a = intercept

b = slope

Apart from the linear relationship, the following relations are also used:

Exponential Relationship: $Y_t = a\, e^{bt}$ (4.4)

On logarithmic transformation this becomes:

$$\log Y_t = \log a + b\, t \qquad (4.4a)$$

Polynomial Relationship: $Y_t = a_0 + a_1\, t + a_2\, t^2 + \ldots + a_n\, t^n$ (4.5)

A polynomial of the second degree is:

$$Y_t = a_0 + a_1\, t + a_2\, t^2 \qquad (4.5a)$$

Cobb Douglas Relationship: $Y_t = a\, t^b$ (4.6)

On logarithmic transformation this becomes:

$$\log Y_t = \log a + b \log t \qquad (4.6a)$$

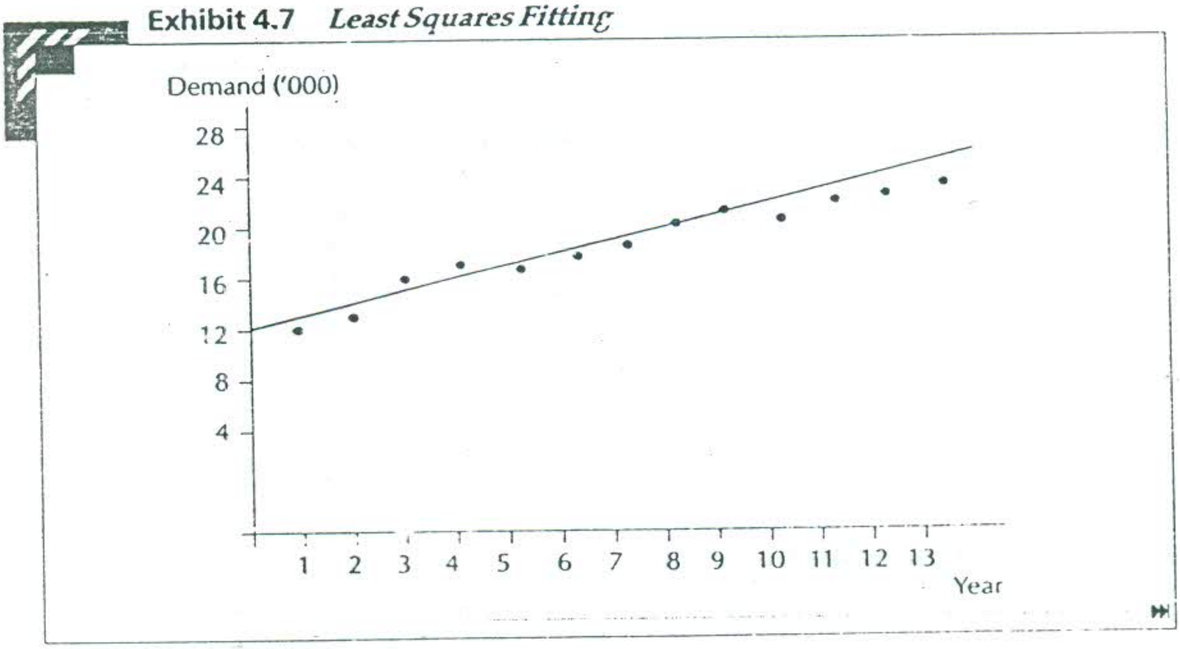
In the above equations Y_t represents demand for year t, t is the time variable, and a, b and a_i s are constants.

Exponential Smoothing Method

In exponential smoothing, forecasts are modified in the light of observed errors. If the forecast value for year t, F_t, is less than the actual value for year t, S_t, the forecast for the year $t+1$, F_{t+1}, is set higher than F_t. If $F_t > S_t$, F_{t+1} is set lower than F_t. In general

$$F_{t+1} = F_t + \alpha e_t \qquad (4.7)$$

Exhibit 4.7 ***Least Squares Fitting***



where F_{t+1} = forecast for year $t + 1$

α = smoothing parameter (which lies between 0 and 1)

e_t = error in the forecast for year $t = S_t - F_t$

Exhibit 4.8 shows how the forecasts would be arrived at, given an initial forecast of F_1 = 29 and α = 0.2. (The choice of these will be discussed later.)

Exhibit 4.9 shows the plot of the forecasts versus the data. The plot shows that the forecasts have the desirable property of being stable.

How should the first forecast (F_1) and the smoothing parameter (α) be chosen? A simple and reasonably satisfactory rule of thumb is to choose F_1 as the mean of the warm-up sample. (The warm-up sample consists of several observations preceding the period for which the forecasting exercise is begun.)

For choosing α, consider several values in the range of 0 to 1 and choose the value which minimises the MSE (mean squared error) in the warm-up period. The mean squared error is defined as

$$1/n = \Sigma(S_i - F_i)^2 \quad (4.8)$$

where S_i = actual value of sales in period i

F_i = forecast value of sales in period i

n = number of periods in the "warm-up" sample

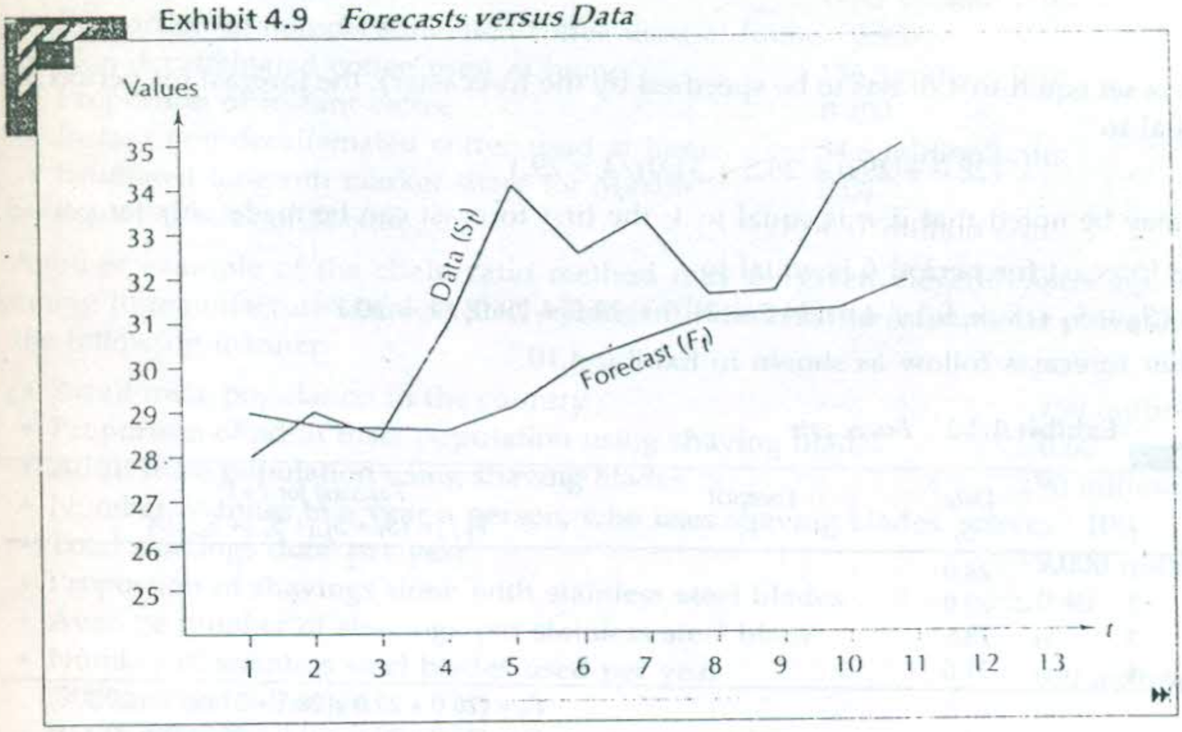
Exhibit 4.8 *Derivation of Forecasts*

t	*Data* (S_t)	*Forecast* (F_t)	*Error* ($e_t = S_t - F_t$)	*Forecast for* $t+1$ $F_{t+1} = F_{t+1} + \alpha e_t$
1	28.0	29.0	−1.0	F_2 = 29.0 + 0.2 (−1.0) = 28.8
2	29.0	28.8	0.2	F_3 = 28.8 + 0.2 (0.2) = 28.8
3	28.5	28.8	−0.3	F_4 = 28.2 + 0.2 (−0.3) = 28.7
4	31.0	28.7	2.3	F_5 = 28.7 + 0.2 (2.3) = 29.2
5	34.2	29.2	5.0	F_6 = 29.2 + 0.2 (5.0) = 30.2
6	32.7	30.2	2.5	F_7 = 30.2 + 0.2 (2.5) = 30.7
7	33.5	30.7	2.8	F_8 = 30.7 + 0.2 (2.8) = 31.3
8	31.8	31.3	0.5	F_9 = 31.3 + 0.2 (0.5) = 31.4
9	31.9	31.4	0.5	F_{10} = 31.4 + 0.2 (0.5) = 31.5
10	34.3	31.5	2.8	F_{11} = 31.5 + 0.2 (2.8) = 32.1
11	35.2	32.1	3.1	F_{12} = 32.1 + 0.2 (3.1) = 32.7

Moving Average Method

As per the moving average method of sales forecasting, the forecast for the next period is equal to the average of the sales for several preceding periods.

Exhibit 4.9 *Forecasts versus Data*



In symbols,

$$F_{t+1} = \frac{S_t + S_{t-1} + \ldots + S_{t-n+1}}{n} \tag{4.9}$$

where F_{t+1} = forecast for the next period

S_t = sales for the current period

n = period over which averaging is done

To illustrate the use of the moving average technique, consider the following time series.

Year	*Sales*
1	28.0
2	29.0
3	28.5
4	31.0
5	34.2
6	32.7
7	33.5
8	31.8
9	31.9
10	34.3
11	35.2
12	36.0

If n is set equal to 4 (n has to be specified by the forecaster), the forecast for period 5 will be equal to

$$(28.0 + 29.0 + 28.5 + 31.0)/4 = 29.1$$

(It may be noted that if n is equal to 4, the first forecast can be made only for period 5.)

The forecast for period 6 is equal to

$$(S_5 + S_4 + S_3 + S_2) / 4 = (34.2 + 31.0 + 28.5 + 29.0)/4 = 30.7$$

Other forecasts follow as shown in Exhibit 4.10.

Exhibit 4.10 *Forecasts*

t	Data S_t	Forecast F_t	Forecast for $t+1$ $F_{t+1} = (S_t + S_{t-1} + S_{t-2} + S_{t-3})/4$
1	28.0		
2	29.0		
3	28.5		
4	31.0		
			$F_5 = (28.0 + 29.0 + 28.5 + 31.0)/4 = 29.1$
5	34.2	29.1	$F_6 = (29.0 + 28.5 + 31.0 + 34.2)/4 = 30.7$
6	32.7	30.7	$F_7 = (28.5 + 31.0 + 34.2 + 32.7)/4 = 31.6$
7	33.5	31.6	$F_8 = (31.0 + 34.2 + 32.7 + 33.5)/4 = 32.9$
8	31.8	32.9	$F_9 = (34.2 + 32.7 + 33.5 + 31.8)/4 = 33.1$
9	31.9	33.1	$F_{10} = (32.7 + 33.5 + 31.8 + 31.9)/4 = 32.5$
10	34.3	32.5	$F_{11} = (33.5 + 31.8 + 31.9 + 34.3)/4 = 32.9$
11	35.2	32.9	$F_{12} = (31.8 + 31.9 + 34.3 + 35.2)/4 = 33.3$
12	36.0	33.3	

In the above illustration, we set n equal to 4. Why should not n be set equal to 3, 5, 6 or any other number? There seems to be no *a priori* way to determine n; it can best be arrived at by experimentation. Another issue may be raised. In Eq. (4.9), which is based on a simple arithmetic average, all preceding values of sales are weighted equally. Should the more recent data not be accorded higher weightage? For example, it may make more sense to assign weights of 0.1, 0.2, 0.3, and 0.4 to the years $t-3$, $t-2$, $t-1$, and t respectively. Here again experimentation seems to be the only way to decide the system of weights.

