED PRINCIPALLY ON PERSONAL JUDGMENT

Sales forecasting techniques cannot be expressed in general terms because they are so numerous and because they are adapted to varying situations. An

4. Thompson, *Forecasting Sales*, p. 3.
arbitrary classification can be made because they do have certain features in common. The first such classification covers techniques based principally on personal judgment. There are several ways to define "judgment", but here the word is used to designate a mental procedure in which values and probabilities that are known are welded into a reasonable conclusion about the unknown. Judgment, therefore, is more than a guess and more than an opinion. Not all judgment, however, is good judgment.

Various individuals both inside and outside the company may be asked to give the sales forecasting program the benefit of their consideration. The individuals in the firm that the forecaster is most likely to call upon for opinions are senior executives, usually the president, the executive vice-president, and the top sales, production and finance executives, as well as executives in the advertising and promotion, credit, budgeting, product development, and marketing research departments, depending upon the type of information he is seeking. Another internal source

of judgment is the sales organization which includes both the salesmen in the field and their immediate supervisors. Opinions can also be obtained from sources outside the firms such as consultants, suppliers, personal friends and even competitors.

The individuals whose opinions are sought may be asked to estimate industry sales, company sales, or sales of a line or sales of a single product. Usually opinions are sought first on matters at the industry level, often on a product-by-product basis, and after that at a company level, on a share-of-market basis.

**Jury of Executive Opinion.**

A group of top executives may be formed into a committee either to pass judgment on the forecaster's predictions or to prepare forecasts themselves. Such a committee is said to constitute a "jury of executive opinion." This polling of the opinions of executives is one of the oldest and simplest means of forecasting industry and company sales and is based on a belief in "safety-in-numbers". A forecast based on the combined judgment of several executives

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is assumed to be superior to a forecast based on the judgment of only one.

Some companies ask the members of their executive committees to prepare individual estimates of sales and hand them to the president, who makes a final forecast based on the opinions expressed or on a statistical average of the estimates. The forecast is sometimes more accurate when the president evaluates the estimates than when he averages them because he learns by experience which men are usually more accurate than others and he can give the estimates of the more accurate ones greater consideration. In some firms the sales and marketing research departments prepare independent sales forecasts. These predictions are then considered by a jury consisting of the president, comptroller, the sales manager and the advertising and market research directors. Discussions are held for days or even weeks until a figure is reached upon which all agree.

The executive polling approach has been reasonably successful in the companies where projections

develop from a study and analysis of market reports, sales reports and business expectations. Many companies now assist their juries by supplying them with a quantity of factual background material which helps the members to understand past events and to convert their opinions about future trends into predictions of future sales. Use of this factual material means that forecasts are based on more than judgment, so a more accurate evaluation can be obtained concerning the factors that affect sales.

Although details may vary, the development of a sales forecast usually proceeds along similar lines. First the forecaster, a committee, or an outside consultant decides upon the direction the economy is expected to take during the forecast period. Whether the expected conditions are presented in broad outline or in detailed statements they are accepted as the firm's assumptions. Past and present conditions in the industry and the company are then studied and important trends are emphasized. Taking into consideration all the facts available and judging their respective importance, the forecaster then projects these trends into the future.

8. Thompson, Forecasting Sales, p. 4.
At this point the jury of executive opinion is brought into the picture. The jury can place its stamp of approval on the estimates, can question the thinking behind the forecast or can add specialized knowledge that has been gained by experience in the firm:

There are several advantages to be gained when the forecaster utilizes the judgment of other executives in the firm. The most important is the pooling of the knowledge of specialists, because one man cannot be an expert in all phases of the past, present, and future operations of the company. The specialized information in itself is not as significant as the judgment of the individuals with the specialized knowledge. For example, the sales manager can assist the forecaster by informing him that channels of distribution are undergoing rapid changes, and he can be of even greater help if he can evaluate the effects of the changes in distribution channels on industry sales and on the company's share of these sales. This method has the further advantage of

bringing diverse opinions together for consideration, which encourages consideration of all facets of the problem. Because senior executives always think in terms of the future they apply themselves to its problems in a more realistic and logical manner than do salesmen, customers and others.

Another advantage of this technique lies in the ease and speed with which it can be employed. One reason for this is that the forecaster does not have to be an expert in the use of surveys or statistical procedures, and another reason is that discussing and judging are normal human activities that can be done easily and quickly in the forecasting activity if the executives are available, if they are willing to co-operate, and if only a limited number of sales figures are being forecast.

The method is also conducive to high morale because the executives participate, or at least are consulted, in the development of the forecast. This participation also helps to secure their co-operation in following through on the plans.

Although the advantages of the executive polling method are numerous and important some weaknesses are apparent. One objection is that personal opinion plays too strong a role. In fact, the method can degenerate sometimes into group guessing. Furthermore, one strong personality may dominate the proceedings. These disadvantages can be minimized if there is a good supply of facts, executives with experience and a forecaster who has the ability and authority to reject certain opinions. Another disadvantage is the expense to the company if executives spend a good deal of time at meetings, and even if they do not give the matter excessive time, work schedules are disrupted to a certain degree.

A further disadvantage of the method is that once the final forecast has been developed, the executives must proceed to break down the estimate into seasonal and individual product forecasts so that production, purchasing, sales and finance plans can be made. One solution to this major stumbling block is to use past records as a basis for breaking down the forecast. But this is not very satisfactory unless conditions remain unchanged and this is most

11. Thompson, Forecasting Sales, p. 4.
unlikely. However, to produce a forecast for each individual item by the jury method would be an endless task in companies with a number of lines. As a result, companies often use past experience as a basis for breaking down the forecast into seasonal and individual item figures and accept the fact that there will be a number of sizeable errors.

**Sales Force Composite Method**

Many firms go beyond the executive level and obtain the assistance of their salesmen in planning probable future sales. This is called the "sales force composite method." There are widely differing opinions concerning the efficacy of this method, but since no published study of the system is available an accurate appraisal cannot be made.

In the sales force composite method each salesman is informed of the estimates required from him. He is told the period the forecast will cover, the products that must be included, the extent to which customers' opinions are to be used, the method to be used in collecting the information and the time period during which the information is to be gathered.
This process of collecting estimates from each salesman on the probable future sales for his territory is known as the "grass roots" approach. Sometimes the salesman makes estimates on his own on forms provided for the purpose, and sometimes he makes them after consulting with the branch or regional manager. The latter method is preferable because the sales manager has an opportunity to become familiar with the salesman's reasons for his estimates, so the manager can modify whatever he believes is out of line. This approach is, unfortunately, a heavy drain on the manager's time.

Companies have found that they receive more accurate reports when salesmen have been supplied with a record of past sales. These past sales figures may be supplied in various forms such as special charts or statistical analyses of the variations of past sales. The salesmen then have basic figures which they can increase or decrease, so their efforts are concentrated on these changes.

When the salesmen have handed in their estimates the results are accumulated for the district

or region and sent to the central office where they are studied and analyzed, and are then incorporated into a single all-inclusive forecast which usually provides estimates of demand by territories, regions and products.

As the forecast progresses through the organization from salesman to the top sales management group, the estimates are carefully inspected. Each district manager examines his salesmen's estimates and also compares the total for the district with past performances and with his own estimates of future sales. Divisional managers and senior sales managers also scrutinize the forecast and make whatever changes their judgment demands. Frequently a head office group, usually the market or economic department or the treasurer's office, makes an independent forecast which is based on figures not normally available to the salesmen. These estimates act as a cross-check on the composite forecast formed from the salesmen's estimates. The causes of major differences between the two forecasts are carefully

13. H. Holmes, "The Role of the Field Sales Force", in Materials and Methods of Sales Forecasting, American Management Association, no. 27, p. 206.
investigated before a final forecast is made. These differences are often attributable to the fact that the head office can influence eventual performance greatly by controlling the amount spent on advertising and promotion, by regulating production and by endeavoring to enter or abandon certain markets.

Because a great deal of time can be spent developing a forecast by the sales force composite method, the forecast is usually done on an annual basis. There have been occasions, however, when the estimates have been developed semi-annually, quarterly and even weekly.

One of the main reasons for using this method in forecasting is to profit from the knowledge the salesmen possess of local conditions. Unlike the senior executives who may be a thousand or more miles away, the salesmen have ample opportunity to become familiar with the economic features of their territories. Top executives are provided with all the current relevant data that can be obtained, but the sales force composite method gives them the advantage of judgment developed at the customer level.

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The localized knowledge of salesmen may not always be a great asset, however. A great deal depends on the ability of the salesman to acquire and interpret local facts, as well as on the significance of the local information to the company’s sales. Also the type of information required by the company may be obtained from sources other than the customer, for published articles now provide a great deal of authoritative data on small areas.

The popularity of the sales force composite method is due largely to the fact that most of the responsibility for forecasting appears to rest upon those who must meet the accepted goals. This method develops greater confidence in the salesmen and sales executives than any other. When these men know how the sales estimates are calculated they are likely to accept them in an attitude of cooperation. When the estimates are developed in a manner they do not understand the men regard them distrustfully, especially if they believe the quotas are too high. Attention should be drawn to the fact that the salesmen’s estimates may undergo considerable

15. Holmes, Materials and Methods of Sales Forecasting, p. 205.
revision, so the responsibility is really not all theirs. Furthermore, the implication that the salesman is the one responsible for sales seems open to question. His efforts in his territory are only a part of the efforts of the company as a whole.

The sales force composite method is said to give geographical and product breakdowns that are more accurate than those calculated in the home office. No evidence seems to be available to justify this assertion, for records show that both types of breakdown have been developed without consulting salesmen.

A final advantage claimed for this technique is the simplicity of operation and the fact that detailed forecasts can be developed easily. If forecasts are required for establishing quotas and developing production schedules this method simplifies the procedure, for as the company grows subtotals are obtained for salesmen, territories, regions and products. Other methods require considerably more work to break down total company estimates into


subtotals for operating purposes.

There are a number of disadvantages associated with the sales force composite method that should be considered. First, the method is slow. Several weeks are required for making the estimates, having them checked and sending the composite forecast through the various levels for examination. Furthermore, the amount of time spent at each level makes the technique expensive.

A more vital problem is the ability of the salesmen to forecast accurately, and not every salesman has this ability. Sometimes they err badly. If a salesman does not have enough time to gather sufficient information he may resort to guessing. Again a salesman may have the best of intentions but be unable to forecast. The salesman who is to make forecasts should be more than a taker of orders, he should be capable of utilizing knowledge that the home office cannot obtain, and he should know which information is relevant to the developing of accurate sales forecasts. Furthermore, he should have a clear understanding of the

market forces at work in his territory, and have frequent contact with people whose positions enable them to have an understanding of the economic forces that are shaping the future. Not every salesman has these attributes.

The high cost of the sales force composite method is this technique's greatest weakness. Since forecasters are always comparing the expense as well as the accuracy of forecasting techniques, an examination of this method will encourage forecasters to consider other approaches. They will probably select this one only for some outstanding reason.

There are two facts that must be borne in mind by companies using this method. First, the home office should make sure that someone is responsible for keeping a record of all forecasts made, with special reference to their accuracy. The sales force composite method should be compared with other methods and used only when superiority is assured. Second, the forecasts produced by this technique must not be used as over-all sales "goals". If they are, appraisals are meaningless.

Area Sales Manager Composite

Efforts have been made to overcome the disadvantages of the sales force composite method while retaining the advantages. The method used with this in mind is the area sales manager composite, and gives the responsibility of making estimates to area sales managers instead of to salesmen. This approach works well in a firm where the branch managers travel extensively with the salesmen, for the managers become familiar with the conditions in the territories and with the needs of the customers. Sales managers usually forecast competently, for they are not as emotionally biased as the salesmen when future sales are anticipated. Salesmen are personally involved in the gain or loss of orders and tend to become optimistic or pessimistic according to their recent personal successes or failures. Sales managers can view the whole territory under them and can take a more detached view of the fluctuations in sales of individual salesmen and therefore are able to discern the trend of sales with greater accuracy. Sales managers are faster in making up the estimates and forwarding them to the head office, partly because they
have a stronger feeling of responsibility to head office and partly because they realize the importance of having a forecast that is accurate. When a sales manager is appointed to his position one of the factors taken into consideration is his judgment. As a result he should be more capable than a salesman of interpreting the significance of local sales conditions in the area.

One aspect of the area sales manager composite method has a definite advantage over the sales force composite method. The task of instructing salesmen about the detailed plans of management for the coming period is a difficult one, but if the salesmen do not know what those plans are they cannot provide a satisfactory forecast. The area sales manager has knowledge both of management's plans and of local conditions and, therefore, he is in a good position to weigh factors in both spheres.

One final advantage of this method is the cost. The forecaster can maintain contact with a smaller number of managers less expensively than he can with a greater number of salesmen.

Use of Persons Outside the Firm

The use of persons outside the firm cannot be called a technique in itself because these people are seldom able to consider the whole program planned by the company and are unable to derive a final sales projection. However, consultants are often brought into a firm to assist in various ways, of which three seem most common. These consultants make projections of general business conditions, they make estimates of industry sales and they assist in solving particularly difficult problems such as the expected sales for a new product or a major change in distribution channels. Only occasionally does a consultant assume almost complete responsibility for the sales forecast of an individual firm.

When a firm wishes to have a general business forecast developed extensive benefits can be derived by hiring a consultant. The economic forecast can be presented when it is needed, the forecast will not be biased, the procedure used by the consultant can be checked, the basic data used in making the forecast can be evaluated, and the time period and area of interest in the economic estimates can be detailed to satisfy special needs.
Although using consultants for developing economic forecasts has several advantages, using consultants for making industry or company forecasts is not so desirable. A better job is usually done if a full-time staff is maintained to develop industry and company projections because specialized knowledge of the industry or company is usually needed. On the other hand there are many situations where only a consultant can acquire and analyze the necessary data. A consultant, however, is expensive, so a firm should not hire one unless his service is necessary.

Competitors sometimes prove useful in a limited way. Sometimes a forecaster can make use of the judgment of a friend in a competing firm, but this is not common practice. More information can be gathered through a trade association. Here the information is usually limited to past sales data and general information. A few trade associations have been able to persuade members to exchange forecasts of industry sales. Of the "outside" group, suppliers are least helpful and are of aid largely to wholesalers and retailers.

2. Grunow, Materials and Methods of Sales Forecasting, p. 60.
IV. TECHNIQUES BASED ON SURVEYS

The second classification covers techniques based on surveys. This device is used in an endeavor to acquire accurate forecasts by taking surveys of customer opinion by personal interviews. When this method is used customers are asked what they plan to buy in the near future. If all of the customers cannot be consulted the information may be obtained by sampling or by turning to the few who provide the major portion of the market. These surveys may be taken for the industry or for the individual firm.

The individual company may take a survey of actual or potential customers on a sample basis or by trying to reach every customer, but the results cannot be relied on. The information may be inaccurate for various reasons. If the customers purchase their products from more than one source they may tell the poll-taker what they expect their total requirements to be rather than what portion of their needs they expect to purchase from the company making the survey. The condition of the market will also influence the customer. If a product is

expected to be in short supply the customer may magnify his requirements to the poll-taker, believing that rationing on the part of the supplier will give him the quantity he really wants.

Surveys on the industry level have been conducted by government organizations, trade associations and publishing companies but the information has been of limited use to sales forecasters. Some trade associations have taken annual surveys and used them as a basis for issuing annual forecasts. The Survey Research Centre of the University of Michigan has done a good deal of survey work concerning consumer financing with special emphasis on durables and housing.

When the customers are industrial producers the survey method puts the forecasting burden on the customers and the sellers' chore is to persuade his buyers to confide in him their purchase or production plans and then to know what allowances to make for errors in their replies. If a buyer gives an honest estimate of his needs he assists the seller in making more accurate predictions provided he has

some basis for estimating his own requirements. A buyer may base his estimates of future purchases on the present price structure and his present level of inventory. However, if a change should occur in the price structure of the goods he purchases, the buyer may decide to deviate from his planned inventory position. As a result, the seller to industrial producers must modify the buyer's estimates in keeping with short-run price movements.

Data based on consumer opinions can be helpful in predicting sales. However, use of these data should be tempered with recognition of their limitations. The predictive record of consumer opinion data has been one of both successes and failures. Successes have been achieved in predicting the general direction of total consumer durable goods sales and in predicting the direction of sales of large durable purchases. Past failures of these data have been: failure to indicate most of the rises and falls in consumer durable goods sales, limited success in predicting accurately the direction of appliance

sales, and a general lack of success in predicting the volume of durable goods sales. Analysis of basic economic factors in combination with consumer opinion data has been shown to improve significantly the accuracy of the forecasting record.

Adoption of the survey technique in sales forecasting has not been widespread. The advantages and disadvantages to be discussed from a practical point of view should shed some light on this lack of acceptance, but let us first examine the method from a theoretical viewpoint. Theoretically, the surveys assume a good deal. They assume that customers can foresee the future, know what conditions will be for them and how they will react to those conditions. They further assume that customers plan their purchases well in advance, even determining the specific product they will select and the price they will pay. They also assume that what a customer desires to buy he can afford to buy. In addition they assume that consumers will report truthfully and thoroughly to the interviewer, and also that if the consumer expects to maintain his economic status he will do so. Because these assumptions

will rarely be met the theoretical basis for forecasts is weak.

From the practical standpoint, however, there are advantages. The idea of considering the intentions of buyers is logical enough. Many industrial products, for instance, are bought in large amounts at infrequent intervals so buyers make estimates during long planning periods. These buyers can supply fairly accurate information for the survey interviewer. Sometimes information can be quite useful even when it does not lead directly to a sales forecast, such as the information that a customer plans to obtain his goods from a different source. If the surveys are being made for other purposes, questions on buying intentions can be inserted at little extra cost.

There are various disadvantages to be found in this method. When a survey is being prepared for householders every effort is made to word the questions so that the customers being queried can be exact in their replies. The questions are confined to certain products and are stated in precise terms. Unfortunately many customers are not capable

of estimating to what extent future happenings will have a bearing on their purchasing and they do not always give answers that are complete. When a comparison is made at the end of the year between the buying plans that were indicated in the surveys and the buying actually done discrepancies are great enough to prevent a great deal of faith in this kind of forecasting. When planned expenditures are compared with actual expenditures for various years the direction of the year-to-year changes do not correspond always with actual changes for durable goods and houses. One reason for failure to receive more correct information by survey is that a year is a long time for a consumer to look into the future and most consumers adapt buying plans readily to changes in their economic condition or to other changes in the home. Even a reaction to a change in prices may not be foreseen easily. Sometimes consumers will refrain from buying for a short time, thus instituting a buyer's strike, and sometimes they are so anxious to acquire goods they will ignore the price change and purchase as planned. Another disadvantage that is always present in

survey forecasting is the difficulty of distinguishing between actual plans and wishful thinking. After all, wishful thinking enters into a good many plans of everyone. Then, too, an interviewer presents the customer with two choices, to buy or not to buy, but later when the customer is ready to make the purchase he finds there are many alternative ways of spending his money.

When sampling is carried out by personal interview it is one of the most expensive methods of forecasting the sale of consumer goods. Some people believe that the cost of sampling is trivial compared with the profits that may be realized but few small consumer goods companies will go to the expense of this method when there are other methods that are far less costly and when results from the survey method are not necessarily satisfactory.

There are various factors which tend to decrease or increase the time required to complete a forecast based on the survey method. The required time is decreased because prior information is seldom

required for the forecast, whereas when correlation techniques or methods using national income data are used time must be spent estimating the independent variables or the individual components of income. At the same time, the survey method is slowed down because of the extended period required to collect the data, especially if the collecting is done by mail.

The survey approach can be very successful if an industrial product such as heavy machinery is sold by the manufacturer directly to the user. Here the salesmen can interview the customers when they make their calls so the sampling is relatively inexpensive. This advantage does not apply when the industrial products are not sold directly to the ultimate users.

A sample survey may stand the best chance of succeeding when it forecasts the sale of items in two categories. The first type is a good that is bought after the purchase has been carefully considered and planned for, so the interviewer learns when the purchase is likely to be made and the character-

istics desired in the product to be bought. The second type is a good purchased often and with little thought, the sales of which are known to be related to such factors as income or the number of families. However, few products show a consistent or dependable relation to either of these factors.

The sampling method may increase in accuracy with the size of the expenditure involved and decrease with the frequency of the purchase. The latter indicates the reliability with which information can be obtained regarding purchases made in the past, but its validity for predicting behavior in the future has not been established. The shorter the interval before the forecast is desired, the more accurate is a sales forecast based on sampling likely to be. Short intervals provide less time for new developments which might change the plans people previously made or alter movements of business activity. The accuracy of a sample-based sales forecast is not necessarily inversely related to the length of time covered by the forecast. This is especially true where the direct

approach is used. Up to a certain point the increase in the period covered by the forecast may allow time for previously stated plans to become effective. Beyond that period, however, the increasing number of purchases represented by plans and developments made after the sample date will more than nullify advantages gained from extending the period.

Surveys of buying intentions rest upon the assumption that future conduct depends partly on the people's present beliefs and plans concerning the future. To the extent that present plans are only a partial basis for future conduct, and to the extent that expected conditions which form the groundwork for those plans fail to materialize and so change future conduct, the survey will be inaccurate as a forecasting tool.

V. TECHNIQUES BASED ON STATISTICAL METHODS

The most popular means of supplementing personal judgment in order to increase the accuracy of sales forecasting is to use methods of statistical

correlation. This is done by noting the relationships and movements in a company's or industry's sales and then measuring them statistically and projecting them. The purpose of the correlation approach is to find a mathematical equation called an "estimating equation", "predicting equation" or "regression equation" which best shows the relationship between a dependent variable and one or more independent variables. If we take the sale of automobiles as our dependent variable, and income, number of families, replacement rates and so on as our dependent variables we may predict variations in the sale of automobiles on the basis of variations in the selected independent variables. Such factors are chosen because, on the basis of knowledge and logic they are considered to be the controlling ones. The statistical analysis is called simple correlation when only one independent variable is used, but is known as multiple correlation if two or more independent variables are involved. In correlation analysis the regression equation that ultimately arises expresses the change in one series of data which tends to occur with a given change in one or more independent series of data. The relationships in correlation analysis may be
illustrated as follows.

If we let \( Y \) denote the sales of a product and \( X \) denote the price of the product, variations in \( Y \) will depend on variations in \( X \), so the relationship can be written conceptually as \( Y = f(X) \).

This is read as "\( Y \) is a function of \( X \)" or "sales are a function of price." What is being said is that a dependent or functional relationship exists between the two variables. The relationship in the equation is one of simple correlation because only one independent variable is involved. If further analysis shows that other factors such as income and the number of families have an important influence on sales in addition to price, the function can be written \( Y = f(X_1, X_2, X_3) \), where \( X_1 \) still refers to price and \( X_2 \) and \( X_3 \) refer to income and number of families respectively. This equation now reads, "\( Y \) is a function of \( X_1, X_2 \) and \( X_3 \)" or "sales are dependent on price, income and the number of families." Here the relationship is known as multiple correlation since more than one independent variable is involved.

The purpose of simple or multiple correlation is to arrive at the actual equation of relationship
among the variables, instead of the conceptual ones stated above. That is, the individual independent variables must be weighted according to the importance they derive from their effect on the dependent variable.

A more detailed description of correlation analysis will now be undertaken. Instead of placing the emphasis on computational techniques we shall focus attention on the fundamental concepts.

**Simple Correlation**

If only two variables are involved, a dependent and an independent, the measurement of the relationship which exists between the two series of data is known as simple correlation. The relationship can be written conceptually as \( Y = f(X) \).

Where there is simple correlation a straight line may best describe the relationship between the dependent and independent variables. If the relationship between the two variables, as shown by a scatter diagram, is linear, the statistical procedure for reaching the equation of relation-

33. Spencer, *Business and Economic Forecasting*, p. 44.
ship is known as simple linear correlation. When a unit change in one variable produces a constant change in the other variable over the entire relevant range of the data, that is, when the slope is constant, the relationship is linear. The equation to show this is \( Y = a + bX \), the equation for a straight line, where \( Y \) is the dependent variable and \( X \) the independent variable. For this relationship \( a \) and \( b \) are not known. They are constants whose values we wish to determine, and we usually use the least squares technique to estimate their values. The method of least squares gives the line of best fit under the assumptions of that method: a normal distribution of the observations around the line and the reduction of the squared residuals to a minimum. The least squares technique produces consistent, unbiased results, is fairly easy to use and is the familiar procedure learned in elementary statistics. An alternative method for estimating the constants, the method of maximum likelihood, chooses the value which makes the probability of occurrence of the estimate a maximum. In most cases the methods of least squares and of

maximum likelihood estimation produce exactly the same results. The value of $a$ in the equation is the value of $Y$ at the mathematical origin of the equation and $b$ represents the average amount of change in $Y$ which occurs with each unit change in $X$. If we find that $a = 8$ and $b = 3$, the predicting equation would then be $Y = 8 + 3X$. With the equation $Y = 8 + 3X$, a unit increase in $X$ will cause $Y$ to rise in value by three units, regardless of whether $X$ increases from one to two, or from fifty-one to fifty-two. The slope is constant and equals three. If we forecast the value of $X$ for a certain period in the future the value of $Y$ for that period can be predicted by substituting for $X$ in the equation.

When an increase in the independent series is accompanied by an increase in the dependent series, the relationship is said to be positive. Positively correlated data on a chart would proceed from the lower left to the upper right. A negative correlation exists when increases in one series are accompanied by decreases in the other series. A line showing this relationship would proceed from

the upper left of a chart toward the lower right.

A line drawn on a scatter diagram to depict
the relationship between two series of data may be
curved. If the line on the chart shows a curvilinear
relationship, the purpose of the statistical analysis
is still to derive an equation which best appears
to explain the relationship between the two
variables. The statistical process is known as
"simple curvilinear correlation". Simple curvilin-
ear correlation expresses a changing relationship
between the two variables instead of the uniform
linear relation shown by the straight line.

In the same way that relations were represented
mathematically by a straight line, relations can be
represented by curves of various types. While only
one equation \( Y = a + bX \) is used to represent any
straight line by determining the proper values to be
assigned to the constants \( a \) and \( b \), there is practic-
ally no limit to the different kinds of curves
which can be similarly described by mathematical
36
equations. For everyday business research, how-
ever, many of the common types can be defined by

p. 76.
a small number of rather simple equations. When this is done the result is known as a "type equation" and each type equation represents an entire family of curves.

Figure 1 represents six families of curves often encountered in economic measurement and forecasting as well as their corresponding type equation.

**FIGURE I**

*Six Families of Curves*

- **straight line**
  \[ Y = a + bX \]

- **2nd degree parabola**
  \[ Y = a + bX + cX^2 \]

- **3rd degree parabola**
  \[ Y = a + bX + cX^3 + dX^3 \]

- **semi-logarithmic curve**
  \[ \log Y = \log a + X \log b \]

- **logarithmic curve**
  \[ \log Y = \log a + b \log X \]

- **reciprocal curve**
  \[ \frac{1}{Y} = a + bX \]
The capital letters in the equations represent the variables while the lower case letters represent the parameters. Whether the curves follow the solid or the dashed pattern depends on whether the sign of the parameters is plus or minus. Whenever the sign, the basic forecasting problem is to employ statistical procedures to find the values of the particular parameters for the particular curve of the family which best seems to fit the data.

**Multiple Correlation**

Situations are often encountered where the variations in the dependent variable can be explained more fully if more independent variables are included in the predicting equation. When two or more independent variables are to be included in a regression equation the statistical analysis is called multiple correlation. When two independent variables are used the functional relationship is expressed conceptually as $Y = f(X_1, X_2)$. Additional $X$'s may be included to represent additional controlling factors.

The reasons for using multiple correlation are the same as the reasons for using simple correlation.
A regression equation is found which best fits the observed data and thus serves as a foundation for future predictions.

Multiple correlation, like simple correlation, may be linear or curvilinear. A linear relationship between the variables in the regression equation is called "linear multiple correlation", and appears when a straight line best represents the scatter diagrams between the dependent variable and each of the independent variables, that is, the $Y = X_1$ relationship and the $Y = X_2$ relationship, and so on. For two independent variables involving linear multiple correlation, the regression or predicting equation would take the form $Y = a + bX_1 + cX_2$, and for three independent variables $Y = a + bX_1 + cX_2 + dX_3$. Each $X$ represents a different independent variable, and $Y$ is dependent. If a fourth independent variable was included the equation would have $eX_4$ added on, and if there was a fifth, $fX_5$ would be added on. The addition of further variables may improve the ability of the equation to predict changes in $Y$ that are caused by variations in each of the $X$'s. The coefficients $b, c, d$, etc. represent the rate of change in the
dependent variable per unit change in each of the independent variables, while the other independent variables are held constant. These coefficients are usually called "coefficients of net regression" to distinguish them from "coefficients of gross regression" in simple correlation, where no allowance is made for indirect influences on the regression. As in simple correlation, the object of the statistical analysis is to determine the best estimates of the parameters of the regression equation and so enable predictions to be made based on past relationships.

Although linear multiple correlation is a satisfactory tool for most multiple correlation problems, curvilinear correlations are entitled to at least a short explanation. In the above linear regression equation, the value of Y changes at a constant rate with respect to changes in each independent value. In graphic terms the correlations \( Y = X_1 \), \( Y = X_2 \), etc. are straight lines on the scatter diagrams; in mathematical terms the regression equation involves only the first powers of the independent variables. If Y should change at increasing or decreasing rates with respect to each of the X's, the correlation lines on the
separate scatter diagrams would be curved rather than straight. Mathematically the regression equation would involve powers greater or less than one for the independent variables. Where the dependent variable shows a curvilinear relationship with one or more of the independent variables we have curvilinear multiple correlation. Although the calculations required to find the parameters of the regression equation are more complicated and difficult, the principles are the same as in the linear case. Some examples of curvilinear multiple regression equations follow:

\[ Y = a + bX_1 + cX_2^2 + dX_3 + eX_4^2 \]
\[ Y = a + bX_1 + cX_2^2 + dX_3^3 + eX_4^4 \]
\[ Y = a + bX_1 + cX_2^2 + dX_3^3 + eX_4^2 \]

As in simple correlation, the problem in multiple correlation is to choose the equation that represents the relationship between the independent and dependent variables. However, the theory upon which the equations are based is often not entirely appropriate to the task on hand, and the best that can be accomplished is to choose the equation that most nearly fits the data.
When the equations by which values of one variable may be estimated from those of two or more independent variables have been worked out, it is frequently desirable to have some measure of how closely such estimates agree with the actual values and of how closely the variation in the dependent variable is associated with the variation in the several independent variables. The standard error of estimate for a multiple regression equation measures the closeness with which the estimated values agree with the original values. From the dependent and independent variables can be developed a measure of correlation, the square of which is known as the coefficient of multiple determination. This describes the proportion of total variation in $Y$ explained by the $X$'s in the equation. Measures of partial correlation, or degree of association, and of partial determination, or proportion of variation, can also be developed between the dependent variable and any combination of independent variables in the regression equation.

**Advantages of Correlation**

The use of simple correlation presents advantages for the user. The forecaster is always hoping to
find an independent variable which fluctuates at a fixed interval before sales fluctuate. If the correlation is based on a series that leads his company sales he does not need to forecast the independent series, he needs only to scrutinize anything that may destroy the past relationships upon which he based his correlation. Even if no lead-lag relationship can be found a good correlation can be useful because the related series may be the concern of other forecasters and so be available in forecasted form. If sales are correlated to a well-known series the forecaster benefits from the opinions of other forecasters. Many persons forecast national income figures, so if a good relationship can be found between sales and national income the forecaster using national income figures can estimate sales very easily. The forecasters calculating the national income series may be wrong, but the potential error will probably be less for them than for sales forecasters who work in small firms and who lack either the experience or the funds necessary for a comprehensive study of the problem.

37. Crawford, Sales Forecasting, p. 34.
Although problems are encountered when multiple regression equations or demand functions are developed, the gains may be great enough to justify the use of this technique. In the first place the sales forecasting in most firms is based largely on a combination of intuition, experience and tradition. If thorough attempts are made to develop demand functions some cherished ideas concerning the estimating of sales can be found to be useless, and even if the real factors responsible for deviations cannot be measured, knowing what those factors are is an advantage. Secondly, a poorly predicting multiple regression equation can sometimes be useful by the nature of its misses. The most important demand factors are usually included in a function, so a miss shows that an unusual factor is having an influence. Just knowing that such an event is happening can be useful.