Chain Ratio Method

The potential sales of a product may be estimated by applying a series of factors to a measure of aggregate demand. For example, General Foods (US) estimated the potential sales for a new product, a freeze-fried instant coffee (Maxim), in the following manner:

- Total amount of coffee sales : 174.5 million units
- Proportion of coffee used at home : 0.835

[C.7

- Coffee used at home : 145.7 million units
- Proportion of non-decaffeinated coffee used at home : 0.937
- Non-decaffeinated coffee used at home : 136.5 million units
- Proportion of instant coffee : 0.400
- Instant non-decaffeinated coffee used at home : 54.6 million units
- Estimated long-run market share for Maxim : 0.08
- Potential sales of Maxim : 4.37 million units

Another example of the chain ratio method may be given. Several years ago a firm planning to manufacture stainless steel blades in India tried to estimate its potential sales in the following manner:

- Adult male population in the country : 150 million
- Proportion of adult male population using shaving blades : 0.60
- Adult male population using shaving blades : 90 million
- Number of times in a year a person, who uses shaving blades, shaves : 100
- Total shavings done per year : 9,000 million
- Proportion of shavings done with stainless steel blades : 0.40
- Average number of shavings per stainless steel blade : 6
- Number of stainless steel blades used per year : 600 million
  (9000 million × 0.40)/6
- Proportion of the stainless steel blade market the firm could capture : 0.20
- Potential sales : 120 million

The chain ratio method uses a simple analytical approach to demand estimation. However, its reliability is critically dependent on the ratios and rates of usage used in the process of determining the sales potential. While some of these ratios and rates of usage may be based on objective proportions, others will have to be subjectively defined.

Consumption Level Method

Useful for a product which is directly consumed, this method estimates consumption level on the basis of elasticity coefficients, the important ones being the income elasticity of demand and the price elasticity of demand.

Income Elasticity of Demand The income elasticity of demand reflects the responsiveness of demand to variations in income. It is measured as follows:

$$E_I = \frac{Q_2 - Q_1}{I_2 - I_1} \times \frac{I_1 + I_2}{Q_2 + Q_1} \qquad (4.10)$$

where E_I = income elasticity of demand

Q_1 = quantity demanded in the base year

Q_2 = quantity demanded in the following year

I_1 = income level in the base year

I_2 = income level in the following year.

Example The following information is available on quantity demanded and income level: $Q_1 = 50$, $Q_2 = 55$, $I_1 = 1{,}000$, and $I_2 = 1{,}020$. What is the income elasticity of demand? The income elasticity of demand is:

$$E_I = \frac{55-50}{1{,}020-1{,}000} \times \frac{1{,}000+1{,}020}{55+50} = 4.81$$

The information on income elasticity of demand along with projected income may be used to obtain a demand forecast. To illustrate, suppose the present per capita annual demand for paper is 1 kg and the present per capital annual income is Rs 18,200. The income elasticity of demand for paper is 2. The projected per capita annual income three years hence is expected to be 10 per cent higher (in real terms) than what it is now. The projected per capita demand for paper three years hence will be:

$$\begin{Bmatrix}\text{Present per}\\ \text{capita}\\ \text{demand}\end{Bmatrix} \begin{Bmatrix} 1 + \begin{matrix}\text{Per capita}\\ \text{change in}\\ \text{income level}\end{matrix} \times \begin{matrix}\text{Income}\\ \text{elasticity}\\ \text{of demand}\end{matrix}\end{Bmatrix}$$

$$= (1)\ (1 + 0.10 \times 2) = 1.2 \text{ kg}$$

The aggregate demand projection for paper will simply be:

Projected per capita demand × Projected population

The income elasticity of demand differs from one product to another. Further, for a given product, it tends to vary from one income group to another and from one region to another. Hence, wherever possible, disaggregative analysis should be attempted.

Price Elasticity of Demand The price elasticity of demand measures the responsiveness of demand to variations in price. It is defined as:

$$E_p = \frac{Q_2 - Q_1}{P_2 - P_1} \times \frac{P_1 + P_2}{Q_2 + Q_1} \tag{4.11}$$

where E_p = price elasticity of demand

Q_1 = quantity demanded in the base year

Q_2 = quantity demanded in the following year

P_1 = price per unit in the base year

P_2 = price per unit in the following year

Example The following information is available about a certain product: P_1= Rs 600, $Q_1 = 10{,}000$, P_2 = Rs 800, $Q_2 = 9{,}000$. What is the price elasticity of demand? The price elasticity of demand is:

$$E_p = \frac{9{,}000 - 10{,}000}{600 - 800} \times \frac{600 + 800}{9{,}000 + 10{,}000} = -0.37$$

The price elasticity of demand is a useful tool in demand analysis. The future volume of demand may be estimated on the basis of the price elasticity coefficient and expected price change. The price elasticity coefficient may also be used to study the impact of variable prices that may be obtained in future on the economic viability of the project. In using the price elasticity measure, however, the following considerations should be borne in mind: (i) The price elasticity coefficient is applicable to only small variations. (ii) The price elasticity measure is based on the assumption that the structure and behaviour remain constant.

End Use Method

Suitable for estimating the demand for intermediate products, the end use method, also referred to as the consumption coefficient method, involves the following steps:

1. Identify the possible uses of the product.
2. Define the consumption coefficient of the product for various uses.
3. Project the output levels for the consuming industries.
4. Derive the demand for the product.

This method may be illustrated with an example. A certain industrial chemical, Indchem, is used by four industries, Alpha, Beta, Gamma, and Kappa. The consumption coefficients for these industries, the projected output levels for these industries for the year X, and the projected demand for Indchem are shown in Exhibit 4.11.

Exhibit 4.11 *Projected Demand for Indchem*

	Consumption Coefficient[3]	*Projected Output in year X*	*Projected Demand for Indchem in year X*
Alpha	2.0	10,000	20,000
Beta	1.2	15,000	18,000
Kappa	0.8	20,000	16,000
Gamma	0.5	30,000	15,000
		Total	69,000

As is clear from the foregoing discussion, the key inputs required for the application of the end use method are: (i) projected output levels of consuming industries (units), and (ii) consumption coefficients. However, it may be difficult to estimate the projected output levels of consuming industries (units). More importantly, the consumption coefficients may vary from one period to another in the wake of technological changes and improvements in the methods of manufacturing. Hence, the end use method should be used judiciously.

3. This is expressed in tonnes of Indchem required per unit of output of the consuming industry.

Leading Indicator Method

Leading indicators are variables which change ahead of other variables, the lagging variables. Hence, observed changes in leading indicators may be used to predict the changes in lagging variables. For example, the change in the level of urbanisation (a leading indicator) may be used to predict the change in the demand for air conditioners (a lagging variable).

Two basic steps are involved in using the leading indicator method: (i) First, identify the appropriate leading indicator(s). (ii) Second, establish the relationship between the leading indicator(s) and the variable to the forecast.

The principal merit of this method is that it does not require a forecast of an explanatory variable. Its limitations are that it may be difficult to find appropriate leading indicator(s) and the lead-lag relationship may not be stable over time.

Econometric Method

An econometric model is a mathematical representation of economic relationship(s) derived from economic theory. The primary objective of econometric analysis is to forecast the future behaviour of the economic variables incorporated in the model.

Two types of econometric models are employed: the single equation model and the simultaneous equation model. The single equation model assumes that one variable, the dependent variable (also referred to as the explained variable), is influenced by one or more independent variables (also referred to as the explanatory variables). In other words, one-way causality is postulated. An example of the single equation model is given below:

$$D_t = a_0 + a_1 P_t + a_2 N_t \quad (4.12)$$

where D_t = demand for a certain product in year t

P_t = price for the product in year t

N_t = income in year t

The simultaneous equation model portrays economic relationships in terms of two or more equations. Consider a highly simplified three equation econometric model of the Indian economy.

$$GNP_t = G_t + I_t + C_t \quad (4.13)$$

$$I_t = a_0 + a_1 GNP_t \quad (4.14)$$

$$C_t = b_0 + b_1 GNP_1 \quad (4.15)$$

where GNP_t = gross national product for year t

G_t = governmental purchases for year t

I_t = gross investment for year t

C_t = consumption for year t

In the above model, Eq. (4.13), is just a definitional equation which says that the gross national product is equal to the sum of government purchases, gross investment, and consumption. Eq. (4.14) postulates that investment is a linear function of gross national product, Eq. (4.15) posits that consumption is a linear function of gross national product.

The construction and use of an econometric model involves four broad steps.

Specification This refers to the expression of an economic relationship in a mathematical form.

Estimation This involves the determination of the parameter values and other statistics by a suitable method such as the least squares method.

Verification This step is concerned with accepting or rejecting the specification as a reasonable approximation to the truth on the basis of the results of estimation.

Prediction This involves projection of the value of the explained variable(s).

The econometric method offers certain *advantages:* (i) The process of econometric analysis sharpens the understanding of complex cause–effect relationships. (ii) The econometric model provides a basis for testing assumptions and for judging how sensitive the results are to changes in assumptions.

The *limitations* of the econometric method are: (i) It is expensive and data-demanding. (ii) To forecast the behaviour of the dependent variable, one needs the projected values of the independent variable(s). The difficulty in obtaining these may be the main limiting factor in employing the econometric method for forecasting purposes.

4.6 UNCERTAINTIES IN DEMAND FORECASTING

Demand forecasts are subject to error and uncertainty which arise from three principal sources:

- Data about past and present market
- Methods of forecasting
- Environmental change

Data about Past and Present Markets

The analysis of past and present markets, which serves as the springboard for the projection exercise, may be vitiated by the following inadequacies of data:

Lack of Standardisation Data pertaining to market features like product, price, quantity, cost, income, etc. may not reflect uniform concepts and measures.

Few Observations Observations available to conduct meaningful analysis may not be enough.

Influence of Abnormal Factors Some of the observations may be influenced by abnormal factors like war or natural calamity.

Methods of Forecasting

Methods used for demand forecasting are characterised by the following limitations:

Inability to Handle Unquantifiable Factors Most of the forecasting methods, being quantitative in nature, cannot handle unquantifiable factors which sometimes can be of immense significance.

Unrealistic Assumptions Each forecasting method is based on certain assumptions. For example, the trend projection method is based on the 'mutually compensating effects' premise and the end use method is based on the constancy of technical coefficients. Uncertainty arises when the assumptions underlying the chosen method tend to be unrealistic and erroneous.

Excessive Data Requirement In general, the more advanced a method, the greater the data requirement. For example, to use an econometric model one has to forecast the future values of explanatory variables in order to project the explained variable. Clearly, predicting the future value of explanatory variables is a difficult and uncertain exercise.

Environmental Changes

The environment in which a business functions is characterised by numerous uncertainties. The important sources of uncertainty are mentioned below:

Technological Change This is a very important but hard-to-predict factor which influences business prospects. A technological advancement may create a new product which performs the same function more efficiently and economically, thereby cutting into the market for the existing product. For example, electronic watches are encroaching on the market for mechanical watches.

Shift in Governmental Policy In India, governmental regulation of business is extensive. Changes in governmental policy, which may be difficult to anticipate, could have a telling effect on the business environment: granting of licences to new companies, particularly foreign companies, may alter the market situation significantly; relaxation of price and distribution controls may widen the market considerably.

Developments on the International Scene Developments on the international scene may have a profound effect on industries. The most classic example of recent times is the OPEC price hike in the seventies which led to a near-stagnation in the Indian automobile industry for a few years.

Discovery of New Sources of Raw Material Discovery of new sources of raw materials, particularly hydrocarbons, can have a significant impact on the market situation of several products.

Vagaries of Monsoon Monsoon, which plays an important role in the Indian economy, is somewhat unpredictable. The behaviour of monsoon influences, directly or indirectly, the demand for a wide range of products.

Coping with Uncertainties

Given the uncertainties in demand forecasting, adequate efforts, along the following lines, may be made to cope with uncertainties.

- Conduct analysis with data based on uniform and standard definitions.
- In identifying trends, coefficient, and relationships, ignore the abnormal or out-of-the-ordinary observations.
- Critically evaluate the assumptions of the forecasting methods and choose a method which is appropriate to the situation.
- Adjust the projections derived from quantitative analysis in the light of unquantifiable, but significant, influences.
- Monitor the environment imaginatively to identify important changes.
- Consider likely alternative scenarios and their impact on market and competition.
- Conduct sensitivity analysis to assess the impact on the size of demand for unfavourable and favourable variations of the determining factors from their most likely levels.