Third, one of the most important reasons for the limited use of multiple regression equations in the past has been the lack of sufficient data to predict the movement and effect of the various

sales factors. The supply of suitable data is constantly increasing, so forecasters should consider using the function as soon as the data they require are available.

Disadvantages of Correlation

Determining the constants for the simple linear regression equation for a given series of data is called "'fitting' the equation to the data". Because the simple linear regression equation is the simplest of all equations to "fit", it is widely used. However, the linear equation is extremely limited in its logical meaning. The simple linear equation can represent only a situation where the change in the dependent variable, for a unit change in the independent variable, would be expected to be just the same no matter how large or how small the independent variable was. This is a narrow, precise relationship. In many situations, the relation which would be expected would be a changing relationship as the value of the independent variable changed and not this unchanging relationship. Fitting a straight line can be regarded only as an empirical exercise, with no meaning being
attached to the constants beyond the purely formal one of specifying the straight line that most nearly represents the data, unless the forecaster has a good logical reason to expect the linear equation to represent honestly the true situation.

A significant disadvantage that faces the user of both simple and multiple correlation is the danger of leaning too heavily upon statistical projections and neglecting to make an independent objective appraisal of the future. Past trends must always be considered when new trends are being predicted, but the forecaster must be ever alert to those factors that can cause sudden and severe deviations from the past. Relationships often fail to hold true for an extended period of time, and the danger is always present of the forecaster ceasing to be alert to changes in the factors that produced the initial relationship.

Despite the fact that multiple regression equations can be useful they will probably never be universally accepted because there are mathematical weaknesses, logical fallacies and

pragmatic limitations that bar such acceptance. An arbitrary decision must be made in choosing the dependent and independent variables to be included in the regression equation. As a result, important independent variables may be overlooked even though an effort usually is made to include the most important variables. In addition, the regression equation produces reliable results only when the forecasted figures lie within the range of figures used to develop the forecasting equation.

The meaning attached to the successful fitting of a demand equation is easily misunderstood. High correlations do not necessarily give proof of cause and effect and forecasters should not succumb to the temptation to assume that they do. A second weakness in logic is the usual assumption that a demand function is static. A static relationship means that the relations between the dependent and independent variables never change. Static relationships simplify computations but seldom really exist, or at the most seldom exist for any length of time. A static equation tends

to average out the effects of the variables over a period of time, so the effects over later years, which are the most important ones in sales forecasting are likely to be obscured by the earlier forces. There are other less important weaknesses in logic. For instance, time is often included as a variable in the equation to represent slow moving forces of a minor nature, but the inclusion is often unjustifiable, especially over many years, because these forces often have an unknown or changing relationship with the dependent variable and cannot be represented effectively by a time variable. Finally, multiple regression equations sometimes yield nonsense results. Spurious correlations can arise as the result of coincidental appearance of relationships between series of data which have no causal or logical connection.

There are other weaknesses that may make the use of demand functions impractical. First, some information, such as competitive strategy, cannot be put in numerical form and other required figures may not be available in the form desired. Also, few firms possess suitable sales data for a period of from ten to twenty years, without which the
demand function has less chance of yielding satisfactory results. Often only annual data are available for multiple correlation analysis. Since most companies require estimates for shorter periods, the demand function must be supplemented by other techniques. Another weakness is the fact that some variable usually must be forecast. By the time several variables have been forecast the collective errors can often equal or even exceed the error of a forecast based on only an opinion. The problems encountered in the use of multiple correlation require such skill in the solving that few forecasters are prepared to cope with the technique.

Generalizations concerning the usefulness of correlation cannot be made because the potentialities of the method are dependent entirely upon the circumstances found in each individual situation. Sometimes correlations have been useful, but at other times relationships that appeared to be dependable proved to be useless. Each forecaster must examine his own situation and make his own decisions. The forecasters who have not considered the possibilities of using correlation have overlooked a useful tool.
Serial Correlation

The relationship between successive observations in the same series of data is referred to as serial correlation. This type of correlation is found most often in the case of time series, where the value of the variable at one period of time is believed to influence the value in a succeeding period. The major problem arises in determining whether or not successive items in a series are serially correlated.

In other types of correlation, interest was focused on the magnitude of the correlation, but in serial correlation interest is centered on ascertaining the presence of correlation. This is done because most of the sampling formulas and procedures used in practice assume that successive observations are independent of each other, and when this assumption no longer holds, most analytical methods are invalidated. Exact means for measuring the extent of bias due to serial correlation are not yet available, as discovering the presence of correlation is the important thing, and measuring

the magnitude of the correlation becomes a secondary problem.

In time series each figure is seldom independent of the preceding figure. If serial correlation affects a time series to a great enough degree, the future of time series may be forecast with considerable accuracy by a technique that is mechanical, simple and inexpensive. The first step in employing the procedure is to use various statistical methods to discover the presence and nature of serial correlation in the different series; the second step is to develop and test different models. A model is an assumption stated in algebraic terms. A sales manager is using a simple model when he states that sales of every item for six months of the year will equal the sales for the same six month period of the preceeding year. In algebraic terms the manager is saying that expected sales \( E_t \) equal past sales \( A_{t-2} \). If the firm forecast a ten percent increase each year the algebraic terms used would be \[ E_t = A_{t-2} + 10\% \times A_{t-2}. \] Such unsophisticated

42. Crawford, *Sales Forecasting*, p. 43.
models as this are seldom satisfactory, so the forecaster will try various methods in order to discover the best one for his series.

Any usefulness provided by an unsophisticated model is usually in the form of a yardstick for measuring the accuracy of forecasts developed by more sophisticated methods. A forecaster can test an unsophisticated model on his past sales, calculate the magnitude of the error, and compare the size of this error with the size of the error that arises from using a more sophisticated technique. He can also use the cost basis for comparing the errors in order to discover the precise cost of more accurate forecasts.

**Time Series Analysis**

At any given point in time, sales are influenced by four major factors, long-term trends, cyclical variations, seasonal variations and irregular fluctuations. Analysis of the historical patterns of the first three factors may prove helpful in forecasting sales and business activity; the fourth factor, irregular fluctuations, has no pattern and defies attempts at systematic forecasting.
The analysis of movements of series of data over periods of time is referred to as "time series analysis". In traditional time series analysis, the assumption is made that any particular value in a series is the product of factors that can be attributed to the various components.

The secular trend of a time series refers to the smooth or regular movement of the series over a long period of time. Intuitively speaking, the trend of a time series characterizes the gradual and consistent pattern of its changes.

Some series of data recorded over a given period of time show an upward trend, some show a downward trend and some remain at a level that is reasonably constant. Certain factors in this country have caused the trend of many important economic series to be upward. Upward movements have been apparent in both industrial production and total personal income.

Trends are of endless variety. Some series increase slowly, some increase quickly, others

decrease at varying rates of speed, while still others remain relatively constant for long periods of time. Some series go through a period of growth or decline and then change direction and go into a period of decline or growth.

The easiest variation of a time series to understand is the seasonal one which consists of patterns regularly repeated when the length of the pattern is a year or less in duration. The study and measurement of seasonal patterns is essential in the analysis of a time series. Sometimes the seasonal patterns themselves are very important because a knowledge of seasonal patterns based on adequate statistical measures is necessary as a basis for planning and scheduling. At other times the seasonal pattern is useful as a means of measuring other variations of a time series.

The point of view is sometimes taken that if a time series has its trend, seasonal variation and irregular fluctuations removed, then what remains is the so-called business cycle. This is probably an oversimplification of the situation, but a common way of measuring a business cycle is to use this process of elimination. A business cycle can also
be described as consisting of a recurrence of the up and down movements of business activity from some sort of statistical trend or normal. By normal we mean something in the nature of a statistical average. We are not considering anything particularly permanent or universal in the word normal.

Business cycles differ from seasonal variations in the length of the time period covered, the business cycle being longer than the seasonal variation. Further, the fluctuations in a business cycle are thought to have different causes than the fluctuations in seasonal variations. Prosperity, recession, depression and recovery are sometimes considered to be the four phases of a business cycle and they are caused by factors other than weather, social customs and other similar factors that create seasonal patterns. Those business cycles which show enough similarity to be identified as such unfortunately show so much dissimilarity as to make predictions of their future occurrence, length and severity of little value.

When the fluctuations of a time series are completely unpredictable, or are caused by unrelated but potent factors such as good or bad news, bank failures, elections, floods, earthquakes, strikes or wars, they are called irregular or erratic variations. Some influences cause disturbances that are strongly felt, while some cause disturbances that work themselves out before they are strongly felt, but both types are classified as erratic.

For practical purposes any variation that does not account for trend, seasonal or cyclical movements is classed as irregular or erratic. If trend, seasonal and cyclical movements are having an influence they produce certain systematic effects, while irregular movements, which result from chance factors, produce random effects which are completely unpredictable when taken one at a time, but which tend to average out over the long run.

When an investigator analyzes a time series he is usually interested in the variations that take place during successive time periods. He may seek

to know if there is a recurring seasonal pattern in
the sale of lumber, or to ascertain what the pattern
of change is in the volume of industrial production
during business cycles. In an endeavor to answer
these questions, the investigator tries to isolate
the movements of immediate interest from all the
other movements that influence the series under
observation. He uses a process called decomposition
with this end in view. The problem confronting
the investigator is, "How are the different move­
ments blended together to make up the historical
series that is actually recorded?" The use of de­
composition does not necessarily supply the answers.
The particular process of decomposition that is
employed depends upon certain assumptions pertain­
ing to the manner in which the effects of different
forces are combined. Some of these assumptions may
be more acceptable than others.

The first of these movements, the trend, is
commonly used to obtain a general visual estimate,
not to develop a precise statistical prediction.
However, the trend can be helpful used either way.

46. F.C. Mills, Statistical Methods, H. Holt
A reliable procedure for exposing the trend is described in the following paragraph.

First, the sales are plotted on arithmetic and semi-logarithmic graph paper. Second, a study is made of the general movement. Third, a logical statement concerning the trend is developed, based on a knowledge of the history of the series concerned. Fourth, a formula is selected that embodies the same movement and is applied to the sales figures.

The trend has many advantages regardless of the way in which development takes place. First, the trend gives the forecaster a base from which to evaluate deviations, for by focusing attention on this movement the forecaster is not influenced too greatly by strong cyclical or irregular factors of a temporary nature. Second, if he can develop projections of the trend, and also of the cyclical movement and the seasonal movement, he can theoretically total them for an estimate of sales. This is seldom done, mainly because the cyclical variation is so difficult to isolate. Third, when there is a possibility of correlating sales with some other variable, the correlation is usually more meaningful.
if the trend has been isolated from both the sales and the other variable.

The sales or other data must be consistent over time, that is, they must be homogeneous. This consistency is usually disregarded where a trend is sought in total company sales. A company seldom produces and sells the same product for twenty years or more, so the sales figures for different years usually cover different items, that is, they are not homogeneous. To obtain consistent data the trend should be sought either in sales series for each product or in total industry sales for each type of product, especially if the share-of-market fluctuates greatly. Another means of attempting to obtain consistent data is to remove the variations caused by price. This is done because there may be a separate trend for price, which, when added to the unit sales trend produces an over-all trend that is heterogenous. Furthermore, the trend should be stressed for recent years since changes may be occurring continuously. Finally, when the forecaster establishes a trend line he must choose the years to be included with care because other groupings of

47. Crawford, *Sales Forecasting*, p. 31.
years will produce different trend lines.

Despite the apparent value of trend determination the disadvantages limit the usefulness of trend analysis. These disadvantages are a lack of homogeneity and an inability to remove the price factor. Trend calculations do a better job of explaining past behavior than of predicting future behavior, because extending a trend offers little help unless the forecaster has an estimate of future cyclical movements. The trend seldom predicts accurately because the effects are usually obscured during the short run, and the trend often changes direction over the long run.

The most logical of all trend curves for many series is the elongated S curve, yet in practice the curve is not as valuable as might be expected. The S curve takes into account the nature of growth to start slowly, accelerate rapidly and level off in maturity. The application of this curve to business growth has not been as valuable as the application in such fields as biology because human sources partly control business data but do not control

biological data. A forecaster is never sure of the position of his sales on the growth curve until they reach the top plateau, and by that time much of the forecasting usefulness of the curve is lost.

The cyclical movement is even more difficult to predict than the trend. Theoretically, if the trend is removed from a sales series and the data are placed on an annual basis, the only fluctuations remaining are cyclical or irregular. A smoothing process then removes much of the irregular fluctuations leaving a nearly pure cyclical movement. In practice this process is almost impossible unless many judgments are made along the way. Even if a cyclical movement is isolated successfully, the movement is seldom in a periodic repeating form. If a fixed periodic pattern is evident, it cannot be relied upon. The forecaster is then back where he started from, attempting to predict the cyclical forces that will operate in the near short-term. Because the forecaster isolated the cyclical movement he derived a better understanding of the past, and so, presumably, is better able to estimate the future. The extent

to which the cyclical movement is useful in this way to the forecaster is the extent to which the force is useful in sales forecasting.

Although the seasonal movement provides the greatest assistance to forecasters, there are disadvantages to be considered. Very short-term forecasts are usually obtained by forecasting for a year, for six months or for a quarter, and then by breaking these estimates down into months by a mechanical process based on expected seasonal patterns. There are several ways to compute a seasonal pattern, and to apply the seasonal percentages to an annual forecast requires nothing more than plain multiplication. However, difficulties are often encountered. The most important is the ability of the seller to change past seasonal patterns. In addition there may not be enough data available to establish a seasonal pattern, and even if sufficient data are obtained the seasonal pattern may be changing over time. Consequently, most forecasters make mental estimates of seasonals, but use them as starting points for considering future sales, not as sole determinants of sales.
The "periodogram" school of business cycle theory is partly responsible for the development of this questionable method called time series analysis. The concept never did have a firm foundation, and with the emergence of the government as a dominating force in the economy, the foundation is still weaker. Basic changes in institutions, risks and motivations have altered markedly the continuity of the stringent conditions necessary for the use of such a projection technique. However, for many products this method has a firm economic foundation, especially when confined to trend extrapolations and a seasonal pattern, and the forecasting of cyclical business changes can be left to other methods. In our growing economy, where urbanization and mechanization are becoming more pronounced, some good long-range forecasts have been obtained for some products by merely projecting the trend.

VI. MULTIPLE METHOD APPROACH

One of the most reliable ways to obtain a sound forecast is to use several techniques. If forecasts are developed by using the jury method, the sales force composite method and one or more statistical means and they all agree reasonably well, far
greater confidence can be placed in the result than if the forecast was reached by only one approach. In the multiple method approach each forecast acts as a check upon the others. When the differences between two or more independent forecasts are scrutinized, executive judgment is sharpened and the final forecast will probably be more reliable.

When each individual forecast is examined by the executives before being used in the developing of the final composite forecast another method is created -- that of using a jury of executive opinion to select the final forecast.

The multiple method approach is usually considered to be more reliable for developing a sales forecast than any single method. This is also true in the gathering of data. Since most business activities are interrelated to some extent, a study of basic forecasting data gathered from many sources will provide several points of cross-reference. While the multiple method of forecasting usually provides best results, a perfect

and infallible forecasting method is unknown, and the development of a forecasting procedure which would result in a more accurate appraisal of future sales prospects is a universal objective.

VII. FORECASTING FROM SCRATCH

Today many companies are having to develop sales forecasts with little or no background material. Many companies have never forecast before and do not possess sales records that are adequate for forecasting. In most industrial fields there is a serious lack of statistical data, so companies receive little assistance from that source.

The first step in preparing forecasts for the first time is to reconstruct the company's sales records and to establish a system for keeping them up-to-date. This is a costly process, but good sales records are so valuable that once they have been prepared their maintenance is inconsequential in comparison with the benefits gained. If records are available in a company but are not in a properly arranged form the necessary arranging may not be unduly time consuming. On the other hand there are instances where thousands of man hours have
been spent constructing sales records from invoice files.

If the forecast is to be based on the company's potential instead of on the company's past performance, the approximate demand of each territory must be ascertained. Industry figures should provide the answer. If such figures are unavailable the company has to make its own estimates.

When a company is in this position a market survey must be made in order to determine the relation between total consumption of the company's products and some factor such as regional population, the number of wage earners employed, payrolls, the assessed valuation of the plant or industrial power consumption. If valid relationships can be established, they can be applied to available data in order to get an idea of total demand. Discovering these relationships and determining their validity requires a good deal of skill. Sometimes one factor will nullify an otherwise perfect correlation and recognizing and correcting for the factor can be a difficult task.

51. Thompson, *Forecasting Sales*, p. 33.
A market survey can also be taken in another way. For instance, if a manufacturer of commercial equipment lacks external data a survey of several cities could provide the company with data related to customer preference in addition to other information from which could be learned the relationship between the sales of the company and the sales of competitors, the sizes of the new and replacement markets, the character and relative importance of the purchasers of the equipment, and the degree to which various markets are saturated. This information, allied to an analysis of company sales, could provide a satisfactory foundation for forecasting.

VIII. FORECASTING THE DEMAND FOR NEW PRODUCTS

Forecasting the demand for a new product is quite unlike forecasting for an established product. A product that is new to the company and to the economy necessitates a careful study of the competitive and economic characteristics of the product, and forecasts that are developed exclusively for that particular product.

Shaping a forecast to fit the needs of a new
product can be done in several ways. 1. The evolutionary approach may be used. Here the demand for the new product may be a projection of the outgrowth and evolution of an existing old product. 2. In the substitute approach the new product is analyzed as a substitute for a product or service already in existence. 3. The growth-curve approach utilizes the growth pattern of established products to estimate the rate of growth and the ultimate level of demand for the new product. 4. In the opinion-polling approach a sample survey is taken of the potential ultimate buyers of the new product and the results of the sampling are blown up to full scale. 5. If the sales-experience approach is used the new product is offered for sale in a sample market. 6. When the vicarious approach is used the product is placed on the market, and customers' reactions are reported by specialized dealers who are depended upon to be informed about customers' needs and the presence of substitute products.

The different approaches offer varying usefulness. The evolutionary approach is useful only

when the new product is little more than an improvement of an existing product. The demand will probably be close to a projection of the potential development of the existing product. The primary problem is to ascertain how the demand patterns of the new version will differ from those of the old.

The substitute approach is very helpful when relevant to the situation. The old product often indicates the most that can be expected from the potential market for the new product, but the important problem is to estimate how rapidly the new product will replace the old, not what the potential market will be. Furthermore, each new product usually has several uses, and each use presents a substitutability problem. Also, the substitution of the new product for the established one may account for only part of the potential demand for the new version.

The growth-curve approach cannot always be developed, and even where development is possible, applicability is limited. This approach is generally used in the later stages of demand projection.
Wide use has been made of opinion-polling to discover the demand for new products. Even for established products sampling carries inherent problems of real intentions and multiple alternative choice. For new products the difficulties of the approach are accentuated and the additional problem is encountered of conveying to the potential customer what the new product is and what it will do.

When the experiment is properly controlled, placing a new product on the market on a trial basis places forecasting on a sounder basis. The significant problem is deciding the necessary allowance to make for the peculiar characteristics of the immature sample market.

The vicarious approach features the utmost simplicity but very little reliability. Estimates from vicarious surveys vary with the ability of the dealer to guess what his customers will buy and to report his guesses in an unbiased fashion.

IX. BREAKDOWN OF THE SALES POTENTIAL TO TERRITORIAL UNITS

The company sales potential can often be broken down into territorial units. This involves preparing an index or choosing one already made. Because more than one factor usually influences sales, several indexes are often combined into one. This is done so frequently that index methods are classified broadly on the basis of the number of indexes combined. For instance, if any indication of the relative potential of different parts of the market for radios is needed, an index of wealth per capita may be used, but a more accurate estimate can be obtained from a composite index developed by combining indexes of wealth per capita, percentage of urban population and degree of literacy.

Many index methods are in use. The reason is that the indexes are based on a variety of assumptions and they differ widely in their complexity and in the accuracy of their results.

Some companies use a single-factor index method upon which to base their regional forecasts. These firms assume that the extent to which their products already permeate the market is reasonably close to the potential of that market for the products. For this reason they are satisfied to use their own past sales as the single factor upon which to base their estimates. This assumption denies the need for an objective standard of sales performance. Furthermore, this assumption is based on other assumptions -- that the company has covered the whole market thoroughly, that all parts of the sales organization have been equally successful, and that competition has been of uniform strength in all areas of the market. Even a company in a quasi-monopolistic position cannot justify such assumptions, especially if competition from substitutes is active. A company is likely to be strong in some areas and weak in others, and the need to determine the company's relative position explains the necessity of acquiring objective standards of sales performance.

Two multiple-factor index methods are used to establish relative market potentials. These are the

"arbitrary factors" or "percentage average" method, and the multiple correlation method. The former provides less accurate estimates. The name "arbitrary factors" is given to the method because the approach used in selecting factors is entirely deductive. Personal judgment plays a major role and the results are frequently inaccurate. The method gets the name "percentage average" from the way in which factors are usually combined. The multiple correlation method is named for the statistical procedure which is used to select and combine the factors into a single index.

The multiple correlation method has many advantages. Use of this method reduces the number of questionable assumptions to be made. The forecaster does not have to rely entirely on deductive reasoning when selecting and weighting factors. When this method is used effectively the results appear to be more accurate than the results obtained from any other index method. The use of this method as an aid in determining market potential is a technical matter and should be undertaken only by statisticians.

56. Phelps, Sales Management, p. 239.
The multiple factor index is a series of estimates in percentage form of the proportion of total sales which different segments of the market would have acquired if the independent variables had been the only determining factors. A well-constructed index based on factors that are reasonably stable and that have had a high relationship with sales in the past may provide a more accurate indication of the distribution of sales in the future than are provided by actual sales in any preceding year. An index of this kind may be regarded as the market demand pattern which represents the most likely distribution of sales over the market.

Comparing the distribution of company sales with that of both industry sales and the estimated index may provide helpful information. For such comparisons indexes by sales territories may have to be prepared. The strong and weak territories of a company may be exposed in this way. Although data made available through the use of multiple

factor indexes are helpful, they are not a substitute for, but a supplement to, good judgment. The function of the data is to expose the potential size of the market in the various sales territories, not to tell management what to do. Without the information management may view the market only through the sales activities and records of the company, and through unorganized observation. With the data, management is provided with additional factual material useful in planning the sales effort and in formulating business policy. The data substitute more accurate assumptions for less accurate ones and give executives a sounder foundation for their planning. Decisions related to marketing should therefore produce fewer errors and greater profits.
CHAPTER V
ADDITIONAL FORECASTING STEPS

I. CHOICE OF METHOD

There are many different forecasting methods and firms should use the techniques that apply best to their particular situations. Many factors must be considered when forecasting procedures are chosen. Some of these factors and the influence they exert upon the choice of the forecasting method are discussed in the following pages.

There are three criteria that should apply to all methods. The first states that executives who use the forecasts must understand the methods by which the forecasts are obtained and they must have confidence in the results. The executive who is not trained in mathematics and statistics cannot understand the more complicated mathematical methods and if he does not understand how the estimates are obtained he may distrust the results. Because the executive must have confidence in the forecasts if his co-operation is to be obtained, persons who decide which techniques are to be used should either make sure that the methods are simple
enough to be understood or find ways of enlightening those who will use the forecasts so they will use them with confidence.

The second rule is very simple but is often overlooked. The method that is chosen should be fairly accurate, that is, accurate so far as the size of the error in individual forecasts is concerned and accurate when considered with the number of times the results are unsatisfactory. A few bad forecasts quickly destroy confidence in what should be a useful tool. At the same time, if the margin of error is allowed to become too great the usefulness of the forecast is greatly impaired. Many companies insist that forecasts be revised frequently so they may be kept in line with changing conditions.

A third requirement is that the method chosen must more than repay the company for the cost of the program. Not only should the direct expense of making a forecast be taken into account, but the time devoted to the forecasting problem by executives and salesmen is an additional expense in the sense that these people have less time to perform
other duties. A good forecast should pay worthwhile dividends if it is to justify the cost.

The types of data available often indicate the method of forecasting that can be used. If a good supply of data is available on company sales and on industry sales the data can be analyzed and basic trends extended. Statistical projections and correlation analyses may also be used. If company records are inadequate but industry records are satisfactory, sales can be forecast on an industry basis and estimates made of the company's share-of-market. If neither company records nor industry records are adequate other methods must be used such as the jury of executive opinion, the sales force composite, or an analysis made of the general economy, as these methods require only the most elementary past records. The cost of reconstructing past records may be prohibitive, but some companies have found that the cost pays for itself over a period of years because forecasting can be done with such increased accuracy.

The estimating of sales for an established product is different from the forecasting of demand for a new product. Even if past records are poor a company can draw upon personal sales experience to predict the future of a well established product. There is no such basis for estimating the future sales of a new product unless the new product is very similar to the old. If the new product bears no resemblance to any previously made by the company a careful study should be made of similar products on the competitive market. These studies could include market research or campaigns to test sales. If the new product is unlike anything previously placed on the market a reliable sales forecast may be an impossibility. When a new product is introduced to the market early sales are watched very closely and forecasts are revised with every significant change of consumer or competitor reaction.

The sales in some industries are not seriously affected by changes in economic conditions and in such cases fairly reliable forecasts can be made merely by making an analysis of industry growth curves and of population changes. Where demand for
a product fluctuates, changes in buying power, national income and prices are among the factors that must be considered. The industry that is subject to extreme fluctuations in the demand for its product must make intensive and elaborate studies of economic conditions and of factors affecting sales. End-use and correlation studies may be helpful and the jury of executive opinion and sales force composite methods may be tried if the executives and sales force have sufficient knowledge of the company's operations.

Forecasting takes a different course when a company has some control over factors that affect sales. During the Second World War and for some time after, many companies found that their sales were limited only by the supply of raw materials, the availability of labour and the capacity of the plant. These companies knew how much of each product they would produce and where the product would be sold. A company whose sales dominate the industry is sometimes in a similar position. Where this occurs the sales forecast is developed on the basis of how much the plant can produce and the profit to be made by each product in the line.
The particular technique chosen for the forecast depends upon the purpose for which the estimates will be used. If the forecast is to be used for financial planning and plant expansion, basic trends are more important than cyclical variations so a long-range forecast with little detail is sufficient. For day-to-day planning the forecast must show at least the significant short-term fluctuations as well as trends in the sales of various products and allow for temporary factors that need not be considered in the long-term forecast. If the temporary factors cannot be estimated, as in the case of weather, the fact is noted in the final forecast. The effect that these immeasurable factors can have on the forecast, as well as the extent of the effect, should be detailed.

When the market for a certain product is limited a study of major customers or consuming industries is often a good basis for a forecast. This is particularly true if the consumers do not react in the same way to the total consuming market as they do to the general economy. In other words, local conditions may have a greater effect upon

2. Thompson, *Forecasting Sales*, p. 44.
sales than do trends in general business conditions. Here the best technique for developing a forecast is one with a territorial basis.

Companies with a complex line of products have found they must group together the products that react in the same way to factors that affect sales. Some products sell poorly when purchasing power is reduced or spendable income decreases, while some products find a ready market in depression years. If certain products share the same reaction to factors that have a bearing on their sales they are grouped together for the forecast. Products that cannot be placed in a group are forecast separately.

Many forecasting methods have been developed over the years by manufacturers, wholesalers, and retailers. Not only are some procedures more difficult to use than others, but the same procedure may be more difficult to use in one type of business than in another. The retailer appears to have the easiest forecasting task because he works to a fairly stable seasonal pattern and he sells to a relatively small local market. The
manufacturer, on the other hand, finds forecasting difficult. He sells to a large and far flung market and has difficulty forecasting shipments over long trade channels. The length of a manufacturer's product line also adds to the complexity of the forecasting. Some firms experience less difficulty in forecasting than others because some industries are basically more stable than others. The amount and kind of data available to the various firms influence the ease with which their forecasting problems can be solved. Companies vary in size, and other things being equal, the larger company has the advantage of being able to afford specialists to study various phases of the forecasting problem. The small firm with no trained personnel for the forecasting task often has to use estimates that are based on little more than intuition.

Although there are many sales forecasting techniques to choose from not all techniques can be utilized by every company and no one technique is the best for all companies. Management must

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decide which method will provide the most accurate and dependable forecast for the company concerned. There are several rules that management might consider when a forecasting method is being chosen.

1. Comprehensibility. If management is going to use the forecast as a basis for planning, the technique used in developing the forecast must be understood by those who are to use the forecast. Executives will have no confidence in a procedure they do not understand and the forecast will be of little value.

2. Accuracy. A forecast cannot be considered accurate if the turns are not predicted as well as the trends. A forecast that indicates a continuation of a trend implies no change in plans. As a turn is approached new decisions must be made and new plans formulated. Since information about a predicted turn is of vital importance a forecast cannot be considered accurate unless the turning points can be predicted accurately.

3. Timeliness. The forecasting method chosen should make use of the most up-to-date information obtainable and should be capable of utilizing new data when conditions change.
4. Usability. The method that is chosen should provide forecasts for the same units and groups as the company uses or be easily converted to those units and groups. For the production department the forecast should be in physical units, for the finance department the prediction should be in current or deflated dollars or whatever form the department requires, and so on for other departments.

5. Economy. Finally the method should be one that the firm can afford and the staff can handle. The value of a forecast is difficult to calculate, so management must decide if the benefits derived warrant the various costs involved.

If these criteria are taken as a guide and a technique is chosen that appears most suitable, the forecasting program will not be successful unless all departments co-operate in the development, and management places confidence in the reliability of the forecast.

II. THE CONCEPT OF A FIRST APPROXIMATION FORECAST

Sales forecasting is described in business literature as a function where all pertinent information and company policies are utilized in order to arrive at a forecast of sales that will be useful throughout the firm. Emphasis has been placed on finding a technique that will provide the most trustworthy forecast. However, some firms discuss an intermediate step, one that all firms implicitly take but few emphasize, and find that when this step is emphasized the forecast is more valuable to management. This intermediate step consists of accepting the forecaster's best prediction as a "first approximation." The procedure is as follows.

The forecaster studies all relevant data and prepares a forecast that he believes is most accurate for the conditions that he has been told or that he assumes will prevail. Here the new idea makes an appearance. Now the various operational executives discuss the estimate, not in terms of what they consider likely, but to discover whether the forecast conforms to the general intentions of the firm and will allow the achievement of desired results. The estimates may provide for the selling
of more of a certain item than the firm can buy raw material to make. In another instance the profit may be too low. The problems are then discussed in an effort to find a more satisfactory prediction.

This procedure is one that businessmen would not be expected to overlook, yet many of them do. Some firms merely instruct their forecasters to prepare estimates, to submit these estimates to the sales managers for approval and then to send the forecasts to those in the firm who require them.

When the latter procedure is followed the executives who develop the plans that are used by the forecaster estimate the results they expect from each part of the plans. When they make decisions on the plans before the forecaster uses them they do not take into consideration the fact that they and the forecaster may not be of the same opinion. The situation is the same when the forecasts are examined by a board of review -- the forecasts are judged on their accuracy, not on their practicality.

To overcome this weakness some firms appraise
not only the forecasts but the forecasted situation. The planning stage is not considered complete until the first approximation forecasts have been prepared and appraised. The review procedure in this case is different from the one undertaken when only the forecast is examined, because all the people who had a share in the original planning are recalled to consider the feasibility of the estimates. In this way the forecast becomes an integral part of the planning procedure of the company.

The very small firm has probably always followed this course of roundtable discussions by the executive committee. When a company grows large and hires or trains a forecasting specialist there is a tendency to separate planning and forecasting. The "first approximation" concept attempts to reunite these two functions.

III. POST-PERFORMANCE ACTIVITIES

When the estimates have been received and accepted they must be distributed throughout the firm and this process can become quite complicated. For example a firm may make complete forecasts

5. C.M. Crawford, Sales Forecasting: Methods of Selected Firms, University of Illinois, 1955, p. 38.
semi-annually and distribute them in this manner:

1. the sales department may receive a forecast of company sales by broad commodity groups, by months and by districts; 2. the production department will require a forecast by commodity groups, in annual units; 3. the inventory control section may obtain a forecast of company sales by commodity groups, in dollars; and 4. the budgeting department may receive a forecast by commodity groups, by months, in dollars. Other firms may have simpler or more complicated methods of distribution, but regardless of the method, distribution is an important problem.

The last performance step, and one that is neglected too often, is the recording of the details of the development of the forecast program and the thinking upon which the decisions were based. Forecasters can study past estimates and learn the reasons for their success or failure. Management should be able to trace errors in the final forecast back to their source in order to learn their cause. If a forecaster is new to a firm past forecasts can be of inestimable value to him, so

management should keep with the company all records of past estimates if the forecaster resigns to go with another organization.