4.7 MARKET PLANNING[4]

A marketing plan usually has the following components:

- Current marketing situation
- Opportunity and issue analysis
- Objectives
- Marketing strategy
- Action programme

We will demonstrate the preparation of a marketing plan for a new product. ABC Limited already has a successful five-year old shampoo addressing the South and East markets in India. ABC now plans to launch a toilet soap named Alpha in the same geographical markets. ABC's current year sales are Rs 100 million. Its gross contribution margin is 18.4 percent and net profit margin is 4.4 percent. The gross and net margins have been roughly the same in the last 5 years. (*Note:* The company and the brands are fictitious. They are meant to illustrate the development of marketing plan.)

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4. This section has been contributed by Dr Y. L. R. Murthy of the Indian Institute of Management, Bangalore. It has been adapted from Philip Kotler, *Marketing Management—Millenium Edition,* 2000 published by Prentice-Hall Inc.

Current Marketing Situation

This part of the marketing plan deals with the different dimensions of the current situation. It examines the market situation, competitive situation, distribution situation, and the macro-environment. In other words, it paints a pen-picture of the present.

Market Situation This deals with size, the growth, the consumer aspirations, and buying behaviour in the market under consideration. The toilet soap market has a size of about 5.5 lakh tons. There are three price-based segments in this market. The low-priced segment consists of Lifebuoy and Nirma Bath. The medium-priced segment has brands like Jai, Breeze, Santoor, and Hamam. The premium segment features soaps like Mysore Sandal, Pears, and Dove. The medium-priced segment is growing at the expense of the low-priced segment.

Competitive Situation This dwells on the major competitors, their objectives, strategies, strengths, etc. Alpha's important competitors are brands of Hindustan Lever (HLL) and Nirma. Lever's marketing prowess is well known. It has more than 50 percent share of the toilet soap market. Its objective would be retaining overall control of the market. It could use the profit from its successful soaps like Lux, Hamam, and Rexona to subsidise its new launches. Nirma, the other competitor, is a challenger and a price fighter. After struggling for 6 years it established its toilet soaps in the market. The competition from both these companies is formidable. Besides, there are other competitors like Godrej, Reckitt-Coleman, and Wipro to contend with.

Distribution Situation This compares the distribution capabilities of the competitors. There are an estimated 9 million retail outlets in the country. These are spread across 570,000 villages, besides towns and cities. Very few companies reach these outlets effectively. Hindustan Lever, Eveready, and ITC are the few companies that have made a name for themselves in distribution. Nirma, by contrast, is strong at the wholesale level. It retains the loyalty of trade by paying them very handsome margins. Recently it launched a brand called Nima to strengthen its retail presence. The questions before Alpha are therefore (a) How many retail outlets should it aim to stock in? (b) What kind of margins should it be paying to its trade? (c) What special schemes can it offer trade, to keep them loyal to Alpha?

Macro-environment This describes the effect of social, political, economic, technological, and other external variables on the market. For instance, when there is an economic downturn, consumption moves towards low priced soaps. Most Indian population is young (as opposed to American, European, and Japanese which is middle aged). Therefore there is likely to be a demand for more fashionable and contemporary soaps. The liberalisation of the Indian economy may bring in cheap raw material. But it will also usher in stiff competition. Thus the macro environment also points to enhanced competition as the competitive situation does.

Opportunity and Issue Analysis

In this section a **SWOT** (Strength, Weakness, Opportunity, Threat analysis) is conducted for Alpha and the core issues before the product are identified. Alpha's **strength** is that its parent ABC has to its credit the successful launch of a shampoo in the current market. Its **weakness** is probably its limited resources. The **opportunity** for Alpha could be the growth witnessed in the medium-priced segment of the toilet soap market at the expense of the low-priced soaps. The **threat** might be the growing acceptance of new launches like Nirma which are already exhausting the opportunities available in the market.

In light of this analysis, the issues before Alpha are:

- Given ABC's limited resources, should Alpha be marketed first in the South and then in the East or should it be launched simultaneously in both the markets.
- Given that its shampoo is already successful should ABC use a new brand name or should it extend its shampoo's brand name to the soap.

Objectives

Objectives have to be clear-cut, specific, and achievable. The following objectives have been set:

- Achieve break-even in three years for Alpha.
- Attain sales of Rs 20 million in the first year, Rs 80 million in the second, and Rs 120 million in the third.
- Achieve a top-of-mind recognition of 75 percent in the target segment for Alpha in the first year and 90 percent in the second.
- Reach 300,000 retail outlets in the first year, 900,000 in the second, and 1,500,000 in the third.

Marketing Strategy

The marketing strategy covers the following: target segment, positioning, product line, price, distribution, sales force, sales promotion, and advertising.

Target Segment The target segment from the point of view of income is middle class (as defined by NCAER). But the segment needs to be described more clearly in terms of its psychographics. This is to make the soap distinct from its competitors. For instance, Alpha could specifically target students or teenagers or entry level executives.

Positioning Positioning is how a product is placed in the mind of the customer. Having decided on targeting students, Alpha could be positioned as "romantic" or "rugged". Similarly, if entry level executives are targeted, the positioning could be "self confidence" or "daylong freshness". An important issue here is, as to which of the above positioning statements dovetail with the shampoo's positioning, if a brand extension is being attempted.

Product Line Would Alpha like to launch a single variant or more than one variant? What fragrance goes with a "romantic" soap (lavender) and what fits if the positioning is "rugged" (cologne)?

Price Will Alpha be launched in the mid-price segment because the segment is growing? Whose pricing will it be closest to, ranging from Breeze at the lower end of this segment to Hamam at the higher end? Will the price decision change depending on whether the positioning is "romantic" or "rugged"?

Distribution Alpha may like to confine its distribution to important consumption centres in the South and East. It may drop out ineffective outlets, as mentioned.

Sales Force The sales force may be marginally increased. In fact, Alpha is likely to press for an increase in the efficiency of its individual salesmen to boost sales.

Sales Promotion Direct consumer promotion is usually expensive because it covers thousands of individual consumers. As a small organisation ABC may like to promote dealers because their number is limited. It may aim at spending 60 percent of the promotion money on dealer schemes and the balance on consumer schemes. (A larger organisation may do the opposite.)

Advertising Unconventional and creative advertising options (balloons, advertising behind bus tickets, pamphlets in newspapers, hoarding in high visibility locations like bus stations, etc) may be allocated 60 percent of the budget. The balance goes into mainstream advertising like newspapers and TV. This is because main stream advertising is expensive and not affordable.

Action Programme

Action programmes operationalise the strategy. The following steps give an idea of how Alpha might like to roll out its marketing plan in the next one year.

Quarter 1 Alpha should attain a top-of-mind-awareness of 60 percent in the target segment. This is done by spending 60 percent of Alpha's advertising budget on unconventional media and the rest on conventional media as mentioned above. Alpha shall reach 100,000 retail outlets by ensuring that all the outlets that currently stock shampoo, stock the soap also.

Quarter 2 Alpha shall reach 200,000 retail outlets. This means doubling the number of outlets stocking Alpha. The outlets that are not stocking shampoo currently shall also be pursued aggressively. Alpha's turnover shall reach Rs 10 million by the second quarter. Display money and stock incentives shall be given to retailers to achieve the required turn over.

Quarter 3 Alpha shall reach 300,000 retail outlets. The aggressive drive for distribution started in the second quarter shall be continued. Top-of-mind awareness should reach 75 percent. Since what is being reached now is incremental audience, promotional programmes shall be more focused. 20 percent of the promotional budget is to be spent in this quarter.

Quarter 4 Alpha shall consolidate its position in 300,000 retail outlets. Dip-stick tests to be conducted on customer preferences to determine whether the strategies adopted have been successful.

SUMMARY

- Given the importance of market and demand analysis, it should be carried out in an orderly and systematic manner. The key steps in such analysis are: (i) situational analysis and specification of objectives, (ii) collection of secondary information, (iii) conduct of market survey, (iv) characterisation of the market, (v) demand forecasting, and (vi) market planning.
- The project analyst may do an informal situational analysis which in turn may provide the basis for a formal study.
- For purposes of a market study, information may be obtained from secondary and/or primary sources.
- Secondary information is information that has been gathered in some other context and is already available. While secondary information is available economically, its reliability, accuracy, and relevance for the purpose under consideration must be carefully examined.
- Secondary information, thought useful, often does not provide a comprehensive basis for market and demand analysis. It needs to be supplemented with primary information gathered through a market survey, specific to the project being appraised, that is likely to be a sample survey.
- Typically, a sample survey consists of the following steps: (i) Define the target population. (ii) Select the sampling scheme and sample size. (iii) Develop the questionnaire. (iv) Scrutinise the information gathered. (vii) Analyse and interpret the information.
- Based on the information gathered from secondary sources and through market survey, the market for the product/service may be described in terms of the following: effective demand in the past and present; breakdown of demand; price; methods of distribution and sales promotion; consumers; supply and competition; and government policy.
- After gathering information about various aspects of the market and demand from primary and secondary sources, an attempt may be made to estimate future demand. A wide range of forecasting methods is available to the market analyst. These may be divided into three broad categories, viz., qualitative methods, time series projection methods, and causal methods.

- Qualitative methods rely essentially on the judgement of experts to translate qualitative information into quantitative estimates. The important qualitative methods are: jury of executive method and Delphi method.
- Time series projection methods generate forecasts on the basis of an analysis of the historical time series. The important time series projection methods are: trend projection method, exponential smoothing method, and moving average method.
- Causal methods seek to develop forecasts on the basis of cause–effect relationships specified in an explicit, quantitative manner. The important causal methods are: chain ratio method, consumption level method, end use method, leading indicator method, and econometric method.
- To enable the product to reach a desired level of market penetration, a suitable marketing plan, covering pricing, distribution, promotion, and service, needs to be developed.

John C. Chambers, Satinder K. Mullick,
and Donald D. Smith

How to choose the right forecasting technique

What every manager ought to know about the different kinds of forecasting and the times when they should be used

Foreword

In virtually every decision he makes, the executive today considers some kind of forecast. Sound predictions of demands and trends are no longer luxury items, but a necessity, if the manager is to cope with seasonality, sudden changes in demand levels, price-cutting maneuvers of the competition, strikes, and large swings of the economy. Forecasting can help him deal with these troubles; but it can help him more, the more he knows about the general principles of forecasting, what it can and cannot do for him currently, and which techniques are suited to his needs of the moment. Here the authors try to explain the potential of forecasting to the manager, focusing special attention on sales forecasting for products of Corning Glass Works as these have matured through the product life cycle. The authors also include a rundown of the whole range of forecasting techniques.

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To handle the increasing variety and complexity of managerial forecasting problems, many forecasting techniques have been developed in recent years. Each has its special use, and care must be taken to select the correct technique for a particular application. The manager as well as the forecaster has a role to play in technique selection; and the better he understands the range of forecasting possibilities, the more likely it is that a company's forecasting efforts will bear fruit.

The selection of a method depends on many factors—the context of the forecast, the relevance and availability of historical data, the degree of accuracy desirable, the time period to be forecast, the cost/benefit (or *value*) of the forecast to the company, and the time available for making the analysis.

These factors must be weighed constantly, and on a variety of levels. In general, for example, the forecaster should choose a technique that makes the best use of available data. If he can readily apply one technique of acceptable accuracy, he should not try to "gold plate" by using a more advanced technique that offers potentially greater accuracy but that requires nonexistent information or information that is costly to obtain. This kind of trade-off is relatively easy to make, but others, as we shall see, require considerably more thought.

Furthermore, where a company wishes to forecast with reference to a particular product, it must consider *the stage of the product's life cycle for which it is making the forecast.* The availability of data and the possibility of establishing relationships between the factors depend directly on the maturity of a product, and hence the life-cycle stage is a prime determinant of the forecasting method to be used.

Our purpose here is to present an overview of this field by discussing the way a company ought to approach a forecasting problem, describing the methods available, and explaining how to match method to problem. We shall illustrate the use of the various techniques from our experience with them at Corning, and then close with our own forecast for the future of forecasting.

Although we believe forecasting is still an art, we think that some of the principles which we have learned through experience may be helpful to others.

Manager, forecaster & choice of methods

A manager generally assumes that when he asks a forecaster to prepare a specific projection, the request itself provides sufficient information for the forecaster to go to work and do his job. This is almost never true.

Successful forecasting begins with a collaboration between the manager and the forecaster, in which they work out answers to the following questions.

1. *What is the purpose of the forecast—how is it to be used?*

This determines the accuracy and power required of the techniques, and hence governs selection. Deciding whether to enter a business may require only a rather gross estimate of the size of the market, whereas a forecast made for budgeting purposes should be quite accurate. The appropriate techniques differ accordingly.

Again, if the forecast is to set a "standard" against which to evaluate performance, the forecasting method should not take into account special actions, such as promotions and other marketing devices, since these are meant to change historical patterns and relationships and hence form part of the "performance" to be evaluated.

Forecasts that simply sketch what the future will be like if a company makes no significant changes in tactics and strategy are usually not good enough for planning purposes. On the other hand, if management wants a forecast of the effect that a certain marketing strategy under debate will have on sales growth, then the technique must be sophisticated enough to take explicit account of the special actions and events the strategy entails.

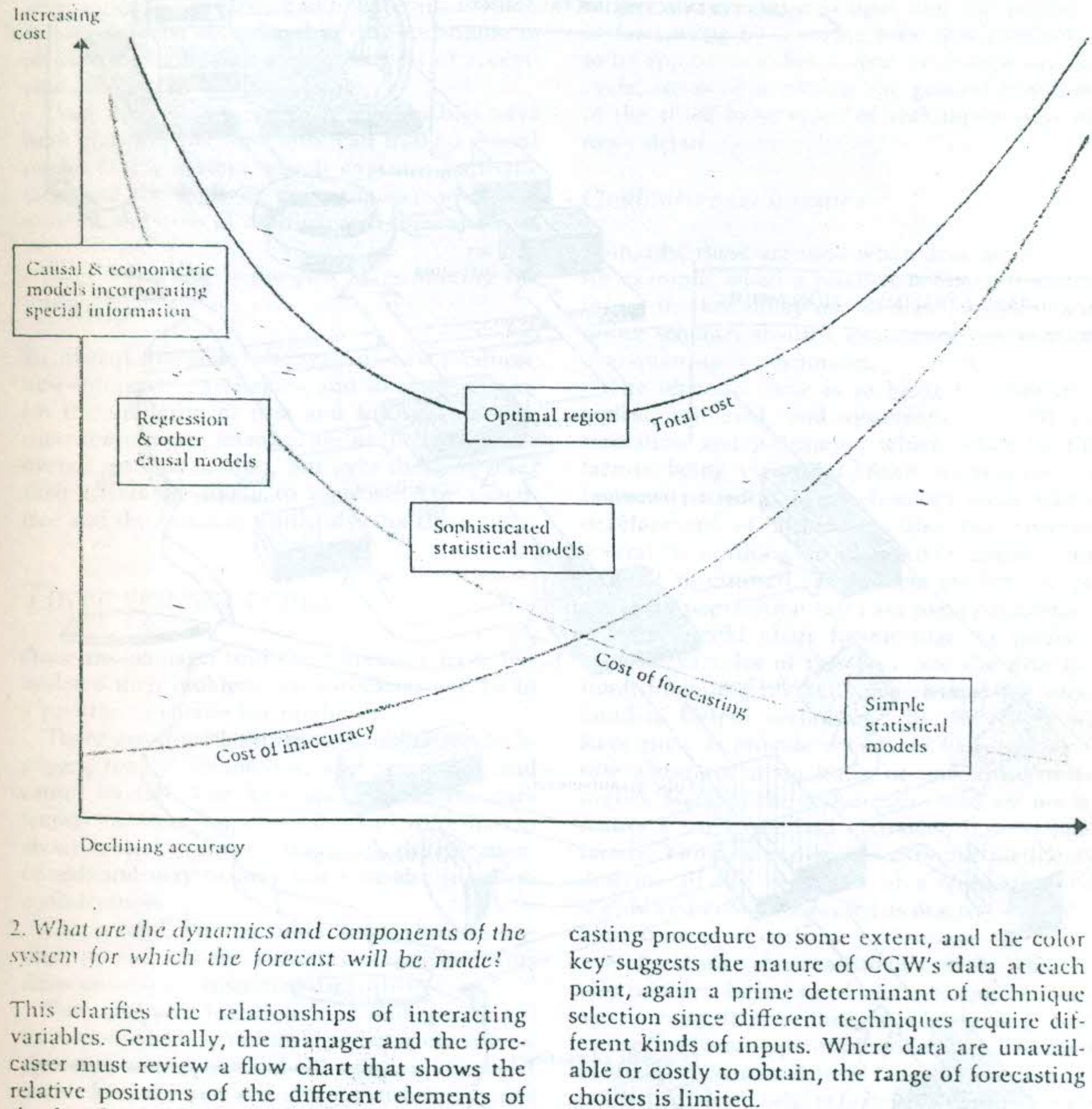
Techniques vary in their costs, as well as in scope and accuracy. The manager must fix the level of inaccuracy he can tolerate—in other words, decide how his decision will vary, depending on the range of accuracy of the forecast. This allows the forecaster to trade off cost against the value of accuracy in choosing a technique.

For example, in production and inventory control, increased accuracy is likely to lead to lower safety stocks. Here the manager and forecaster must weigh the cost of a more sophisticated and more expensive technique against potential savings in inventory costs.

Exhibit I shows how cost and accuracy increase with sophistication and charts this against the corresponding cost of forecasting errors, given some general assumptions. The most sophisticated technique that can be economically justified is one that falls in the region where the sum of the two costs is minimal.

Once the manager has defined the purpose of the forecast, the forecaster can advise him on how often it could usefully be produced. From a strategic point of view, they should discuss whether the decision to be made on the basis of the forecast can be changed later, if they find the forecast was inaccurate. If it *can* be changed, they should then discuss the usefulness of installing a system to track the accuracy of the forecast and the kind of tracking system that is appropriate.

Exhibit I. Cost of forecasting versus cost of inaccuracy for a medium-range forecast, given data availability



2. What are the dynamics and components of the system for which the forecast will be made?

This clarifies the relationships of interacting variables. Generally, the manager and the forecaster must review a flow chart that shows the relative positions of the different elements of the distribution system, sales system, production system, or whatever is being studied.

Exhibit II displays these elements for the system through which CGW's major component for color TV sets—the bulb—flows to the consumer. Note the points where inventories are required or maintained in this manufacturing and distribution system—these are the *pipeline elements,* which exert important effects throughout the flow system and hence are of critical interest to the forecaster.

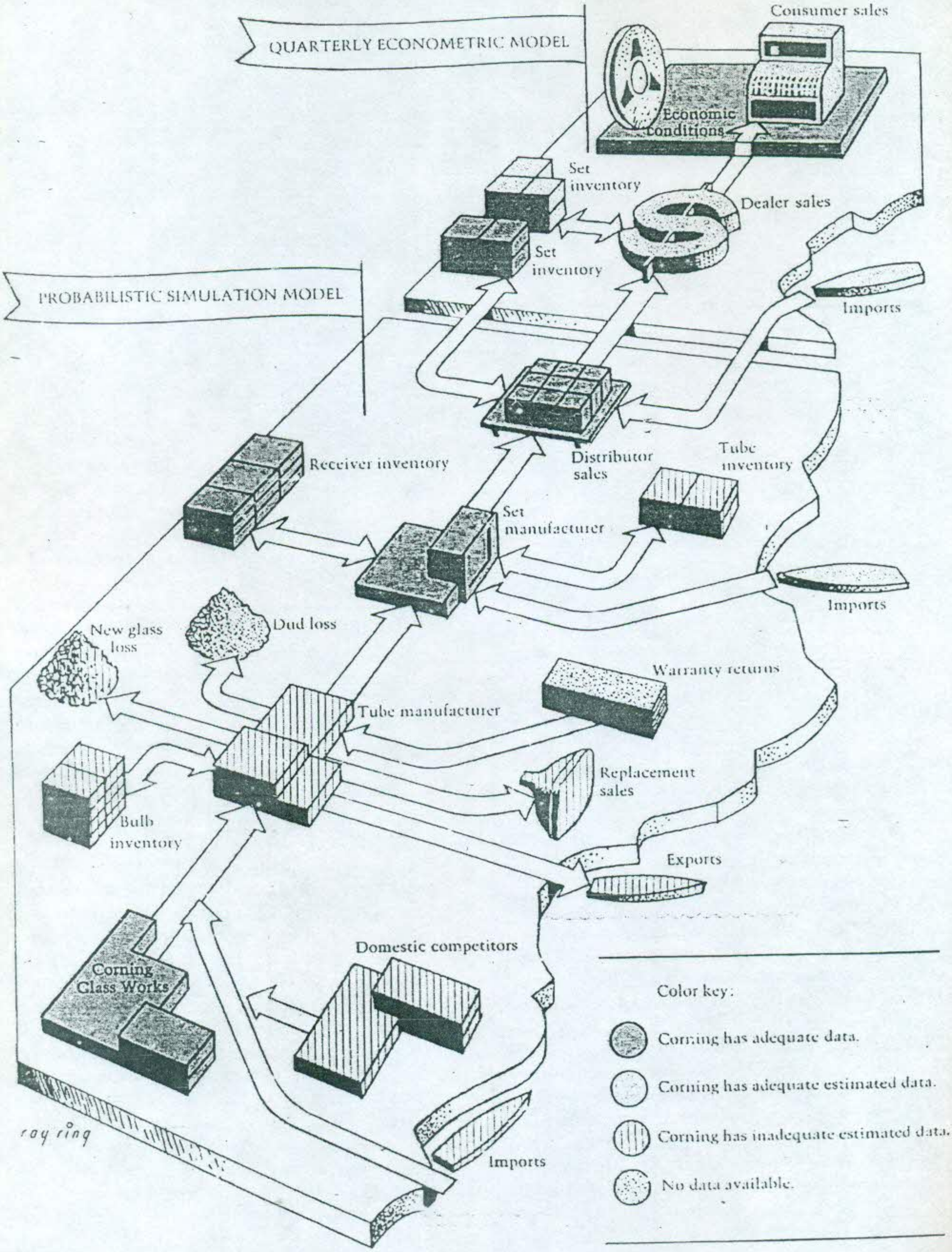
All the elements in blue directly affect forecasting procedure to some extent, and the color key suggests the nature of CGW's data at each point, again a prime determinant of technique selection since different techniques require different kinds of inputs. Where data are unavailable or costly to obtain, the range of forecasting choices is limited.

The flow chart should also show which parts of the system are under the control of the company doing the forecasting. In *Exhibit II,* this is merely the volume of glass panels and funnels supplied by Corning to the tube manufacturers.

In the part of the system where the company has total control, management tends to be tuned in to the various cause-and-effect relationships, and hence can frequently use forecasting techniques that take causal factors explicitly into account.

The flow chart has special value for the fore-

Exhibit II. Flow chart of TV distribution system



caster where causal prediction methods are called for because it enables him to conjecture about the possible variations in sales levels caused by inventories and the like, and to determine which factors must be considered by the technique to provide the executive with a forecast of acceptable accuracy.

Once these factors and their relationships have been clarified, the forecaster can build a causal model of the system which captures both the facts and the logic of the situation—which is, after all, the basis of sophisticated forecasting.

3. *How important is the past in estimating the future?*

Significant changes in the system—new products, new competitive strategies, and so forth—diminish the similarity of past and future. Over the short term, recent changes are unlikely to cause overall patterns to alter, but over the long term their effects are likely to increase. The executive and the forecaster must discuss these fully.

Three general types

Once the manager and the forecaster have formulated their problem, the forecaster will be in a position to choose his method.

There are three basic types—*qualitative techniques, time series analysis and projection*, and *causal models*. The first uses qualitative data (expert opinion, for example) and information about special events of the kind already mentioned, and may or may not take the past into consideration.

The second, on the other hand, focuses entirely on patterns and pattern changes, and thus relies entirely on historical data.

The third uses highly refined and specific information about relationships between system elements, and is powerful enough to take special events formally into account. As with time series analysis and projection techniques, the past is important to causal models.

These differences imply (quite correctly) that the same type of forecasting technique is not appropriate to forecast sales, say, at all stages of the life cycle of a product—for example, a technique that relies on historical data would not be useful in forecasting the future of a totally new product that has no history.

The major part of the balance of this article will be concerned with the problem of suiting the technique to the life-cycle stages. We hope to give the executive insight into the potential of forecasting by showing how this problem is to be approached. But before we discuss the life cycle, we need to sketch the general functions of the three basic types of techniques in a bit more detail.

Qualitative techniques

Primarily, these are used when data are scarce—for example, when a product is first introduced into a market. They use human judgment and rating schemes to turn qualitative information into quantitative estimates.

The objective here is to bring together in a logical, unbiased, and systematic way all information and judgments which relate to the factors being estimated. Such techniques are frequently used in new-technology areas, where development of a product idea may require several "inventions," so that R&D demands are difficult to estimate, and where market acceptance and penetration rates are highly uncertain.