IV. PRINCIPLES OF CONTROL APPLIED TO SALES FORECASTING

In factory management two types of control can be exercised — production control and quality control. Production is controlled in an effort to gain smooth performance in the plant from raw material to finished product. Quality is controlled to ensure that the final product reaches the desired standard. We can apply this distinction to forecasting and find that control which pertains to the development of the sales forecasting program is a type of production control, and control which pertains to the methods used in actually preparing the forecast is a type of qualitative control. The latter type will be discussed here.

The quality of the final forecast depends upon every step taken from the planning stage to the final estimates. However, a forecaster can do

three things to augment the quality of his estimates. First, he can state the limits of his forecast. Most people who use a forecast need an exact statement of the best expectations, but some users find they can make better use of a forecasted "range". Even those who need an exact statement of estimates often find that a forecasted range helps them in their own planning. A forecasted range helps an appraiser to know just what the forecast is intended to portray, so control in later stages is easier to maintain.

A second step the forecaster can take to control the performance of the forecast is to state the assumptions on which the estimates were based. These assumptions can cover general economic conditions such as national income, expenditures on producers' durable goods and patterns of consumers' spending, and they may also cover the expected results of important company plans. Less significant assumptions should also be stated because they cannot all be remembered and yet reference to them later may prove very useful.

Finally, a forecaster can try to get a last-minute appraisal of his forecast before it is used. This can be done in several ways but the most usual ways are to consult with top executives or to use an outside advisory service.

After the forecast is made some changes usually occur in conditions which influence sales and even if none occur some degree of error will usually be found in the estimates. One factor in the forecasters' favor is that the forecast, unlike the product of the factory, can be changed as soon as the estimates are completed. Because of this, forecasters have always used what can be considered a control factor when they compare the predicted results with actual results as soon as the figures come into the company.

One way in which this type of control can be obtained is by plotting the forecast on chart paper and showing the control limits beyond which the forecast will be too inaccurate to be of value. If the forecast becomes unreliable, the forecaster must revise his estimates. Forecasts plotted in this manner can be revised at the beginning of a period as well as at the end, so
changes can be made before the forecast loses all value. The interesting aspect of this device is the fact that a control formerly based solely on judgment can now be accomplished statistically. This approach can probably be adapted to fit the conditions in individual firms.

A forecast should be revised when the value is lost because of inaccuracy. Therefore, the sooner the company discovers the need for change the sooner can the adjustments be made. The most common way to learn when a forecast needs adjusting is to review the estimates. This brings up the problem of how often forecasts should be reviewed.

V. REVIEW AND REVISION

Some forecasters believe that reviewing should be done every month. This may seem like an inordinate amount of effort, but such need not be the case. Even in a medium sized company where the forecasting is the responsibility of one man a monthly review is feasible. Once the forecast is finalized the forecaster does not isolate himself from economic news or from news of the field sales force for months at a time. Furthermore,
the review should not consume a disproportionate amount of time because with experience the forecaster becomes skilled and he becomes accustomed to gathering pertinent information during the month.

In addition to a monthly review more and more companies are forecasting twelve months ahead every quarter. This means that the previous estimate for the next nine months is revised, and a first estimate made for the quarter that is a year ahead. This system avoids the implication that years should be planned as units, and emphasizes the fact that the forecaster is continually searching for new developments and new information.

A short- or medium-range forecast covering a period ahead of two to eighteen months should always be in existence and should be reviewed at least every quarter. When the short-range forecast is reviewed several factors are weighed such as current information on sales, news about the industry, news about the general economy and new plans the company is making. The result of the review is

a general estimate of error in the forecast or a general estimate of a new forecast.

The long-range forecast which predicts for a period ahead of five to ten or more years should be revised from every year to every five years. The emergence of a problem particular to long-range planning indicates the need for added revision.

No rule can be used for deciding when the review of an industry's forecast indicates that a new forecast must be made. Some industries are quite stable, but other industries fluctuate violently, so general statements cannot be applied indiscriminately. However, for most industries reforecasting is advisable when the error is five percent or more. In other words, if a new forecast would vary as much as five percent from the existing one, a new forecast should be made.

Either one of two situations may arise that would indicate the need for a revision of the forecast. A new forecast should be made if the present forecast is apparently poor, or if the forecast has been satisfactory until the present, but factors significant to sales have obviously changed. If
the forecast is poor, every effort should be made to learn the cause. Perhaps the prediction of general business was satisfactory but the estimates of sales were wrong, or perhaps the general economy varied from that predicted because of factors the forecaster did not or could not foresee.

Forecast sales and realized sales should be compared in order to learn when the forecast has gone beyond the maximum expected error, and management should receive notice as soon as possible when this occurs. For this reason the forecast should be broken down by months or by four-week periods in order to make continual comparisons of sales. This is true even in industries where a forecast for a period shorter than a quarter is impractical.

In addition to this information on predicted sales and actual sales the forecaster needs both general and detailed information concerning business conditions. He needs to know the general economic climate, the activities of his company's competitors, as well as the latest prices and the latest knowledge about future prices. He should know also if his company has made new plans,
developed a new product or entered a new market. In short he needs the information that he needed to make the forecast in the first place.

In order to acquire sufficient data for a review of the estimates, the forecaster should have a regular program of conferences with men in the sales organization. The information the sales staff brings from the field may provide the first indication that a new development is taking place. Interviews should be held with the production planning, traffic, purchasing and any other departments where recent information can be gathered. The forecaster is interested not only in the influences that affected sales in the recent past, but in developments that will affect sales in the future.

When recent sales results are to be reviewed they first should be compared with the estimated figures for a given period. The fact that some differences will exist is accepted. The problem is whether these differences are expected and acceptable. The forecaster should know the probable amount of error and he should know the greatest error that "chance variations" may cause. These variations result from causes that are unknown.
When recent sales records have been reviewed several conclusions are possible. The forecaster may be right for the wrong reasons. Every individual item may be wrong but his total may be nearly correct because errors cancelled each other. He may be wrong for a short-range reason, that is, a temporary situation that will soon be changed. For instance, January sales may be higher than expected and February sales correspondingly lower, but the sales for the quarter may be as predicted. Another situation that causes wrong forecasting for a temporary reason is the occurrence of "chance" fluctuations, which are variations resulting from the sum of minor positive and negative forces which are not considered separately. In theory, these variations cancel each other over a period of time, but in the short run either the positive or the negative forces may dominate the situation and produce a divergence from the forecasted figures.

The forecast may be wrong for a more permanent kind of reason, one that means the forecast will

10. McGowan, Sales Forecasting, p. 103
remain faulty. This may be the result of incorrect interpretation of correct data or be an unforeseen development in the general economy. Sometimes such errors appear when the forecaster was unaware of some happening either in his company or in the industry when he made the forecast.

Serious defects of this type usually mean that the forecast must be redone. It may be possible to adapt the present forecast if only one factor is different and if that factor is so simple in effect that a single alteration will correct the forecast. Such a situation seldom occurs. The errors usually require that a new forecast be made.

An opportunity to study factors affecting sales is presented whenever a forecast is reviewed. The forecaster can discover for management what is happening to the company and the industry. A company that has forecast reviews may learn the increasing significance of a marketing factor long before companies that do not have forecast reviews. If the company learns of a weakness in a single product, in a product group or in a channel of distribution, the weakness can be rectified before serious consequences result.
A factor that must be assessed when a forecast is reviewed is new information that has not yet affected actual sales. When the forecaster holds conferences with the sales organization, interviews other departments about product, price and supply, and diligently searches for information concerning the industry and the general economy he is sure to discover some information that was not in his possession when he made the forecast.

The new information may be concerned with a variety of subjects. The general business outlook may have changed in an unexpected manner since the forecast was made, the economic situation or the needs of customers may have changed. The outlook for industries that buy from the industry being forecast needs special study. The future trend of the customers' business may be indicated by reports covering the value of construction contracts, by the number of requests for mortgage appraisals or by similar reports. The forecaster should not fail to become familiar with estimates made within the industry that buys his company's products, because the forecast within the industry will be used as
a basis for that company's planning and buying.

The correct way to proceed with a new forecast is to start with the pieces and put them together. Recent sales in each segment of the industry must be studied in detail product by product, channel by channel, and, wherever possible, market by market. These segments are then formed into a total forecast.

VI. CONTROL AFTER THE FORECASTED PERIOD

When a forecast is discarded for a new one, many forecasters have no more interest in the old forecast. Some forecasters would like to examine the past forecast but do not know what to do. Whether a forecaster wishes to examine the past forecast or not, he cannot unless he kept detailed records during the preparation of the forecast. If adequate records have been kept the appraisal can be conducted in the following manner.

First, the forecaster must obtain from management a definite opinion concerning the margin of error that is acceptable in the forecast. Then department heads should be consulted regarding

11. MacGowan, Sales Forecasting, p. 105.
their opinions on the margin of error acceptable in connection with operations under their direction. Second, the margin of error should be considered in relation to the cost of the forecasting program because the greater the cost the greater the degree of accuracy that should be expected.

Statements are sometimes made in the business press concerning general limits of error in forecasts. Forecasters do not find these statements useful. Generalizations cannot be made about forecast errors, for each error depends upon the environment of the firm or industry in which the error occurred. In every case the acceptable error depends upon such factors as the time period covered and the product mix.

The third step in the appraisal process is to apply these opinions to the errors in the past forecast in an effort to learn the cause of each error. These efforts are not always successful because many variables that cannot be measured are usually present during a forecasted period. However, many of the errors can be explained.

If the forecaster obtains assistance from others in the firm and records all important details he is in a position to improve his subsequent forecasts.

A forecaster may take one of two courses of action if his forecasts need to be improved. He may change his present forecast or change his method of forecasting. If he changes his forecast he may either revise or reforecast, but the latter procedure is more common. Reforecasting usually proves satisfactory provided the forecaster recorded every detail and opinion that influenced the forming of the estimates, and provided he was thorough in his efforts to trace the causes of his errors. Almost any forecasting program can be improved, the problem is to decide how much time and money can be justifiably spent on the process. If the decision is made to change the forecasting method this should be done before the next forecasts are prepared. In many firms the methods used are temporary arrangements, anyway, except where a forecaster has been employed by a firm for several years. Because the records of most forecasters

13. Crawford, Sales Forecasting, p. 60.
are incomplete so far as assumptions, methods, and so on are concerned, and because forecasters generally tend to avoid statistical techniques, advances in the area of forecasting control are dependent upon a few firms.
CHAPTER VI

MAKING THE SALES FORECAST

This chapter will show the development of sales forecasts of softwood plywood for Crown Zellerbach Company for the years 1964 and 1968. First we shall discuss typical uses of plywood and mention materials that are competitors of plywood. This will be followed by a development of various predicting equations and the equation that appears most desirable will be used for forecasting sales in the plywood industry. The next step will be to forecast plywood sales for 1964 and 1968. Then we shall predict the share of the total market that Crown Zellerbach can expect to capture.

I. PRODUCT HISTORY

The first commercial production of plywood in Canada started at Fraser Mills, British Columbia, in 1910. In 1961 there were seventy-five plants throughout Canada classed in the Veneer and Plywood industry group as follows:

There are two basic types of plywood—softwood and hardwood. Most of the softwood plywood that is produced is made from Douglas fir but a small amount of plywood is made from hemlock and white pine. Nearly all the softwood plywood produced in Canada is manufactured in British Columbia. Hardwood plywood is produced in the eastern provinces and is made from birch, maple, basswood and elm.

II. TYPICAL USES OF PLYWOOD

By a sizeable margin the construction industry is plywood's biggest customer. Some of the uses to which plywood is put in construction are presented below.

1. Form Work - Strong, waterproof glue fir plywood panels are required for form work. Because the panels are large, uniform in size, and of relatively light weight, they can be handled easily and erected quickly on a variety of jobs from the construction of conventional house foundations to complex bridges, dams and highway overpasses.
A fir plywood panel can be used for as many as fifty concrete pours and still be used for a long time on the construction site for ramps, runways, fences or crew huts.

2. Sheathing - A large volume of fir plywood is sold as sheathing for roofs, walls and floors. Sheathing must have outstanding bracing ability and possess great resistance to racking, and it must have high lateral nail-bearing strength and be easily handled for fast erection. Plywood is rigid, possesses nail-bearing strength due to cross-laminated panel construction and is easily handled because of lightness and size, so makes ideal sheathing.

3. Prefabrication - The factory production of large-sized building components is called prefabrication. Fir plywood has properties that lend themselves perfectly to prefabrication. In fact prefabrication has made great strides ever since fir plywood was developed. In North America, prefabricated walls, floors, ceiling and roof panels for houses and commercial buildings are


nearly always built of solid wood framing members covered with plywood skins.

Structural components made of plywood in arch and many other forms are enabling contemporary architects to use new forms of expression and at the same time are providing building developers with opportunities to economize in material and labor costs.

4. Agriculture - On the farm plywood can be used in more ways than any other building material. Fir plywood can be used for inside and outside jobs in the construction of barns, feeders, silos and storage units. There is wide scope for a clear-span structure that can be erected by farm hands and such a structure can be built of lumber frames joined by plywood gussets to form a three-hinged arch.

5. Industrial - The combination of great strength and light weight makes fir plywood an excellent choice for industrial purposes. High resistance to racking combined with low weight makes fir plywood ideal for all types of industrial packaging.

5. PMABC, Canadian Douglas Fir Plywood, p. 10.
Plywood crates are scientifically designed for shipping goods of all kinds from fragile precision instruments to jet engines. The use of plywood pallet boxes makes the handling and storing of many kinds of foods much easier. Plywood is sold for making temporary screens or partitions, and far outsells any other material for making shelves. Because of good structural properties at a reasonable price plywood is used in thousands of ways by North American industries.

III. COMPETITIVE PRODUCTS

Plywood has many competitors. For exterior sheathing plywood competes with shiplap, masonry and stucco; for interior use plywood is superceded by plaster except in basement and attic; for sub-flooring and underlayment fir plywood and shiplap are equally popular. Some newer products such as fiberglass, aluminum, steel and plastics are taking a portion of the market.