The gatefold chart facing page 54 presents several examples of this type (see the first section), including market research and the now-familiar Delphi technique.[1] In this chart we have tried to provide a body of basic information about the main kinds of forecasting techniques. Some of the techniques listed are not in reality a single method or model, but a whole family. Thus our statements may not accurately describe all the variations of a technique and should rather be interpreted as descriptive of the basic concept of each.

A disclaimer about estimates in the chart is also in order. Estimates of costs are approximate, as are computation times, accuracy ratings, and ratings for turning-point identification. The costs of some procedures depend on whether they are being used routinely or are set up for a single forecast; also, if weightings or seasonals have to be determined anew each time a forecast is made, costs increase significantly. Still, the figures we present may serve as general guidelines.

The reader may find frequent reference to this gatefold helpful for the remainder of the article.

Time series analysis

These are statistical techniques used when several years' data for a product or product line are

1. See Harper Q. North and Donald L. Pyke, "'Probes' of the Technological Future," HBR May-June 1969, p. 68.

available and when relationships and trends are both clear and relatively stable.

One of the basic principles of statistical forecasting—indeed, of all forecasting when historical data are available—is that the forecaster should use the data on past performance to get a "speedometer reading" of the current rate (of sales, say) and of how fast this rate is increasing or decreasing. The current rate and changes in the rate—"acceleration" and "deceleration"—constitute the basis of forecasting. Once they are known, various mathematical techniques can develop projections from them.

The matter is not so simple as it sounds, however. It is usually difficult to make projections from raw data since the rates and trends are not immediately obvious; they are mixed up with seasonal variations, for example, and perhaps distorted by such factors as the effects of a large sales promotion campaign. The raw data must be massaged before they are usable, and this is frequently done by time series analysis.

Now, a *time series* is a set of chronologically ordered points of raw data—for example, a division's sales of a given product, by month, for several years. Time series *analysis* helps to identify and explain:

○ Any regularity or systematic variation in the series of data which is due to seasonality—the "seasonals."

○ Cyclical patterns that repeat any two or three years or more.

○ Trends in the data.

○ Growth rates of these trends.

(Unfortunately, most existing methods identify only the seasonals, the combined effect of trends and cycles, and the irregular, or chance, component. That is, they do not separate *trends* from *cycles*. We shall return to this point when we discuss time series analysis in the final stages of product maturity.)

Once the analysis is complete, the work of projecting future sales (or whatever) can begin.

We should note that while we have separated analysis from projection here for purposes of explanation, most statistical forecasting techniques actually combine both functions in a single operation.

A future like the past: It is obvious from this description that all statistical techniques are based on the assumption that existing patterns will continue into the future. This assumption is more likely to be correct over the short term than it is over the long term, and for this reason these techniques provide us with reasonably accurate forecasts for the immediate future but do quite poorly further into the future (unless the data patterns are extraordinarily stable).

For this same reason, these techniques ordinarily *cannot* predict when the rate of growth in a trend will change significantly—for example, when a period of slow growth in sales will suddenly change to a period of rapid decay.

Such points are called *turning points*. They are naturally of the greatest consequence to the manager, and, as we shall see, the forecaster must use different tools from pure statistical techniques to predict when they will occur.

Causal models

When historical data are available and enough analysis has been performed to spell out explicitly the relationships between the factor to be forecast and other factors (such as related businesses, economic forces, and socioeconomic factors), the forecaster often constructs a *causal model*.

A causal model is the most sophisticated kind of forecasting tool. It expresses mathematically the relevant causal relationships, and may include pipeline considerations (i.e., inventories) and market survey information. It may also directly incorporate the results of a time series analysis.

The causal model takes into account everything known of the dynamics of the flow system and utilizes predictions of related events such as competitive actions, strikes, and promotions. If the data are available, the model generally includes factors for each location in the flow chart (as illustrated in *Exhibit II*) and connects these by equations to describe overall product flow.

If certain kinds of data are lacking, initially it may be necessary to make assumptions about some of the relationships and then track what is happening to determine if the assumptions are true. Typically, a causal model is continually revised as more knowledge about the system becomes available.

Again, see the gatefold for a rundown on the most common types of causal techniques. As the chart shows, causal models are by far the best for predicting turning points and preparing long-range forecasts.

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Methods, products & the life cycle

At each stage of the life of a product, from conception to steady-state sales, the decisions that management must make are characteristically quite different, and they require different kinds of information as a base. The forecasting techniques that provide these sets of information differ analogously. *Exhibit III* summarizes the life stages of a product, the typical decisions made at each, and the main forecasting techniques suitable at each.

Equally, different products may require different kinds of forecasting. Two CGW products that have been handled quite differently are the major glass components for color TV tubes, of which Corning is a prime supplier, and CORNING WARE® cookware, a proprietary consumer product line. We shall trace the forecasting methods used at each of the four different stages of maturity of these products to give some firsthand insight into the choice and application of some of the major techniques available today.

Before we begin, let us note how the situations differ for the two kinds of products:

▽ For a consumer product like the cookware, the manufacturer's control of the distribution pipeline extends at least through the distributor level. Thus he can affect or control consumer sales quite directly, as well as directly control some of the pipeline elements.

Many of the changes in shipment rates and in overall profitability are therefore due to actions taken by the manufacturer himself. Tactical decisions on promotions, specials, and pricing are usually at his discretion as well. The technique selected by the forecaster for projecting sales therefore should permit incorporation of such "special information." One may have to start with simple techniques and work up to more sophisticated ones that embrace such possibilities, but the final goal is there.

△ Where the manager's company supplies a component to an OEM, as Corning does for tube manufacturers, the company does not have such direct influence or control over either the pipeline elements or final consumer sales. It may be impossible for the company to obtain good information about what is taking place at points further along the flow system (as in the upper segment of *Exhibit II*), and, in consequence, the forecaster will necessarily be using a different genre of forecasting from that he uses for a consumer product.

Between these two examples, our discussion will embrace nearly the whole range of forecasting techniques. As necessary, however, we shall touch on other products and other forecasting methods.

1. Product development

In the early stages of product development, the manager wants answers to questions such as these:

○ What are the alternative growth opportunities to pursuing product X?

○ How have established products similar to X fared?

○ Should *we* enter this business; and if so, in what segments?

○ How should we allocate R&D efforts and funds?

○ How successful will different product concepts be?

○ How will product X fit into the markets five or ten years from now?

Forecasts that help to answer these long-range questions must necessarily have long horizons themselves.

A common objection to much long-range forecasting is that it is virtually impossible to predict with accuracy what will happen several years into the future. We agree that uncertainty increases when a forecast is made for a period more than two years out. However, at the very least, the forecast and a measure of its accuracy enable the manager to know his risks in pursuing a selected strategy and in this knowledge to choose an appropriate strategy from those available.

Systematic market research is, of course, a mainstay in this area. For example, priority pattern analysis can describe the consumer's preferences and the likelihood he will buy a product, and thus is of great value in forecasting (and updating) penetration levels and rates. But there are other tools as well, depending on the state of the market and the product concept.

For a defined market

While there can be no direct data about a product that is still a gleam in the eye, information about its likely performance can be gathered in a number of ways, provided the market in which it is to be sold is a known entity.

First, one can compare a proposed product with competitors' present and planned products, ranking it on quantitative scales for different factors. We call this *product differences measurement*.[2]

If this approach is to be successful, it is essential that the (in-house) experts who provide the basic data come from different disciplines—marketing, R&D, manufacturing, legal, and so on—and that their opinions be unbiased.

Second, and more formalistically, one can construct *disaggregate market models* by separating off different segments of a complex market for individual study and consideration. Specifically, it is often useful to project the S-shaped growth curves for the levels of income of different geographical regions.

When color TV bulbs were proposed as a product, CGW was able to identify the factors that would influence sales growth. Then, by disaggregating consumer demand and making certain assumptions about these factors, it was possible to develop an S-curve for rate of penetration of the household market that proved most useful to us.

Third, one can compare a projected product with an "ancestor" that has similar characteristics. In 1965, we disaggregated the market for color television by income levels and geographical regions and compared these submarkets with the historical pattern of black-and-white TV market growth. We justified this procedure by arguing that color TV represented an advance over black-and-white analogous to (although less intense than) the advance that black-and-white TV represented over radio. The analyses of black-and-white TV market growth also enabled us to estimate the variability to be expected—that is, the degree to which our projections would differ from actual as the result of economic and other factors.

The prices of black-and-white TV and other major household appliances in 1949, consumer disposable income in 1949, the prices of color TV and other appliances in 1965, and consumer disposable income for 1965 were all profitably considered in developing our long-range forecast for color-TV penetration on a national basis. The success patterns of black-and-white TV, then, provided insight into the likelihood of success and sales potential of color TV.

Our predictions of consumer acceptance of CORNING WARE® cookware, on the other hand, were derived primarily from one expert source, a manager who thoroughly understood consumer preferences and the housewares market. These predictions have been well borne out. This reinforces our belief that sales forecasts

Exhibit III. Types of decisions made over a product's life cycle, with related forecasting techniques

Stage of life cycle	Product development	Market testing & early introduction	Rapid growth	Steady state
Typical decisions	Amount of development effort Product design Business strategies	Optimum facility size Marketing strategies, including distribution & pricing	Facilities expansion Marketing strategies Production planning	Promotions, specials Pricing Production planning Inventories
Forecasting techniques	Delphi method Historical analysis of comparable products Priority pattern analysis Input-output analysis Panel consensus	Consumer surveys Tracking & warning systems Market tests Experimental designs —	Statistical techniques for identifying turning points Tracking & warning systems Market surveys Intention-to-buy surveys	Time series analysis & projection Causal & econometric models Market surveys for tracking & warning Life-cycle analysis

2 See John C. Chambers, Satinder K. Mullick, and David A. Goodman, "Catalytic Agent for Effective Planning," HBR January-February 1971, p. 110.

for a new product that will compete in an existing market are bound to be incomplete and uncertain unless one culls the best judgments of fully experienced personnel.

For an undefined market

Frequently, however, the market for a new product is weakly defined or few data are available, the product concept is still fluid, and history seems irrelevant. This is the case for gas turbines, electric and steam automobiles, modular housing, pollution measurement devices, and time-shared computer terminals.

Many organizations have applied the Delphi method of soliciting and consolidating experts' opinions under these circumstances. At CGW, in several instances, we have used it to estimate demand for such new products, with success.

Input-output analysis, combined with other techniques, can be extremely useful in projecting the future course of broad technologies and broad changes in the economy. The basic tools here are the input-output tables of U.S. industry for 1947, 1958, and 1963, and various updatings of the 1963 tables prepared by a number of groups who wished to extrapolate the 1963 figures or to make forecasts for later years.

Since a business or product line may represent only a small sector of an industry, it may be difficult to use the tables directly. However, a number of companies are disaggregating industries to evaluate their sales potential and to forecast changes in product mixes—the phasing out of old lines and introduction of others. For example, Quantum-Science Corporation (MAPTEK) has developed techniques that make input-output analyses more directly useful to today's electronics businessmen. (Other techniques, such as panel consensus and visionary forecasting, seem less effective to us, and we cannot evaluate them from our own experience.)

2. *Testing & introduction*

Before a product can enter its (hopefully) rapid penetration stage, the market potential must be tested out and the product must be introduced—and then more market testing may be advisable. At this stage, management needs answers to these questions:

○ What shall our marketing plan be—which markets should we enter and with what production quantities?

○ How much manufacturing capacity will the early production stages require?

○ As demand grows, where should we build this capacity?

○ How shall we allocate our R&D resources over time?

Significant profits depend on finding the right answers, and it is therefore economically feasible to expend relatively large amounts of effort and money on obtaining good forecasts, short-, medium-, and long-range.

A sales forecast at this stage should provide three points of information: the date when rapid sales will begin, the rate of market penetration during the rapid-sales stage, and the ultimate level of penetration, or sales rate, during the steady-state stage.

Using early data

The date when a product will enter the rapid-growth stage is hard to predict three or four years in advance (the usual horizon). A company's only recourse is to use statistical tracking methods to check on how successfully the product is being introduced, along with routine market studies to determine when there has been a significant increase in the sales rate.

Furthermore, the greatest care should be taken in analyzing the early sales data that start to accumulate once the product has been introduced into the market. For example, it is important to distinguish between sales to *innovators*, who will try anything new, and sales to *imitators*, who will buy a product only after it has been accepted by innovators, for it is the latter group that provides demand stability. Many new products have initially appeared successful because of purchases by innovators, only to fail later in the stretch.

Tracking the two groups means market research, possibly via opinion panels. A panel ought to contain both innovators and imitators, since innovators can teach one a lot about how to improve a product while imitators provide insight into the desires and expectations of the whole market.

The color TV set, for example, was introduced in 1954, but did not gain acceptance from the majority of consumers until late 1964. To be sure, the color TV set could not leave the introduction stage and enter the rapid-growth stage until the networks had substantially increased their color programming. However, special flag signals like "substantially increased network color programming" are likely to come after the fact, from the planning viewpoint; and in general, we find, scientifically designed consumer surveys conducted on a regular basis provide the earliest means of detecting turning points in the demand for a product.

Similar-product technique

Although statistical tracking is a useful tool during the early introduction stages, there are rarely sufficient data for statistical forecasting. Market research studies can naturally be useful, as we have indicated. But, more commonly, the forecaster tries to identify a similar, older product whose penetration pattern should be similar to that of the new product, since overall markets can and do exhibit consistent patterns.

Again, let's consider color television and the forecasts we prepared in 1965.

For the year 1947-1968, *Exhibit IV* shows total consumer expenditures, appliance expenditures, expenditures for radios and TVs, and relevant percentages. Column 4 shows that total expenditures for appliances are relatively stable over periods of several years; hence, new appliances must compete with existing ones, especially during recessions (note the figures for 1948-1949, 1953-1954, 1957-1958, and 1960-1961).

Certain specific fluctuations in these figures are of special significance here. When black-and-white TV was introduced as a new product in 1948-1951, the ratio of expenditures on radio and TV sets to total expenditures for consumer goods (see column 7) increased about 33% (from 1.23% to 1.63%), as against a modest increase of only 13% (from 1.63% to 1.88%) in the ratio for the next decade. (A similar increase of 33% occurred in 1962-1966 as color TV made its major penetration.)

Probably, the acceptance of black-and-white TV as a major appliance in 1950 caused the ratio of all major household appliances to total consumer goods (see column 5) to rise to 4.98%; in other words, the innovation of TV caused the consumer to start spending more money on major appliances around 1950.

Our expectation in mid-1965 was that the introduction of color TV would induce a similar

Exhibit IV. Expenditures on appliances versus all consumer goods
(In billions of dollars)

Year (1)	All consumer goods* (2)	Household appliances† (3)	Radio, TV & other† (4)	Totals of columns 3 & 4 (5)	Column 5 ÷ Column 2 (6)	Column 4 ÷ Column 2 (7)
1947	110.9	3.18	1.43	4.61	4.16%	1.29%
1948	118.9	3.47	1.48	4.95	4.16	1.23
1949	119.1	3.13	1.70	4.83	4.06	1.43
1950	128.6	3.94	2.46	6.40	4.98	1.91
1951	138.4	3.87	2.26	6.13	4.43	1.63
1952	143.3	3.82	2.37	6.19	4.32	1.65
1953	150.0	3.99	2.61	6.60	4.40	1.74
1954	151.1	4.02	2.74	6.77	4.48	1.81
1955	162.9	4.69	2.79	7.48	4.59	1.71
1956	168.2	4.89	2.87	7.76	4.61	1.71
1957	176.4	4.63	3.00	7.63	4.33	1.70
1958	178.1	4.44	3.07	7.51	4.22	1.72
1959	190.9	4.86	3.42	8.28	4.34	1.79
1960	196.6	4.74	3.62	8.36	4.25	1.84
1961	200.1	4.77	3.76	8.53	4.26	1.88
1962	212.1	5.01	3.94	8.95	4.22	1.8[illegible]
1963	222.5	5.24	4.54	9.78	4.40	2.04
1964	237.9	5.74	5.41	11.15	4.69	2.27
1965	257.4	6.03	6.01	12.04	4.68	2.33
1966	277.7	6.77	6.91	13.68	4.93	2.49
1967	288.1	7.09	7.41	14.50	5.03	2.57
1968	313.9	7.80	7.85	15.65	4.99	2.50

*Data obtained from *Survey of Current Business*, Personal Consumption Expenditure Tables (U.S. Department of Commerce, July issues).

† Data obtained from the *Survey of Current Business Statistics* (U.S. Department of Commerce, 1969 Biennial Edition).

BASIC FORECASTING TECHNIQUES

Technique	A. Qualitative methods		
	1. Delphi method	2. Market research	3. Panel consensus
Description	A panel of experts is interrogated by a sequence of questionnaires in which the responses to one questionnaire are used to produce the next questionnaire. Any set of information available to some experts and not others is thus passed on to the others, enabling all the experts to have access to all the information for forecasting. This technique eliminates the bandwagon effect of majority opinion.	The systematic, formal, and conscious procedure for evolving and testing hypotheses about real markets.	This technique is based on the assumption that several experts can arrive at a better forecast than one person. There is no secrecy, and communication is encouraged. The forecasts are sometimes influenced by social factors, and may not reflect a true consensus.
Accuracy			
Short term (0-3 months)	Fair to very good	Excellent	Poor to fair
Medium term (3 months-2 years)	Fair to very good	Good	Poor to fair
Long term (2 years & up)	Fair to very good	Fair to good	Poor
Identification of turning points	Fair to good	Fair to very good	Poor to fair
Typical applications	Forecasts of long-range and new-product sales, forecasts of margins.	Forecasts of long-range and new-product sales, forecasts of margins.	Forecasts of long-range and new-product sales, forecasts of margins.
Data required	A coordinator issues the sequence of questionnaires, editing and consolidating the responses.	As a minimum, two set of reports over time. One needs a considerable collection of market data from questionnaires, surveys, and time series analyses of market variables.	Information from a panel of experts is presented openly in group meetings to arrive at a consensus forecast. Again, a minimum is two sets of reports over time.
Cost of forecasting*			
With a computer	$2,000+	$5,000+	$1,000+
Is calculation possible without a computer?	Yes	Yes	Yes
Time required to develop an application & make a forecast	2 months+	3 months+	2 weeks+
References	North & Pyke, " 'Probes' of the Technological Future," HBR May-June 1969, p. 68.	Bass, King & Pessemeier, *Applications of the Sciences in Marketing Management* (New York, John Wiley & Sons, Inc., 1968).	———

*These estimates are based on our own experience, using this machine configuration: an IBM 360-40, 256 K system and a Univac 1108 Time-Sharing System, together with such smaller equipment as G.E. Time-sharing and IBM 360-30's and 1130's.

		B. Time series analysis & projection	
4. Visionary forecast	5. Historical analogy	1. Moving average	2. Exponential smoothing
A prophecy that uses personal insights, judgment, and, when possible, facts about different scenarios of the future. It is characterized by subjective guesswork and imagination; in general, the methods used are nonscientific.	This is a comparative analysis of the introduction and growth of similar new products, that bases the forecast on similarity patterns.	Each point of a moving average of a time series is the arithmetic or weighted average of a number of consecutive points of the series, where the number of data points is chosen so that the effects of seasonals or irregularity or both are eliminated.	This technique is similar to the moving average, except that more recent data points are given more weight. Descriptively, the new forecast is equal to the old one plus some proportion of the past forecasting error. Adaptive forecasting is somewhat the same except that seasonals are also computed. There are many variations of exponential smoothing: some are more versatile than others, some are computationally more complex, some require more computer time.
Poor Poor Poor	Poor Good to fair Good to fair	Poor to good Poor Very poor	Fair to very good Poor to good Very poor
Poor	Poor to fair	Poor	Poor
Forecasts of long-range and new-product sales, forecasts of margins.	Forecasts of long-range and new-product sales, forecasts of margins.	Inventory control for low-volume items.	Production and inventory control, forecasts of margins and other financial data.
A set of possible scenarios about the future prepared by a few experts in light of past events.	Several years' history of one or more products.	A minimum of two years of sales history, if seasonals are present. Otherwise, less data. (Of course, the more history the better.) The moving average must be specified.	The same as for a moving average.
$100+ Yes	$1,000+ Yes	$.005 Yes	$.005 Yes
1 week+	1 month+	1 day−	1 day−
————	Spencer, Clark & Hoguet, *Business & Economic Forecasting* (Homewood, Illinois, Richard D. Irwin, Inc., 1961).	Hadley, *Introduction to Business Statistics* (San Francisco, Holden-Day, Inc., 1968).	Brown, "Less Risk in Inventory Estimates," HBR July-August 1959, p. 104.

3. Box-Jenkins	4. X-11	5. Trend projections	C. Causal methods 1. Regression model
Exponential smoothing is a special case of the Box-Jenkins technique. The time series is fitted with a mathematical model that is optimal in the sense that it assigns smaller errors to history than any other model. The type of model must be identified and the parameters then estimated. This is apparently the most accurate statistical routine presently available but also one of the most costly and time-consuming ones.	Developed by Julius Shiskin of the Census Bureau, this technique decomposes a time series into seasonals, trend cycles, and irregular elements. Primarily used for detailed time series analysis (including estimating seasonals); but we have extended its uses to forecasting and tracking and warning by incorporating other analytical methods. Used with special knowledge, it is perhaps the most effective technique for medium-range forecasting – three months to one year – allowing one to predict turning points and to time special events.	This technique fits a trend line to a mathematical equation and then projects it into the future by means of this equation. There are several variations: the slope-characteristic method, polynomials, logarithms, and so on.	This functionally relates sales to other economic, competitive, or internal variables and estimates an equation using the least-squares technique. Relationships are primarily analyzed statistically, although any relationship should be selected for testing on a rational ground.
Very good to excellent Poor to good Very poor	Very good to excellent Good Very poor	Very good Good Good	Good to very good Good to very good Poor
Fair	Very good	Poor	Very good
Production and inventory control for large-volume items, forecasts of cash balances.	Tracking and warning, forecasts of company, division, or department sales.	New-product forecasts (particularly intermediate- and long-term).	Forecasts of sales by product classes, forecasts of margins.
The same as for a moving average. However, in this case more history is very advantageous in model identification.	A minimum of three years' history to start. Thereafter, the complete history.	Varies with the technique used. However, a good rule of thumb is to use a minimum of five years' annual data to start. Thereafter, the complete history.	Several years' quarterly history to obtain good, meaningful relationships. Mathematically necessary to have two more observations than there are independent variables.
$10.00 Yes	$10.00 No	Varies with application Yes	$100 Yes
1-2 days	1 day	1 day–	Depends on ability to identify relationships.
Box-Jenkins, *Time Series Analysis, Forecasting & Control* (San Francisco, Holden-Day, Inc., 1970).	McLaughlin & Boyle, "Short-term Forecasting," AMA Association Booklet, 1968.	Hadley, *Introduction to Business Statistics* (San Francisco, Holden-Day, Inc., 1968); Oliver & Boyd, "Techniques of Production Control," Imperial Chemical Industries, 1964.	Clelland, de Cani, Brown, Bush & Murray, *Basic Statistics with Business Applications* (New York, John Wiley & Sons, Inc., 1966).

2. Econometric model	3. Intention-to-buy & anticipations surveys	4. Input-output model	5. Economic input-output model
An econometric model is a system of interdependent regression equations that describes some sector of economic sales or profit activity. The parameters of the regression equations are usually estimated simultaneously. As a rule, these models are relatively expensive to develop and can easily cost between $5,000 and $10,000, depending on detail. However, due to the system of equations inherent in such models, they will better express the causalities involved than an ordinary regression equation and hence will predict turning points more accurately.	These surveys of the general public (a) determine intentions to buy certain products or (b) derive an index that measures general feeling about the present and the future and estimates how this feeling will affect buying habits. These approaches to forecasting are more useful for tracking and warning than forecasting. The basic problem in using them is that a turning point may be signaled incorrectly (and hence never occur).	A method of analysis concerned with the interindustry or interdepartmental flow of goods or services in the economy or a company and its markets. It shows what flows of inputs must occur to obtain certain outputs. Considerable effort must be expended to use these models properly, and additional detail, not normally available, must be obtained if they are to be applied to specific businesses. Corporations using input-output models have expended as much as $100,000 and more annually to develop useful applications.	Econometric models and input-output models are sometimes combined for forecasting. The input-output model is used to provide long-term trends for the econometric model; it also stabilizes the econometric model.
Good to very good Very good to excellent Good	Poor to good Poor to good Very poor	Not applicable Good to very good Good to very good	Not applicable Good to very good Good to excellent
Excellent	Good	Fair	Good
Forecasts of sales by product classes, forecasts of margins.	Forecasts of sales by product class	Forecasts of company sales and division sales for industrial sectors and subsectors.	Company sales for industrial sectors and subsectors.
The same as for regression.	Several years' data are usually required to relate such indexes to company sales.	Ten or fifteen years' history. Considerable amounts of information on product and service flows within a corporation (or economy) for each year for which an input-output analysis is desired.	The same as for a moving average and X-11.
$5,000 – Yes	$5,000 Yes	$50,000 + No	$100,000 No
2 months+	Several weeks	6 months+	6 months+
Evans, *Macro-economic Activity: Theory, Forecasting & Control* (New York, Harper & Row Publishers, Inc., 1969).	Publications of Survey Research Center, Institute for Social Research, University of Michigan; and of Bureau of the Census.	Leontief, *Input-Output Economics* (New York, Oxford University Press, 1966)	Evans & Preston, "Discussion Paper #138," Wharton School of Finance & Commerce, The University of Pennsylvania.