The rigid insulating board industry, which competes with the plywood industry, covers asphalted sheathing board, building board (in natural or coated

6. PMABC, *Canadian Douglas Fir Plywood*, p. 11
panels), roof insulation board, decorative board (tile or plank form, including acoustical tile), other boards and asbestos. Plywood's principal competitor is probably asphalted sheathing board which is believed to be used mainly for house wall sheathing. (See Table I)

Semi-hardboard competes with plywood for use under tile floors, with sanded grades of plywood for wall panelling, and sometimes with plywood for grain bin linings. (See Table II)


TABLE I

Domestic Shipments of Rigid Insulating Boards
(Square feet 1/2" basis)

<table>
<thead>
<tr>
<th>Year</th>
<th>Building Boards</th>
<th>Asphalted Lath for Plaster</th>
<th>Roof Insulation</th>
<th>Other Rigid Boards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1953</td>
<td>108,997,145</td>
<td>52,895,230</td>
<td>19,243,862</td>
<td>65,854,751</td>
</tr>
<tr>
<td>1954</td>
<td>100,273,269</td>
<td>55,928,778</td>
<td>15,001,148</td>
<td>76,555,220</td>
</tr>
<tr>
<td>1955</td>
<td>97,552,187</td>
<td>70,178,551</td>
<td>12,211,787</td>
<td>86,952,548</td>
</tr>
<tr>
<td>1956</td>
<td>111,697,922</td>
<td>83,560,324</td>
<td>7,112,871</td>
<td>100,013,364</td>
</tr>
<tr>
<td>1957</td>
<td>90,306,788</td>
<td>68,143,153</td>
<td>5,013,069</td>
<td>98,354,839</td>
</tr>
<tr>
<td>1959</td>
<td>74,592,115</td>
<td>89,414,382</td>
<td>152,275,921</td>
<td>78,371,472</td>
</tr>
<tr>
<td>1960</td>
<td>61,290,396</td>
<td>78,909,381</td>
<td>156,069,631</td>
<td>70,362,103</td>
</tr>
<tr>
<td>1961</td>
<td>57,188,897</td>
<td>83,863,624</td>
<td>149,238,124</td>
<td>89,308,596</td>
</tr>
<tr>
<td>1962</td>
<td>54,519,168</td>
<td>91,081,701</td>
<td>181,868,995</td>
<td>97,563,784</td>
</tr>
<tr>
<td>1963</td>
<td>59,377,398</td>
<td>100,907,522</td>
<td>185,032,631</td>
<td>101,809,283</td>
</tr>
</tbody>
</table>

### TABLE II

Canadian Semi-Hardboard Production and Shipments

<table>
<thead>
<tr>
<th>Year</th>
<th>Production (Sq. ft., 1/8&quot; basis)</th>
<th>Shipments Domestic (Sq. ft.)</th>
<th>Shipments Export (Sq. ft., 1/8&quot; basis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1952</td>
<td>17,012,468</td>
<td>15,983,132</td>
<td></td>
</tr>
<tr>
<td>1953</td>
<td>23,072,928</td>
<td>20,576,741</td>
<td>373,264</td>
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<tr>
<td>1954</td>
<td>29,234,912</td>
<td>21,725,269</td>
<td>8,481,024</td>
</tr>
<tr>
<td>1955</td>
<td>79,330,419</td>
<td>45,825,893</td>
<td>35,452,572</td>
</tr>
<tr>
<td>1956</td>
<td>105,531,480</td>
<td>64,806,041</td>
<td>40,233,440</td>
</tr>
<tr>
<td>1957</td>
<td>104,531,385</td>
<td>67,137,236</td>
<td>39,969,152</td>
</tr>
<tr>
<td>1958</td>
<td>105,715,675</td>
<td>92,214,502</td>
<td>15,756,142</td>
</tr>
<tr>
<td>1959</td>
<td>123,324,122</td>
<td>102,442,287</td>
<td>23,135,816</td>
</tr>
<tr>
<td>1960</td>
<td>127,067,173</td>
<td>117,328,657</td>
<td>11,580,339</td>
</tr>
<tr>
<td>1961</td>
<td>144,809,587</td>
<td>137,827,246</td>
<td>15,615,530</td>
</tr>
<tr>
<td>1962</td>
<td>174,475,530</td>
<td>155,531,795</td>
<td>19,237,514</td>
</tr>
<tr>
<td>1963</td>
<td>159,675,136</td>
<td>147,383,866</td>
<td>24,411,948</td>
</tr>
</tbody>
</table>

IV. HISTORY OF CROWN ZELLERBACH
BUILDING MATERIALS, LIMITED

Crown Zellerbach Building Materials Limited, presently owned by Crown Zellerbach (Canada) Limited, originated in the latter part of the nineteenth century on the banks of the Fraser River and was called the McLaren Mill.

From 1905 to 1908 the McLaren mill was rebuilt and enlarged under the name of Fraser River Sawmills. In 1909 there was a shortage of skilled sawmill workers so the company brought out from Quebec one hundred ten workmen and their families. These people settled in an area close to the millsite and started the French-speaking community of Maillardville. In 1910 the company was reorganized under the name of Canadian Western Lumber Company, Limited.

During the next three years the sawmill was modernized, a door factory was added, more homes were built in the townsite known as Fraser Mills. Approximately one hundred fifty retail outlets were

purchased to include the prairie provinces in the company's market. In 1913 the plywood plant was completed and was the first of its kind in Canada.

Canadian Western became an affiliate of Crown Zellerbach, Canada, Limited in 1953 and the name was changed to Crown Zellerbach Building Materials, Limited.

Today this plant is a modern up-to-date plant barking approximately 1,400 logs per day, cutting 550,000 feet of lumber per day, turning out 420,000 square feet of plywood per day (3/8" basis) and cutting 400 squares of shingles per day.

The company's head office is in Vancouver, and other field offices are in Calgary, Winnipeg, Waterloo, Toronto and Montreal. Sales representatives cover the entire country.

In 1961 the Fraser Mills plywood plant of Crown Zellerbach, Canada, Limited embarked on a $1.5 million expansion program. In 1962 the plywood plant set an all-time production record of 103 million square feet. A $2 million modernization of the Fraser Mills sawmill division was started during 1962,
V. PREPARING TO FORECAST

To make forecasts of plywood sales the technique to be used must be selected. To prepare 1964 and 1968 forecasts of plywood sales for Crown Zellerbach Company procedures that culminate in regression equations were chosen. At present, forecasts of plywood sales in this company are prepared by sales forecasters who use personal judgment based on an analysis of all available pertinent information, as well as on the opinions of field representatives. Personal judgment plays an important role in the method presently used by the company, but in this study personal judgment is placed in a minor role with the major responsibility for the forecast being placed in statistical equations. The object of the study is to find one or more estimating equations which show the relationship between the dependent variable, domestic softwood plywood sales, and one or more independent variables. The

independent variables that have been chosen were selected because on the basis of knowledge and logic they appear to be the major factors controlling the volume of plywood sales. The resulting predicting equations are developed on the basis of statistical analysis.

The independent variables used in preparing the forecasting equations are gross national product, personal expenditure on consumer goods and services, residential construction, industrial construction, commercial construction and institutional construction. These factors were chosen because they are believed to play an important part in determining the sales of plywood. The specific reasons for choosing each of these factors are discussed in the following paragraphs.

Gross National Product

About 27 per cent of total plywood sales are made to homeowners who use the product for renovations, repairs and do-it-yourself projects.

11. The percentage of total plywood sales purchased by various groups in the economy was provided in a personal interview with Mr. D. Owen of Crown Zellerbach Company.
The amount of money spent on plywood by homeowners is believed to be related to their incomes. Individual incomes are incorporated in the national income and the latter bears a close relationship to the Gross National Product. Therefore there appears to be a relationship between plywood sales to homeowners and the Gross National Product.

Farmers purchase approximately 11 per cent of the plywood sold in Canada. The amount of money that farmers spend on building and repairing is determined to a considerable extent by their incomes. Again there is a relationship between income and Gross National Product and again there is justification for assuming that a relationship exists between plywood sales to farmers and Gross National Product.

Industry is estimated to use 27 per cent of the plywood sold. The amount of plywood purchased by industry is influenced by the pace of industrial activity. Since the industrial activity of the country is reflected in the Gross National Product there again appears to be a definite relationship between the amount of plywood used by industry and the Gross National Product.
Gross National Product figures have been available for some time and will continue to be available. Gross National Product figures of the past, though based on a large number of estimates, are generally considered to be reasonably accurate. In addition, estimates of these figures are continually being made available by economists.

Residential Construction.

Residential contractors use about 23 per cent of the plywood sold. Figures for residential construction have been published by the Dominion Bureau of Statistics for many years. Similar figures will be available in the future and they are certain to be as accurate as the figures have been in the past.

Non-residential Construction

About 13 per cent of the plywood sold was used for non-residential construction and a large part of the 13 per cent appears to have been used for industrial, commercial and institutional construction. For many years now the Dominion Bureau of Statistics has published annual dollar
figures for these three segments of the construction industry.

**Personal Expenditure on Consumer Goods and Services**

As previously stated, there appears to be a close relationship between Gross National Product and plywood sales and this close relationship justifies the incorporation of GNP into an estimating equation for plywood sales. But when other factors are incorporated into the equation, such as residential, industrial, commercial and institutional construction, the inclusion of GNP produces a problem, because GNP includes the total dollar figures spent on residential, industrial, commercial and institutional construction. As a result the inclusion of both GNP and construction figures in the same equation results in some double counting. In an attempt to decrease the amount of double counting, GNP can be replaced with Personal Expenditure on Consumer Goods and Services. When this is done only the residential construction figures are counted twice.

**Selection of the Estimating Equations**

Current annual dollar figures and constant 1957 annual dollar figures were acquired for GNP
and personal expenditure on consumer goods and services. Current annual dollar figures also were obtained for residential, industrial, commercial and institutional construction. In addition, Canadian annual softwood plywood consumption figures were acquired. For all seven series of data the figures covered the years 1943 to 1962.

The construction figures were then re-stated in terms of 1957 dollars. (see Tables III and IV).

When all seven series of data were examined, the trend line that seemed to fit each series of data best was a straight line. As a result this investigator decided that simple and multiple linear regression equations would be developed in order to forecast softwood plywood sales for the years 1964 and 1968.

12. The deflators that would convert GNP current dollar figures into constant 1957 dollar figures were determined. After this was done, the construction figures in current dollars were multiplied by their appropriate deflators. This resulted in the construction figures being re-stated in constant 1957 dollars.

13. The first step in the selection of the curve type was the plotting of each series of data on graph paper. When this was done, it was possible by inspection to discover that in each case the appropriate line to be fitted was a straight line. This conclusion was verified by determining that the "first-order differences" for each of the various series of data were constant.
It was decided that four regression equations would be developed. In all four equations the dependent variable is plywood sales. The first equation is a simple linear regression equation with GNP as the independent variable. The second, third and fourth equations are multiple linear regression equations. The independent variables in the second equation are residential, industrial, commercial and institutional construction. In the third equation the independent variable personal expenditure on consumer goods and services is added to the four construction series. The fourth equation contains five independent variables - GNP, residential, industrial, commercial and institutional construction.

14. The simple regression equation was developed by hand but the multiple regression equations were produced by an IBM 1620 electronic computer. Instructions necessary for informing the computer how to prepare the desired multiple regression equations were programmed into the computer.

In addition, it was decided that certain information about the equations should be made available. The coefficient of correlation and the standard error of estimate were to be determined for the simple regression equation. The coefficients of correlation, the coefficients of multiple determination, and the standard errors of estimates were to be acquired - with the aid of the computer - for the multiple regression equations.
## TABLE III
Dependent and Independent Variables

<table>
<thead>
<tr>
<th>Year</th>
<th>GNP (000)</th>
<th>RESIDENTIAL (000)</th>
<th>INDUSTRIAL (000)</th>
<th>COMMERCIAL (000)</th>
<th>INSTITUTIONAL (000)</th>
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<tbody>
<tr>
<td>1943</td>
<td>$11,088,000</td>
<td>$63,684</td>
<td>$142,516</td>
<td>$38,873</td>
<td>$13,148</td>
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<td>1944</td>
<td>11,850,000</td>
<td>83,928</td>
<td>75,862</td>
<td>29,918</td>
<td>21,006</td>
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<tr>
<td>1945</td>
<td>11,835,000</td>
<td>125,524</td>
<td>88,743</td>
<td>39,682</td>
<td>30,448</td>
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<tr>
<td>1946</td>
<td>11,850,000</td>
<td>193,627</td>
<td>157,573</td>
<td>84,894</td>
<td>48,624</td>
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<tr>
<td>1947</td>
<td>13,165,000</td>
<td>233,303</td>
<td>204,964</td>
<td>143,246</td>
<td>73,361</td>
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<td>1948</td>
<td>15,120,000</td>
<td>255,756</td>
<td>242,832</td>
<td>166,073</td>
<td>121,421</td>
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<td>1949</td>
<td>16,343,000</td>
<td>356,562</td>
<td>215,664</td>
<td>199,266</td>
<td>174,462</td>
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<tr>
<td>1950</td>
<td>18,006,000</td>
<td>508,525</td>
<td>274,849</td>
<td>211,763</td>
<td>206,219</td>
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<td>1951</td>
<td>21,170,000</td>
<td>1,042,000</td>
<td>393,000</td>
<td>359,000</td>
<td>291,000</td>
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<td>1952</td>
<td>23,995,000</td>
<td>1,029,000</td>
<td>422,000</td>
<td>326,000</td>
<td>314,000</td>
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<td>1953</td>
<td>25,020,000</td>
<td>1,297,000</td>
<td>402,000</td>
<td>502,000</td>
<td>343,000</td>
</tr>
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<td>1954</td>
<td>24,871,000</td>
<td>1,400,000</td>
<td>364,000</td>
<td>546,000</td>
<td>377,000</td>
</tr>
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<td>1955</td>
<td>27,132,000</td>
<td>1,735,000</td>
<td>398,000</td>
<td>513,000</td>
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<td>1956</td>
<td>30,585,000</td>
<td>1,902,000</td>
<td>604,000</td>
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<table>
<thead>
<tr>
<th>Year</th>
<th>Personal Expenditures on Consumer goods and Services (000)</th>
<th>Plywood Sales (sq. ft. 3/8&quot; basis) (000)</th>
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<td>$5,727</td>
<td>162,500</td>
</tr>
<tr>
<td>1944</td>
<td>6,187</td>
<td>181,667</td>
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TABLE IV
Variables in Constant 1957 Dollars

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<th>INDUSTRIAL</th>
<th>COMMERCIAL</th>
<th>INSTITUTIONAL</th>
<th>PERSONAL EXPENDITURE ON CONSUMER GOODS AND SERVICES</th>
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<tr>
<td></td>
<td>(000)</td>
<td>(000)</td>
<td>(000)</td>
<td>(000)</td>
<td>(000)</td>
<td>(000)</td>
</tr>
<tr>
<td>1943</td>
<td>$20,317,000</td>
<td>$116,669</td>
<td>$261,089</td>
<td>$71,215</td>
<td>$24,087</td>
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<tr>
<td>1944</td>
<td>21,071,000</td>
<td>149,224</td>
<td>134,883</td>
<td>53,194</td>
<td>37,349</td>
<td>11,000,000</td>
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<td>20,575,000</td>
<td>213,161</td>
<td>154,235</td>
<td>68,967</td>
<td>52,919</td>
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<td>334,380</td>
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<td>496,480</td>
<td>18,606,000</td>
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<td>1,959,060</td>
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<td>588,130</td>
<td>468,650</td>
<td>19,398,000</td>
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<td>519,000</td>
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<td>453,755</td>
<td>675,369</td>
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<td>23,715,000</td>
</tr>
</tbody>
</table>

Source: Developed from Table III by multiplying the various figures by their appropriate deflators.
Least-squares Method

The method that is used in this study for fitting the straight lines to the numerical data is known as the method of least squares. The criterion of least squares demands that the line that is fitted to the data be such that the sum of the squares of the vertical deviations from the points to the line be a minimum. While this method is used almost universally for fitting lines to numerical data it has not escaped criticism because the assumptions this method makes about the data are not always correct. The least squares method requires that the independent variables be independent of each other, that is, that they not be strongly intercorrelated. There should be no auto-correlation within the various independent series. It also is assumed tacitly that there are no observational errors, that is, that the statistical data dealt with are based on measurements that are exact. This method assumes that the dependent variable is dependent and plays no part in influencing the size of the independent variables.


When these assumptions are not met the regression equation that is developed from the least squares technique can produce biased results. However, the extent of error may not be very serious and a forecasting equation developed by another technique may produce equally biased results. Since the least squares technique is well known, easy to use and usually produces results as acceptable as any other method, the investigator is justified in using this method for fitting straight lines (and other curves) to numerical data.

**End-use Index Method**

The independent variables used in this study are not the only variables that could be or have been used to forecast plywood sales. In *Business and Economic Forecasting* a predicting equation was developed to forecast plywood sales in the U.S. One of the independent variables incorporated into the equation was an end-use index. In order to develop the end-use index the various markets for plywood were defined and measured. Then the respective

17. Wold, *Demand Analysis*, p. 28.

markets were weighted by the proportion of total plywood sales consumed by each of these markets during the early nineteen-fifties and were then combined in an additive manner to form the final end-use index. The end-use index method takes into account the varying rates of growth in the different end-use markets but the method used in this essay does not do this. Moreover, neither method takes into account changes in the percentage of the total plywood sales consumed by the various markets over a period of time.

The end-use index method is not used in this essay because certain necessary information is not available. To use this method the forecaster must know what the various end-use markets are and he must possess total yearly consumption figures for each of the markets. This type of information is not available on plywood sales in Canada. The forecaster must also know the percentage of total plywood sales consumed by each of the end-use markets, and this information is not available for the Canadian plywood market. As a result, a forecast based on an end-use index was not developed because collecting information about the total
dollar consumption figures for each of the plywood markets and the percentage of total plywood sales consumed by each of the end-use markets would require a separate extensive study.