5. Diffusion index	7. Leading indicator	8. Life-cycle analysis	
The percentage of a group of economic indicators that are going up or down, this percentage then becoming the index.	A time series of an economic activity whose movement in a given direction precedes the movement of some other time series in the same direction is a leading indicator.	This is an analysis and forecasting of new-product growth rates based on *S*-curves. The phases of product acceptance by the various groups such as innovators, early adapters, early majority, late majority, and laggards are central to the analysis.	
Poor to good Poor to good Very poor	Poor to good Poor to good Very poor	Poor Poor to good Poor to good	Accuracy
Good	Good	Poor to good	Turning point identification
Forecasts of sales by product class.	Forecasts of sales by product class.	Forecasts of new-product sales.	Applications
The same as an intention-to-buy survey.	The same as an intention-to-buy survey + 5 to 10 years' history.	As a minimum, the annual sales of the product being considered or of a similar product. It is often necessary to do market surveys.	Data required
$1,000 Yes	$1,000 Yes	$1,500 Yes	Cost
1 month+	1 month+	1 month+	Time required to develop forecast
Evans, *Macro-economic Activity: Theory, Forecasting & Control* (New York, Harper & Row Publishers, Inc., 1969).	Evans, *Macro-economic Activity: Theory, Forecasting & Control* (New York, Harper & Row Publishers, Inc., 1969).	Bass, "A New Product Growth Model for Consumer Durables," *Management Science*, January 1969.	References

PULL OUT TO READ

GETTING THINGS DONE

Four Steps to Forecast Total Market Demand

Without a total-demand forecast, you're operating in the dark.

by F. WILLIAM BARNETT

Recent history is filled with stories of companies and sometimes even entire industries that have made grave strategic errors because of inaccurate industrywide demand forecasts. For example:

- In 1974, U.S. electric utilities made plans to double generating capacity by the mid-1980s based on forecasts of a 7% annual growth in demand. Such forecasts are crucial since companies must begin building new generating plants five to ten years before they are to come on line. But during the 1975-1985 period, load actually grew at only a 2% rate. Despite the postponement or cancellation of many projects, the excess generating capacity has hurt the industry financial situation and led to higher customer rates.
- The petroleum industry invested $500 billion worldwide in 1980 and 1981 because it expected oil prices to rise 50% by 1985. The estimate was based on forecasts that the market would grow from 52 million barrels of oil a day in 1979 to 60 million barrels in 1985. Instead, demand had fallen to 46 million barrels by 1985. Prices collapsed, creating huge losses in drilling, production, refining, and shipping investments.
- In 1983 and 1984, 67 new types of business personal computers were introduced to the U.S. market, and most companies were expecting explosive growth. One industry forecasting service projected an installed base of 27 million units by 1988; another predicted 28 million units by 1987. In fact, only 15 million units had been shipped by 1986. By then, many manufacturers had abandoned the PC market or gone out of business altogether.

The inaccurate suppositions did not stem from a lack of forecasting techniques; regression analysis, historical trend smoothing, and others were available to all the players. Instead, they shared a mistaken fundamental assumption: that relationships driving demand in the past would continue unaltered. The companies didn't foresee changes in end-user behavior or understand their market's saturation point. None realized that history can be an unreliable guide as domestic economies become more international, new technologies emerge, and industries evolve.

As a result of changes like these, many managers have come to distrust traditional techniques. Some even throw up their hands and assume that business planning must proceed without good demand forecasts. I disagree. It is possible to develop valuable insights into future market conditions and demand levels based on a deep understanding of the forces behind total-market demand. These insights can sometimes make the difference between a winning strategy and one that flounders.

A forecast of total-market demand won't guarantee a successful strategy. But without it, decisions on investment, marketing support, and other resource allocations will be based on hidden, unconscious assumptions about industrywide requirements, and they'll often be wrong. By gauging total-market demand explicitly, you have a better chance of controlling your company's destiny. Merely going through the process has merit for a management team. Instead of just coming out with pat answers, numbers, and targets, the team is forced to rethink the competitive environment.

Total-market forecasting is only the first stage in creating a strategy. When you've finished your forecast, you're not done with the planning process by any means.

There are four steps in any total-market forecast:

1. Define the market.
2. Divide total industry demand into its main components.
3. Forecast the drivers of demand in each segment and project how they are likely to change.
4. Conduct sensitivity analyses to understand the most critical assumptions and to gauge risks to the baseline forecast.

Defining the market

At the outset, it's best to be overly inclusive in defining the total market. Define it broadly enough to include *all* potential end users so that you can both identify the appropriate drivers of demand and reduce

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the risk of surprise product substitutions.

The factors that drive forecasts of total-market size differ markedly from those that determine a particular product's market share or product-category share. For example, total-market demand for office telecommunications products nationally depends in part on the number of people in offices and their needs and habits, while total demand for PBX systems depends on how they compare on price and benefits with substitute products like the local telephone company's central office switching service. Beyond this, demand for a particular PBX is a function of price and benefit comparisons with other PBXs.

In defining the market, an understanding of product substitution is critical. Customers might behave differently if the price or performance of potential substitute products changes. One company studying total demand for industrial paper tubes had to consider closely related uses of metal and plastic tubes to prevent customer switching among tubes from biasing the results.

Understand, too, that a completely new product could displace one that hitherto had comprised the entire market – like the electronic calculator, which eliminated the slide rule. For a while after AT&T's divestiture, the Bell telephone companies continued to forecast volume of long-distance calls by using historical trend lines of their revenues – as if they were still part of a monopoly. Naturally, these forecasts grew more inaccurate with time as end users were presented with new choices. The companies are now broadening their market definitions to take account of heightened competition from other long-distance carriers.

There are several ways you can make sure you include all important substitute products (both current and potential). From interviews with industrial customers you can learn about substitutes they are studying or about product usage patterns that imply future switching opportunities. Moreover, market research can lead to insights about consumer products. Speaking with experts in the relevant technologies or reviewing technological literature can help you identify potential developments that could threaten your industry.

Finally, careful quantification of the economic value of alternative products to different customers can yield deep insights into potential switching behavior – for example, how oil price movements would affect plastics prices, which in turn would affect plastic products' ability to substitute for metal or paper.

Analyses like these can lead to the construction of industry demand curves – graphs representing the relationship between price and volume. With an appropriate definition, the total-industry demand curves will often be steeper than demand curves for individual products in the industry. Consumers, for example, are far more likely to switch from Maxwell House to Folgers coffee if Maxwell House's prices increase than they are to stop buying coffee if all coffee prices rise.

In some cases, managers can make quick judgments about market definition. In other cases, they'll have to give their market considerable thought and analysis. A total-market forecast may not be critical to business strategy if market definition is very difficult or the products under study have small market shares. Instead, your principal challenge may be to understand product substitution and competitiveness. One company analyzed the potential market for new consumer food cans, and it concluded that growth trends in food product markets were not critical to the strategy question. What was critical was knowing the value positions of the new packages relative to metal cans, glass jars, and composite cans. So the company spent time on that subject.

Dividing demand into component parts

The second step in forecasting is to divide total demand into its main components for separate analysis.

There are two criteria to keep in mind when choosing segments: make each category small and homogeneous enough so that the drivers of demand will apply consistently across its various elements; make each large enough so that the analysis will be worth the effort. Of course, this is a matter of judgment.

You may find it useful in making this judgment to imagine alternative segmentations (based on end-use customer groups, for example, or type of purchase). Then hypothesize their key drivers of demand (discussed later) and decide how much detail is required to capture the true situation. As the assessment continues, managers can return to this stage and reexamine whether the initial decisions still stand up.

> Americans bought half as many computers as the industry had predicted.

Managers may wish to use a "tree" diagram like the accompanying one constructed by a management team in 1985 to study demand for paper. In this disguised example, industry data permitted the division of demand into 12 end-use categories. Some categories, like business forms and reprographic paper, were big contributors to total consumption; others, such as labels, were not. One (other converting) was fairly large but too diverse for deep analysis. The team focused on the four segments that accounted for 80% of 1985 demand. It then developed secondary branches of the tree to further dissect these categories and to determine their drivers of demand. It analyzed the remaining segments less completely (that is, via a regression against broad macroeconomic trends).

Other companies have used similar methods to segment total demand. One company divided demand for maritime satellite terminals by type of ship (e.g., seismic ships, bulk/cargo/container ships). Another divided demand for long-distance telephone service into business and residential customers

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Components of Uncoated White Paper Making Up Total Demand

Total Demand — End-Use Category	Percent of Total 1986 Demand
Business Forms	[illegible]
Commercial Printing	[illegible]
Reprographic	[illegible]
Envelopes	[illegible]
Other Converting	5
Stationery and Tablet	5
Books	5
Directories	1 or less
Catalogs	↓
Magazines	↓
Inserts	↓
Labels	↓

(Shaded rows:) Reviewed in Depth

and then subdivided it by usage level. And a third segmented consumer appliances into three purchase types – appliances used in new home construction, replacement appliance sales in existing homes, and appliance penetration in existing homes.

In thinking about market divisions, managers need to decide whether to use existing data on segment sizes or to commission research to get an independent estimate. Reliable public information on historical demand levels by segment is available for many big U.S. industries (like steel, automobiles, and natural gas) from industry associations, the federal government, off-the-shelf studies by industry experts, or ongoing market data services. For some foreign markets and less well-researched industries in the United States, like the labels industry, you may have to get independent estimates. Even with good data sources, however, the readily available information may not be divided into the best categories to support an insightful analysis. In these cases, managers must decide whether to develop their forecasts based on the available historical data or to undertake their own market research programs, which can be time-consuming and expensive.

Note that while such segmentation is sufficient for forecasting total demand, it may not create categories useful for developing a marketing strategy. A single product may be driven by entirely different factors. One study of industrial components found that consumer industry categories provided a good basis for projecting total-market demand but gave only limited help in formulating a strategy based on customer preferences: distinguishing those who buy on price from those who buy on service, product quality, or other benefits. Such buying-factor categories generally do not correlate with the customer industry categories used for forecasting. A strong sales force, however, can identify customer preferences and develop appropriate account tactics for each one.

Forecasting the drivers of demand

The third step is to understand and forecast the drivers of demand in each category. Here you can make good use of regressions and other statistical techniques to find some causes for changes in historical demand. But this is only a start. The tougher challenge is to look beyond the data on which regressions can easily be based to other factors where data are much harder to find. Then you need to develop a point of view on how those other factors may themselves change in the future.

An end-use analysis from the commodity paper example, reprographic paper, is shown in the accompanying chart. The management team, using available data, divided reprographic paper into two categories: plain-paper copier paper and nonimpact page printer paper. Without this important differentiation, the drivers of demand would have been masked, making it hard to forecast effectively.

In most cases, managers can safely assume that demand is affected both by macroeconomic variables and by industry-specific developments. In looking at plain-paper copier paper, the team used simple and multiple regression analyses to test relationships with macroeconomic factors like white-collar workers, population, and economic performance. Most of the factors had a significant effect on demand. Intuitively, it also made sense to the team that the level of business activity would relate to paper consumption levels. (Economists sometimes refer to growth in demand due to factors like these as an "outward shift" in the demand curve – toward a greater quantity demanded at a given price.)