VI. MAKING THE INDUSTRY FORECASTS

A presentation and discussion of the four regression equations and pertinent information about these equations will now be provided. The first equation to be developed was the simple linear regression equation. A simple linear regression equation is of the form \( y = a + bx \). Here \( a \) and \( b \) are numerical constants and once they are known a predicted value of \( y \) for any given value of \( x \) can be calculated by direct substitution. In the simple linear equation developed for this study GNP is the independent variable and plywood sales the dependent variable. In this particular case the regression equation takes the form

\[
y = -282,148 + .03317 X_1
\]

The standard deviation about a line of average relationship, being a measure of the accuracy of the estimates, is called the standard error of
19. Given an approximately normal distribution of items about the line of relationship, 68 per cent of all the cases will be within a range of $\pm S$, 95 per cent will fall within $\pm 2S$ and 99 per cent will fall within $\pm 3S$. If there were no scatter about the line fitted to the points representing the corresponding value of $X$ and $Y$, $S$ would have a value of zero, and the value of $Y$ could be estimated from the value of $X$ with perfect accuracy. The less the dispersion about the least-squares line, the smaller the value of $S$. The value of $S$ serves, therefore, as an indicator of the significance and usefulness of the line which describes the relationship between the two variables. The standard error of estimate for the simple regression equation is

$$Sy = 36,853,000 \text{ sq. ft.}$$

The coefficient of correlation is a measure of the goodness of fit of the least-squares line. If the fit is poor, the coefficient of correlation will be close to 0. If the fit is good, the


The coefficient of correlation will be close to +1 or -1. The coefficient of correlation \((r)\) for the equation is

\[ r = .994 \]

Since \(r\) is close to 1, we can say that the fit of the least-squares line is extremely good. There is a strong linear relationship between \(X\) and \(Y\).

A multiple linear regression equation is of the form

\[ y = a + bx_1 + cx_2 + dx_3 \]

The second equation, a multiple linear regression equation, takes the form

\[ Y = 162,693 + .06637X_3 - .55849X_4 + .03608X_5 + 1.34605X_6 \]

where \(X_3\) is residential construction, \(X_4\) is industrial construction, \(X_5\) is commercial construction and \(X_6\) is institutional construction.

After working out the equation by which the values of one variable may be estimated from those

of several independent variables, it is desirable to have some measure of how closely such estimates agree with the actual values and of how closely the variation in the dependent variable is associated with the variation in the independent variable.

The standard error of the estimate for a multiple regression equation measures the closeness with which the estimated values agree with the original values.

\[ Sy = 93,281,000 \text{ sq. ft.} \]

The coefficient of multiple determination is the square of the coefficient of multiple correlation. The coefficient of multiple determination \((R^2)\) offers a measure of the proportion of the variation in the dependent factor which can be explained by, or is associated with, variation in the independent factors.

\[ R^2 = .930 \]

Since \( R^2 \) is close to 1 the fit of the least-squares line is extremely good.

The third equation, a multiple linear regression equation, takes the form

\[ Y = -659,579 + .07452X_2 + .14958X_3 - .33454X_4 - .51256X_5 + .21947X_6 \]


where \( X_2 \) is personal expenditure on consumer goods and services, \( X_3 \) is residential construction, \( X_4 \) is industrial construction, \( X_5 \) is commercial construction and \( X_6 \) is institutional construction. The Standard Error of Estimate is

\[
Sy = 69,183,000 \text{ sq. ft.}
\]

The Coefficient of Multiple Determination is

\[
R^2 = .964
\]

Since \( R^2 \) is close to 1 the fit of the least squares line again is extremely good.

The final multiple linear regression equation takes the form

\[
Y = -185182 + .05079X_1 - .08086X_3 - .30121X_4
+ .21172X_5 + .23431X_6
\]

where \( X_1 \) is Gross National Product, \( X_3 \) is residential construction, \( X_4 \) is industrial construction, \( X_5 \) is commercial construction and \( X_6 \) is institutional construction.

The Standard Error of Estimate is

\[
Sy = 59,101,000 \text{ sq. ft.}
\]

The Coefficient of Multiple Determination is

\[
R^2 = .974
\]

Since \( R^2 \) is close to 1 the fit of the least squares line is extremely good.
In all four equations the least squares technique produces an excellent fit. However, in each of the multiple regression equations one or more of the constants associated with the independent variables are negative. Since the coefficients of correlation between each of the independent variables and the dependent variable are positive (see Table V), one would expect all of the constants to be positive. Because the multiple regression equations contain these negative figures when all of the coefficients of correlation are positive, one or more of the assumptions underlying the use of the least squares technique and the regression equation has not been met. From Table V it can be seen that the coefficient of correlation between pairs of the independent variables are extremely high. This indicates that there is a considerable amount of intercorrelation between these variables. But a basic assumption underlying the use of the least squares technique is that there must be no intercorrelation between pairs of independent variables. The failure to meet this prerequisite probably accounts for the undesirable presence of the negative figures in the equation.
None of the multiple linear regression equations produce a better fit to the data than the simple regression equation and they contain negative figures that should not be present. Only the simple linear regression equation is reasonable and logical. As a result, it seems desirable to select this regression equation for use as the forecasting model.
TABLE V
Coefficients of Correlation For the Dependent and Independent Variables

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<th>04</th>
<th>05</th>
<th>06</th>
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<td>.975</td>
<td>.906</td>
<td>.583</td>
<td>.918</td>
<td>.952</td>
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</table>

Source: Analysis of the six independent series of data and the single dependent series of data.
VII. CANADIAN ECONOMY

Since the simple regression equation containing Gross National Product as the independent variable is to be used to forecast plywood sales, it seems desirable that the recent history of the Canadian economy be reviewed. A knowledge of Canada's economic history may shed some light on the future path to be followed by the economy and thus make a Gross National Product prediction more accurate or at least make it easier to justify a forecasted Gross National Product.

Since World War II, growth in the Canadian economy has been phenomenal. In constant dollar terms the GNP increased by 124 per cent between 1939 and 1945, which is an annual compound rate increase of 5.16 per cent. The per capita Gross National Product increased in real terms by 61 per cent, or at an annual compound rate of 3.04 per cent. During this same period the index of industrial production increased by 142 per cent or at an annual compound rate of 5.68 per cent. Growth of this magnitude was possible because of concurrent growth in the basic

24. Canada, Royal Commission on Canada's Economic Prospects, Queen's Printer, 1958, p. 79.
factors of production. The population increased rapidly resulting in an increase in the labor force, and a large amount of capital became available for the exploration and development of natural resources. The greatest increase in economic expansion, however, was in the area of secondary manufacturing. The two factors largely responsible for this expansion were the absence of foreign competition and the development of improved methods and materials as a result of intensified research. It is estimated that between 1939 and 1944 the output of secondary manufacturing industries increased by 160 per cent.

As might be expected, government expenditure provided the chief stimulus to economic expansion during the war years. Government expenditure on goods and services, including exports directly or indirectly financed by government, represented about 40 per cent of the Gross National Product.

After the end of the war, when the economy was being converted to peacetime production, and on through

1949 when the total output again began to rise, the principal stimulus to economic growth and activity appears to have been consumer expenditure. At the war's end there was a large backlog of unsatisfied consumer demand and a sizeable accumulation of personal savings. As levels of consumer income remained fairly constant the consumer demands and available savings combined to cause such a stream of consumer spending that the economy shifted from a wartime to a civilian basis without either an undue decline in output or a disturbing increase in unemployment.

Although consumer demand seems to have provided the main economic stimulus from 1945 to 1949, private investment and external demand exerted a strong influence during those years. New housing developments appeared on the edges of Canadian cities and these housing developments have been increasing ever since. Farmers bought combines and tractors in such numbers that farming procedures in the prairie provinces were completely changed.

The outbreak of war in Korea in 1950 resulted in

extensive export demand accompanied by heavy capital
spending and another economic boom came into being.
This period saw the continuation of a strong demand
for consumer goods. The fact that there was a wide
distribution and a levelling up of incomes throughout
the population enabled consumers to satisfy many of
their desires.

By 1955 Canada had developed a much more diversified
economy than she had in 1939. A large number of new
industries were firmly established and secondary
manufacturing occupied a stronger position in the
economy than it had ever done before. In addition,
the sources of raw materials were greatly extended.
Commodities exported in significant volume covered a
wider range than they had done previously, but total
exports accounted for a much smaller segment of the
Gross National Product than they had done in 1939.
This was caused by the declining importance of agric­
ultural exports in relation to total output.

During 1955 Canada recovered rapidly from the
mild contraction that existed from the middle of 1953
to the middle of 1954. In the latter part of 1954
the output of goods and services began to rise and
continued to rise so that the output for 1955 was
ten per cent greater than the output for 1954. In 1955 and 1956 there was a great increase in the nation's production but in 1957 there was a noticeable levelling off in the rate of economic activity.

The great increase in the outlays of investment capital that characterized 1955 and 1956 moderated in 1957, investment in machinery and other equipment declined in the last three-quarters of the year and outlays for non-residential construction decreased. However, after a series of declines, residential construction began to increase during 1957.

During 1958 economic activity as a whole increased, and the Gross National Product gradually resumed an upward course. By the second quarter of the year the upward trend was more firmly established and by the closing quarter it had begun to gather momentum. During 1959 improvement continued on a broad front.

There was a slackening of economic activity during the first quarter of 1960 followed by a slight decline in the second quarter which caused a small decrease


in the Gross National Product, when seasonal factors are taken into account. Nevertheless, aggregative measures of activity were higher than those for the same period of 1959. The slackening of activity during the first half of 1960 was related to a major decrease in housebuilding and to a decrease in the rate of accumulation of stocks. By the fourth quarter of 1960, however, economic activity once again resumed an upward trend. Support for this trend came mainly from expansion in government outlays for goods and services, and from a sharp increase in the demand for Canadian export products.

The advance in Gross National Product was resumed in 1961. The first quarter of the year was weak but the level of activity moved on a rising trend for the rest of the year. One of the characteristics of this upward trend was a sharp increase in imports. Furthermore, during the latter half of the year business inventories showed a modest improvement and consumer expenditures increased at a moderate rate. Outlays for goods and services by the government continued to bolster the economy throughout 1961.

1962 proved to be another good year in terms of output. The Gross National Product increased eight per cent in value and six per cent in physical volume, and real output per person increased markedly for the first time since 1956. The volume of production increased during the first half of the year and prices increased during the second half of the year, the latter due partly to the depreciation of the Canadian dollar. The increased activity was widespread geographically and in variety of employment and received further impetus because of a good wheat crop in the fall. The important stimulus, however, were a sizeable increase in merchandise exports and an important increase in the outlays of goods and services by provincial and municipal governments.

Business conditions in Canada remained favorable throughout 1963. The flow of exports exerted an influence that permeated business and industry. The construction industry operated successfully and farm income was good. There was little incentive to stock up on inventories and the supply of goods and labor was adequate.

The Gross National Product for 1963 was about 6.6 per cent above the 1962 level. There was some increase in prices as higher costs worked their way through the price system, but most of the increase in GNP was in real output. Production, employment, incomes, profits, consumption and foreign trade reached record high levels during the year. Capital spending in the business sector of the economy was at an all-time 32 high in terms of current dollars.

At a forum of members of the National Industrial Conference Board a panel of economists predicted that Canada's Gross National Product for 1964 will be 33 $44.6 billions, a gain of 4.5 per cent over 1963. Only about one per cent of this increase is likely to result from price rises. The panel further predicted that spending for consumer goods and services will total $28 billion, a rise of four per cent over the estimated expenditure for 1963. One economist expressed the opinion that spending on consumer durables which reached a peak in the second quarter of 1963 when spending ran at an annual rate of 3.1 billion.


probably not reach that rate again in 1964. Another economist decided that the boom in the car market is losing momentum. There will probably be a four per cent gain in spending on non-durables, one per cent of which will be caused by price increases. Food prices are expected to rise two per cent and clothing prices one per cent.

Government spending is sure to strengthen the economy during 1964, but the second half of the year may show a firmer trend than the first half. Federal expenditures on goods and services will increase slightly to $3.2 billion, while provincial and municipal expenditures will increase by approximately 9.5 per cent to $5.7 billion, which is a rise of seven per cent over the 1963 estimated level.

One economist suggested that 1964 be regarded as the threshold to another period of vigorous investment expansion, another gave 1965 as the starting year.


Differences of opinion regarding the timing of this expansion resulted in estimates of a one per cent decline for 1964 to an eight per cent increase in capital spending.

An averaging of the forecasts called for an investment of $7.7 billion in 1964, which is a gain of four per cent over 1963.

Housing starts are expected to go down to about 130,000 in 1964, and housing expenditures are expected to slip by two per cent or three per cent. Total exports of goods and services are expected to rise 5.5 per cent to $9.3 billion, while imports will probably rise three per cent to $9.5 billion. This would leave a current account deficit of $200,000,000. The consensus of opinion was that 1964 will be a good year with 1965 or 1966 even better.

The Canadian economy is expected to expand more rapidly in the years 1954 to 1979 than it did in the years 1928 to 1953. Three reasons may be given in support of these expectations.


1. Less Serious Disturbances Expected

During the early part of the period 1928 to 1953 Canada experienced the worst depression in her history. Most other nations of the world suffered from the same disturbance. Canada's long-term economic expansion was seriously retarded for a long time by this depression. This same period included six years of World War II which stimulated greatly both industrial expansion and diversification, but which also channeled a significant proportion of the nation's energies into military purposes. Neither serious depression nor all-out war are expected during 1954 to 1979.

2. More Research and Scientific Work

Industrial research and scientific work influence economic development in Canada far more than they ever did before and they are expected to have considerable effect upon the Canadian economy.


3. Greater Experience and Confidence

Canadian management is more experienced and efficient than it was in the early part of the twentieth century; Canadian workers have acquired greater and more varied skills and capital equipment is available in larger quantities and Canadian citizens are more confident concerning the country's future economic achievements.

Despite the knowledge and research that are utilized in making these predictions the predictions cannot be guaranteed for there are important factors that could prevent Canada from realizing the anticipated development. The economy could be disrupted by a series of crop failures, by serious labor strife or by a breakdown in international trade. If investment expenditures decreased or if growth were temporarily halted a slowdown in Canada's economic growth would result.

VIII. PLYWOOD SALES FOR 1964

The preparation of the domestic softwood plywood sales forecast for 1964 can now be described. Gross

National Product, the independent variable in the forecasting equation, must be determined for the year 1964. The components of GNP are consumption, government spending, investment and foreign trade. These components were collected in current dollars for the years 1948 to 1962, and then, with the aid of the deflators previously mentioned, were converted into constant 1957 dollars. (see Table VI).

Linear trend lines were fitted to these figures using the least squares technique and estimates of the various components were obtained for 1964. For consumption and government and investment spending the figures for the years 1948 to 1962 were used; for foreign trade the figures for the years 1953 to 1962 were used. A shorter time span was used for foreign trade because a basic change seems to have taken place in this area during recent years. Since 1953 there has been a large annual foreign trade deficit.

The figures in 1957 dollars for the various components of the 1964 GNP are as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>25,530,000,000</td>
</tr>
<tr>
<td>Government</td>
<td>7,576,000,000</td>
</tr>
<tr>
<td>Investment</td>
<td>7,630,000,000</td>
</tr>
<tr>
<td>Foreign Trade</td>
<td>-1,005,000,000</td>
</tr>
<tr>
<td>Gross National Product</td>
<td>$ 39,731,000,000</td>
</tr>
</tbody>
</table>
Reference has already been made to the fact that Canadian economists estimate a 1964 GNP of $44.6 billion in current dollars. In terms of 1957 dollars this amount is approximately $39.7 billion, so the two independent estimates are the same in total. Since the trend line produced the same estimated GNP figure as the economists, the GNP figure produced by the trend line will be used for forecasting 1964 plywood sales.

The calculation of the domestic softwood plywood sales forecast for the year 1964 is given below. The simple linear regression equation previously developed and accepted was used for this purpose.

\[ Y = -282,148 + .03317X_1 \]

where \( X_1 \) is Gross National Product and \( Y \) is domestic softwood plywood sales.

\[ Y = -282,148 + .03317 \times (39,731,000,000) \]

\[ Y = 1,317,880,000 \text{ sq. ft.} \]

The sale of softwood plywood in Canada during 1964 is expected to total, 1,317,880,000 sq. ft. of 3/8" basis.
TABLE VI
Components of GNP in Constant 1957 Dollars

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumption (000)</th>
<th>Government (000)</th>
<th>Investment (000)</th>
<th>Foreign Trade (000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1948</td>
<td>$13,049</td>
<td>$2,839</td>
<td>$4,043</td>
<td>517</td>
</tr>
<tr>
<td>1949</td>
<td>13,637</td>
<td>3,175</td>
<td>4,390</td>
<td>189</td>
</tr>
<tr>
<td>1950</td>
<td>14,542</td>
<td>3,349</td>
<td>5,146</td>
<td>-260</td>
</tr>
<tr>
<td>1951</td>
<td>14,759</td>
<td>4,188</td>
<td>5,659</td>
<td>-375</td>
</tr>
<tr>
<td>1952</td>
<td>15,775</td>
<td>5,250</td>
<td>5,675</td>
<td>-55</td>
</tr>
<tr>
<td>1953</td>
<td>16,658</td>
<td>5,251</td>
<td>6,268</td>
<td>-561</td>
</tr>
<tr>
<td>1954</td>
<td>17,044</td>
<td>5,098</td>
<td>5,095</td>
<td>-485</td>
</tr>
<tr>
<td>1955</td>
<td>18,304</td>
<td>5,319</td>
<td>6,137</td>
<td>-931</td>
</tr>
<tr>
<td>1956</td>
<td>19,478</td>
<td>5,664</td>
<td>8,100</td>
<td>-1588</td>
</tr>
<tr>
<td>1957</td>
<td>20,072</td>
<td>5,722</td>
<td>7,566</td>
<td>-1422</td>
</tr>
<tr>
<td>1958</td>
<td>20,707</td>
<td>6,113</td>
<td>6,484</td>
<td>-948</td>
</tr>
<tr>
<td>1959</td>
<td>21,711</td>
<td>6,205</td>
<td>6,900</td>
<td>-1448</td>
</tr>
<tr>
<td>1960</td>
<td>22,357</td>
<td>6,255</td>
<td>6,576</td>
<td>-1136</td>
</tr>
<tr>
<td>1961</td>
<td>23,070</td>
<td>6,544</td>
<td>5,977</td>
<td>-710</td>
</tr>
<tr>
<td>1962</td>
<td>23,915</td>
<td>6,761</td>
<td>6,806</td>
<td>-490</td>
</tr>
</tbody>
</table>

Source: Components of GNP were multiplied by their appropriate deflators.
IX. PLYWOOD SALES FOR 1968

The simple linear regression equation can be used to forecast sales of plywood in Canada during 1968. The size of the independent variable, GNP, must be estimated for this year. For this forecast a different technique is used to calculate GNP. Assumptions are needed of the rate of growth of five economic factors - population, labor force, persons employed, hours worked per week, and output per man hour.

At this point the factors that have determined the size of Canada's population in the past and will determine the rate of growth in the future should be mentioned.

Canada's Population

Many forecasts have been made concerning the size of Canada's population a few years hence. The forecasts vary greatly. The Dominion Bureau of Statistics has produced population projections for 1971 showing that Canada may have a population in that year of twenty-one to twenty-four million. If such a population is to materialize there must be annual growth ratios of 1.97 per cent or 2.73 per cent (compound) respectively.
An approximate rate of population growth can be determined by examining past rates of growth and by considering some of the factors that will have a bearing on the expansion of Canada's population during the next few decades.

1. Birth Rate

Canada's present birth rate is higher than it was before the war. Although there are sure to be fluctuations this upward trend is expected to continue. The second half of the sixties are expected to show more rapid population growth than the first half of the sixties.

2. Death Rate

There has been a steady decline in the Canadian death rate and this decline is expected to continue.

3. Immigration

Since the war levels of immigration have varied with the prosperity of the country. Immigration was at a high rate when the economy was expanding rapidly and was at a low rate when the economy was expanding slowly.

4. Emigration

So long as the economy expands most Canadians

42. Firestone, Growth and Future of the Canadian Market, p. 102.
will find increasing opportunities to prosper in their own country, so emigration is not expected to rise to any great extent.

**TABLE VII**

Number of Families and Number of Households in Canada

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Families</th>
<th>No. of Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951</td>
<td>3,282,445</td>
<td>3,409,295</td>
</tr>
<tr>
<td>1952</td>
<td>3,413,000</td>
<td>3,561,000</td>
</tr>
<tr>
<td>1953</td>
<td>3,477,000</td>
<td>3,675,000</td>
</tr>
<tr>
<td>1954</td>
<td>3,595,000</td>
<td>3,785,000</td>
</tr>
<tr>
<td>1955</td>
<td>3,685,000</td>
<td>3,891,000</td>
</tr>
<tr>
<td>1956</td>
<td>3,705,000</td>
<td>3,974,000</td>
</tr>
<tr>
<td>1957</td>
<td>3,849,000</td>
<td>4,055,000</td>
</tr>
<tr>
<td>1958</td>
<td>3,953,000</td>
<td>4,173,000</td>
</tr>
<tr>
<td>1959</td>
<td>4,038,000</td>
<td>4,303,000</td>
</tr>
<tr>
<td>1960</td>
<td>4,138,000</td>
<td>4,404,000</td>
</tr>
<tr>
<td>1961</td>
<td>4,140,384</td>
<td>4,509,000</td>
</tr>
<tr>
<td>1962</td>
<td>4,239,000</td>
<td>4,592,000</td>
</tr>
</tbody>
</table>


The population of Canada has increased steadily over the last ten years. The average annual increase in population between 1953 and 1962 was 414,000. (see Table VIII). If this average increase continues until 1968, Canada's population in that year should be 21,100,000.
Sometimes the growth of Canada's labor force has been more rapid than the population growth and sometimes less rapid. Between 1953 and 1962 the labor force averaged 36.5 per cent of the population. If this relationship prevails in 1968 the labor force will be 7,701,500.

Unemployment averaged five per cent of the population during the same period of 1953 to 1962. If the unemployment is five per cent of the labor force in 1968 the unemployed will total 385,000. The number of persons employed will then be 7,316,425.

In 1953 the number of hours worked per week in Canadian manufacturing industries averaged 41.3. Assuming that employees worked 50.0 weeks per year, the employees worked a total of 2,065 hours per year.


In 1962 the number of hours worked per week in Canadian manufacturing industries averaged 40.7. If employees worked 49.5 weeks per year, the employees worked a total of 2,015 hours per year.

The output per employed person in 1953 was $5,258, and in 1962 the output per employed person was $5,983. These figures are in 1957 dollars.

If the output per employed person was $5,258 in 1953 and the hours worked per employed person were 2,065 in 1953, the output per man per hour was $2.546. In 1962 the output per employed person was $5,983 and the hours worked per employed person were 2,015, therefore, the output per man per hour was $2.983. The increase in output per man hour from 1953 to 1962 resulted in an average increase per year of $0.047. Thus the increase in output per man hour and per man year was 1.7 per cent.

The total reduction in working hours per year between 1953 and 1962 was forty hours. With an average reduction of 5.5 hours per year and an average number of hours worked per year of 2,045 there was a 0.2 per cent reduction in hours per year of work. As a result:
1.7 per cent - 0.2 per cent = 1.5 percent increase in
output per year
+0.1 percent adjustment
for expected improve-
ment.
= 1.6 percent increase in
output per year.

Therefore the output per employed person in 1968
should be $6,581. With an employed labor force of
7,316,425 the gross national product in 1968 in 1957
dollars will be $48,149,000,000.
<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gross National Product</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At Market Prices</td>
<td>25,020</td>
<td>24,871</td>
<td>27,132</td>
<td>30,585</td>
<td>31,909</td>
<td>32,894</td>
<td>34,915</td>
<td>36,254</td>
<td>37,421</td>
<td>40,401</td>
</tr>
<tr>
<td>Constant(1957)dollars</td>
<td>27,525</td>
<td>26,714,</td>
<td>29,018</td>
<td>31,508</td>
<td>31,909</td>
<td>32,284</td>
<td>33,398</td>
<td>34,144</td>
<td>35,023</td>
<td>37,195</td>
</tr>
<tr>
<td><strong>Population and Employment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Population (June 1)</td>
<td>14,845</td>
<td>15,287</td>
<td>15,698</td>
<td>16,081</td>
<td>16,610</td>
<td>17,080</td>
<td>17,483</td>
<td>17,870</td>
<td>18,238</td>
<td>18,570</td>
</tr>
<tr>
<td>Civilian Labor Force (Annual Avg.)</td>
<td>5,397</td>
<td>5,493</td>
<td>5,610</td>
<td>5,782</td>
<td>6,003</td>
<td>6,127</td>
<td>6,228</td>
<td>6,403</td>
<td>6,518</td>
<td>6,608</td>
</tr>
<tr>
<td>Employment (Annual Avg.)</td>
<td>5,235</td>
<td>5,243</td>
<td>5,364</td>
<td>5,585</td>
<td>5,725</td>
<td>5,695</td>
<td>5,856</td>
<td>5,955</td>
<td>6,049</td>
<td>6,217</td>
</tr>
<tr>
<td>Unemployment (Annual Avg., per cent of labor force)</td>
<td>3.0</td>
<td>4.6</td>
<td>4.4</td>
<td>3.4</td>
<td>4.6</td>
<td>7.1</td>
<td>6.0</td>
<td>7.0</td>
<td>7.2</td>
<td>6.0</td>
</tr>
</tbody>
</table>

The calculation of the domestic softwood plywood sales forecast for 1968 is given below. The simple linear regression equation was used for this purpose.

\[ Y = -282,148 + 0.03317X_1 \]

where \( X_1 \) is Gross National Product and \( Y \) is domestic softwood plywood sales.

\[ Y = -282,148 + 0.03317 (48,149,000,000) \]

\[ Y = 1,597,100,000 \text{ sq. ft.} \]

The sale of softwood plywood in Canada during 1968 is expected to be 1,597,100,000 sq. ft., 3/8" basis.

**X. CROWN ZELLERBACH SALES**

The total sales to be achieved by Crown Zellerbach can be determined now that the industry sales estimates are available. Crown Zellerbach management have indicated that they plan to retain their share of the plywood market in Canada. As previously pointed out they have increased the capacity of their manufacturing plant and have built up a national sales organization.

The percentage of the total domestic market realized by Crown Zellerbach is confidential information. However, since the company knows this percentage and the expected industry sales of plywood, the company forecaster can calculate the amount of
plywood to be sold in 1964 and 1968.

For the sake of discussion let us suppose that Crown Zellerbach has at present 12 per cent of the industry sales. Then, in 1964 their domestic softwood plywood sales should be:

12 per cent of 1,317,880,000 sq. ft., 3/8" basis

= 158,145,600 sq. ft., 3/8" basis

and in 1968 their sales should be:

12 per cent of 1,597,100,000 sq. ft. 3/8" basis

= 191,652,000 sq. ft. 3/8" basis.
CHAPTER VII
SUMMARY AND CONCLUSION

All companies face a future that holds an endless array of problems for them. An increasing awareness of this fact and the increasing dimensions of the problems have induced management to place an increased emphasis on corporate planning. Essential to good planning is forecasting - forecasting the economy, the industry volume and the company sales - for the short term or over an extended period, or both. With the assistance of such guidelines vital marketing, financial and production plans ultimately emerge, together with their supporting schedules. Without adequate forecasting these plans and schedules can go woefully astray.

Sales forecasts emanate from a number of sources. The salesman or his district manager is involved in the preparation of field sales forecasts. Sometimes a senior company executive, such as the general sales manager, prepares the forecasts. In a number of companies the market research department is responsible. In some companies an economist or an economics department provides sales forecasts. Sometimes all
these people can be involved. In large companies especially, the number of personnel or departments involved in forecasting can be numerous.

However, only one person should have over-all responsibility for the forecasting task and the extent to which he is responsible should be clearly defined. To be effective, this individual must acquire not only a detailed understanding of company activities but a thorough knowledge of the characteristics of a sound forecasting operation. Not only must the forecaster be familiar with the techniques or methods available for developing forecasts, but he must understand also the necessity of carrying out various pre-performance and post-performance activities.

While an executive can determine how accurate a forecast is after the fact, only the soundness of the forecasting operation can be appraised before the fact. Frequently a simple naive approach is used. Company sales are forecast by reference only to past sales with modifications based on opinions gathered from the field. What general economic conditions are likely to be, or what the industry is likely to sell, or how the company's markets are going to fare - these factors are overlooked all too often. Since
no company exists in a vacuum, a forecast prepared in a vacuum is prone to excessive error because it fails to relate the company sales activities to the opportunities in the market place.

In forecasts covering a full year ahead, substantial deviations in even the best of forecasts will occur, if not in the total then in some product or territorial component of the forecast. When deviations arise and there is no time-table for review and revision management hesitates to develop a new forecast. Under these circumstances, if a revision finally is decided upon, it probably will be drawn up hastily and carelessly. On the other hand, when a revision is deferred indefinitely, a number of "private" forecasts may arise in different departments. A situation of this type leads to independent, uncoordinated decisions, and planning deteriorates. Scheduled reviews of forecasts with the opportunity to revise them when necessary undoubtedly are desirable if the forecasts are to be of maximum usefulness.

In addition there is a need for post-mortems. Significant deviations between actual and forecasted figures should be appraised and explained.
Not only should a forecaster acquire a knowledge of the characteristics of a good forecasting operation, but he should possess also an appreciation of the limitations and problems inherent in forecasting. A forecaster cannot assume that his forecasted figures are exact and certain. He faces a situation similar to the production executive. The production man has his tolerances: he permits a deviation within a certain range of values, and his familiarity with probability in quality control results in his expectation of the occasional faulty product.

The forecaster faces many problems. For example, much of the government data used to forecast the economic and industry outlook consists of estimates, and these estimates contain errors. Sometimes these errors are large, sometimes they are small, but always they are present. The forecaster's awareness of this type of problem prompts him to caution in using and projecting figures.

This thesis has presented a general review of sales forecasting literature with particular attention to the preparing of the forecast, the pre-planning and the review. In addition, forecasts were prepared
showing the expected sales of domestic softwood plywood to be achieved by the plywood industry and by Crown Zellerbach Company for the years 1964 and 1968.

A simple regression equation and three multiple regression equations were produced with the intention of using them to forecast industry plywood sales. The three multiple regression equations contained high coefficients of multiple determination, but each of the equations also possessed one or more unacceptable negative constants. One of the basic assumptions underlying the development of the multiple regression equations apparently had not been met. Because of this difficulty all of these equations were rejected for use in preparing a forecast. A simple regression equation was developed which possessed an extremely high coefficient of correlation and a small standard error of estimate. Since this equation contained these desirable features and seemed to incorporate no underlying fallacy, this simple regression equation was the one used to forecast industry plywood sales.

This simple equation is acceptable if one wishes to estimate accurately one variable when another
variable is given, but if the objective is to obtain an explanation of one variable as a function of one or more other variables, the simple equation cannot be considered entirely acceptable. Gross National Product must be viewed as providing an explanation of plywood sales in only the broadest sense. If the multiple regression equations had been acceptable, the objective of obtaining an explanation of one variable as a function of one or more other variables would have been realized to a much greater degree. However, the high coefficient of correlation, the low standard error of estimate and the reasonableness of the simple regression equation make it acceptable for predicting industry plywood sales.

Since the management of Crown Zellerbach Company has taken action necessary for retaining their share-of-market in an expanding industry, the assumption that they will obtain the same percentage of the industry market as they now possess seems reasonable. This justifies multiplying the total projected industry sales figures by a percentage which represents the company's present share of the total market. The development of 1964 and 1968 plywood sales forecasts for Crown Zellerbach results in the achievement of the objective stated at the beginning of the study.
Since the simple equation explains plywood sales in only the broadest sense and does not directly relate the dependent variable to various known independent variables, the management of Crown Zellerbach should not depend entirely on this equation when forecasting plywood sales. Forecasts developed by using other techniques should be made before a final forecast is chosen. A desirable statistical technique to use would be the end-use index method described in Chapter VI. In this method the various markets for plywood are defined, measured, weighted and then combined in an additive manner to form the final end-use index. Unfortunately, the necessary information about the plywood markets is not available, so this method cannot be used at the present time.

A judgment method which produces satisfactory results is used by the Crown-Zellerbach Company forecaster. He consults with salesmen, sales managers, dealers and others who have knowledge about the plywood market. The forecaster receives information about the plywood industry from the plywood manufacturers association and he receives information about general business conditions from various sources. The forecaster evaluates the information that he has gathered
and determines how much plywood Crown-Zellerbach should sell in the coming year. Without a doubt the forecaster owes a good deal of his success in using this method to his own extensive experience in forecasting plywood sales and to the experience of the men with whom he consults regarding the condition of the plywood market. The company forecaster should continue to employ the judgment technique that he presently uses, but he would follow a better course if he used one or more statistical methods in addition to his present method. A final forecast could be selected after an analysis had been made of the forecasted figures developed by the various techniques.
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