Demand growth for copy paper, however, had exceeded the real rate of economic growth and the challenge was to find what other factors had been causing this. The team hypothesized that declining copy costs had caused this increased usage. The relationship was proved by estimating the substantial cost reductions that had occurred, combining those with numbers of tons produced over time, and then fashioning an indicative demand curve for copy paper. (See the chart "Understanding Copy Paper Demand Drivers.") The clear relationship between cost and volume meant that cost

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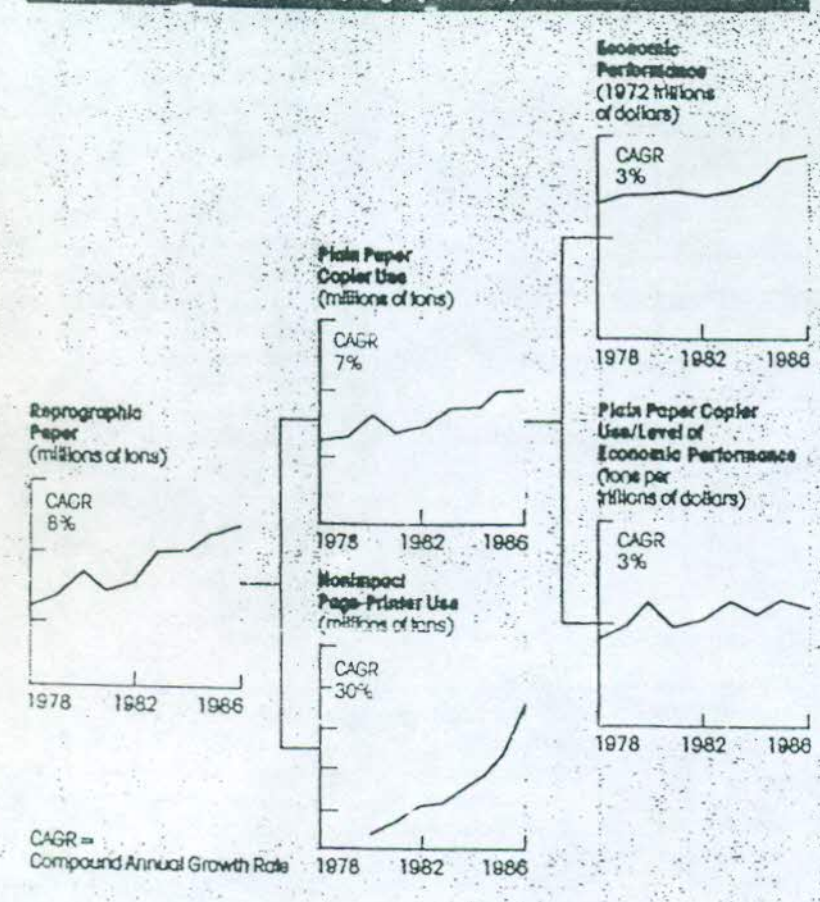
Drivers of Demand for Reprographic Paper



reductions had been an important cause of past demand growth. (Economists sometimes describe this as a downward-shifting supply curve leading to movement down the demand curve.)

Further major declines in cost per copy seemed unlikely because paper costs were expected to remain flat, and the data indicated little increase in price elasticity, even if cost per copy fell further. So the team concluded that usage growth (per level of economic performance) was likely to continue the flattening trend begun in 1983: growth in copy paper consumption would be largely a function of economic growth, not cost declines as in the past. The team then reviewed several econometric services forecasts to develop a base case economic forecast.

Similar studies have been performed in other industries. A simple one was the industrial components analysis mentioned before, a case where the total forecast was used as background but was not critical to the company's strategy decision. Here the team divided demand into its consuming industries and then asked experts in each industry for production forecasts. Total demand for components was projected on the assumption that it would move parallel to a weight-averaged forecast of these customer industries. Actual demand three years later was 2% above the team's prediction, probably because the industry experts underestimated the impact of the economic recovery of 1984 and 1985.

In another example, a team forecasting demand for maritime satellite terminals extrapolated past penetration curves for each of five categories of ships. These curves were then adjusted for major changes in the shipping industry (e.g., adding the depressing effect of the growing oil glut, taking out of these historical trends the unnatural demand growth that had been caused by the Falklands war). The actual figure three years later was within 1% of the forecast.

Knowing the drivers of demand is crucial to the success of any total-market demand forecast. In 1974, as I mentioned earlier, most electric utilities used an incomplete total-demand forecast to predict robust demand growth. In the early 1980s, one company's management team, however, decided to study potential changes in end-user demand as well. The team divided electricity demand into the three traditional categories: residential, commercial, and industrial. It then profiled differences in residential demand because of more efficiency in home appliances and changes in home size and the ratio of multi-unit to single-family dwellings. Industrial demand was analyzed by evaluating the future of several key consuming industries, paying special attention to changes in their total production and electricity use. This end-use approach sharply reduced the utility's initial forecasts and led to cancellation of two $700 million generating plants then in the planning stage.

In 1983, forecasters in the U.S. personal computer industry were saying that demand would continue to rise at a rapid rate because there were 50 million white-collar workers and only 8 million installed PCs. One company, however, did a more detailed demand forecast that showed that growth would soon flatten out. It found that more than two-thirds of white-collar workers either did not require PCs in their jobs—actors and elevator operators, for instance—or were supported mostly by inexpensive terminals linked to large computers, as in the case of many clerical workers. The potential market was not big enough to support the growth rate. Indeed, the market began to flatten the next year.

Forecasting total demand became crucial for another company that was thinking about acquiring a maker of video games. Many thought

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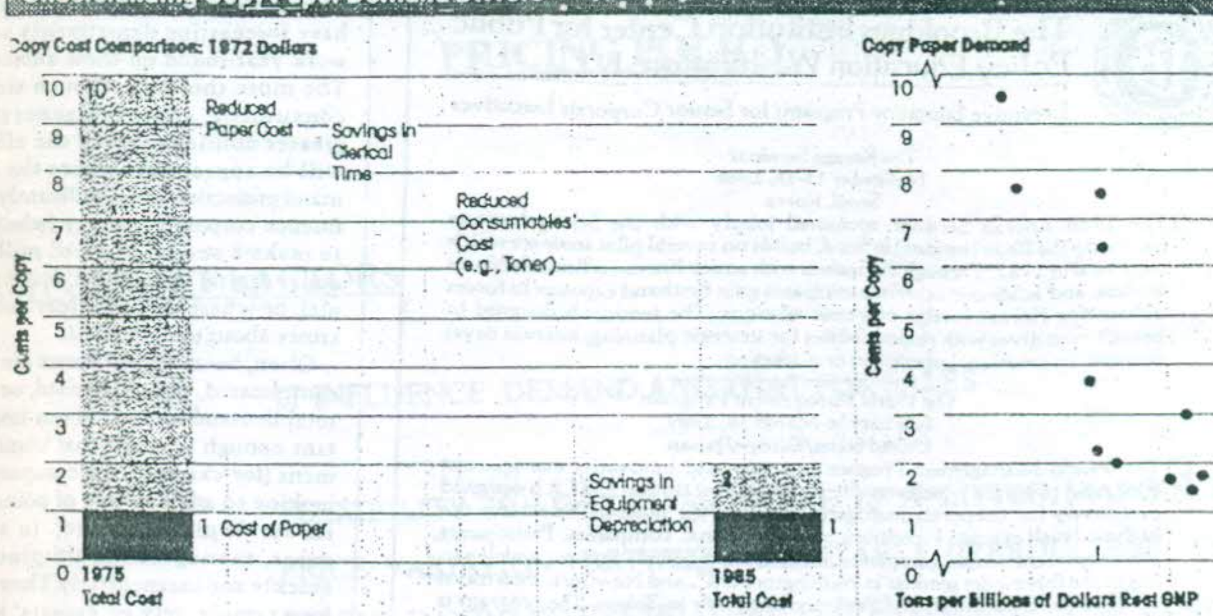
Understanding Copy Paper Demand Drivers



that low overall market penetration (10% of U.S. households) signified a lot of room for growth before the market became saturated, when about 50% of the households would have games. Using available data, however, the management team created categories based on family income and children's ages. The analysis made clear that the main target market, upper-income families with children, was already well penetrated. Families with incomes exceeding $50,000 and children between the ages of 6 and 15 already were 75% penetrated. This finding convinced management that demand would fall and that the proposed acquisition did not make sense. The dramatic decline in video game sales shortly thereafter confirmed the wisdom of this judgment.

Conducting sensitivity analyses

Managers who rely on single-point demand forecasts run dangerous risks. Some of the macroeconomic variables behind the forecasts could be wrong. Despite the best analysis, moreover, the assumptions behind the other demand drivers could also be wrong, especially if discontinuities loom on the horizon. Imaginative marketers who ask questions like "What things could cause this forecast to change dramatically?" produce the best estimates. They are more likely to identify potential risks and discontinuities – developments in competing technologies, in customer industry competitiveness, in supplier cost structures – than those who do not. So once a baseline forecast is complete, the challenge is to determine how far it could be off target.

At one level, such a sensitivity analysis can be done by simply varying assumptions and quantifying their impact on demand. But a more targeted approach usually provides better insight.

Begin such an analysis by thinking through and quantifying the areas of greatest strategic risk. One company's strategy decision may be affected only if demand is well below the baseline forecast; in another case, big risks may result from small forecasting errors.

Next, gauge the likelihood of such a development. In the white paper example, the baseline forecast called for continued market growth, though below historical levels. In any particular year, demand could fluctuate with the economy, but the critical question was whether demand would at some point begin a long decline. If so, the companion supply-curve analysis indicated that prices would probably fall dramatically.

The team created two scenarios of a gradual decline, one based largely on changes in the economy and the other on changes in assumed end-use trends. These scenarios showed what would make demand fall (e.g., different rates of decline in copier prices) and thereby provided a basis for evaluating the likelihood of a downturn.

Determining an appropriate effort

The forecasting framework outlined above can work for both comprehensive and simple assessments, but there are different ways to carry out these analyses. A big challenge in demand forecasting (just as with other types of market analysis) is to gauge the appropriate effort for the project's purpose. It's useful to ask: "How much do I need to know to make the decision at hand?"

Managers can invest a lot of time in such analyses – the paper example took about 8 man-weeks and the

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large-scale electricity forecast about 14 man-weeks. Some companies have forecasting departments who work year-round on these subjects. The more thorough, though time-consuming, approach generates greater confidence, and the effort will be appropriate where the demand projection can significantly influence corporate strategy (whether to make a several hundred million dollar capital investment, for example), or where there is great uncertainty about total demand.

Often, however, the issues are not complicated, time is limited, or the total demand forecast is not important enough to merit that commitment (for example, the company is looking to add a couple of points to its small market share). In such cases, managers should proceed quickly and inexpensively. They can, for example, rely on experts' judgment or unsophisticated regressions to forecast drivers of demand. Even the limited approaches can yield insights. Furthermore, beginning the demand analysis process can help managers determine whether important demand issues exist that should be analyzed in greater depth.

Total-demand forecasting can be important to strategy decisions. Developing independent forecasts through the four-step framework I've outlined will not only lead to better recommendations but also help build conviction and consensus for action by creating understanding of the drivers of demand and the risks in forecasts.

Even when the work is sound, though, uncertainties will remain: discontinuities will still be difficult to predict, especially if they are rooted in momentous political, macroeconomic, or technological changes. But managers who push their thinking through the steps in this framework will have a better chance of finding these discontinuities than those who do not. And those who base their business strategies on a solid knowledge of demand will stand a much greater chance of making wise investments and competing effectively. ∇

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PRICING POLICY

IMPORTANT FACTORS

⇒ IT INFLUENCE DEMAND AND THAT FOR SALES

⇒ FLEXIBILITY IS LIMITED AS THERE IS A LITTLE MARGIN FOR PRICE VARIATION BETWEEN INEVITABLE /IRREDUCIBLE COST ON ONE HAND AND ESTABLISHED PRICE LEVEL IN THE MARKET ON OTHER HAND

⇒ VALIDITY OF PRICE IS SHORT AS PRICE WOULD CHANGE DUE TO COST CHANGES, COMPETITORS ACTION OR CHANGE IN CONSUMERS HABIT OR DUTY STRUCTURE, EXCHANGE RATE., ETC.

⇒ BAD PRICING DECISIONS LEADS TO A SERIOUS HARM.

⇒ NO THUMB RULE

⇒ FALLING IN LINE - PRICE LEVEL ARE ALREADY ESTABLISHED THE MARKET THEREFORE YOU CAN NOT SET YOUR PRICE.

PRICING ALTERNATIVES

A) COST ORIENTED PRICING

B) MARKET ORIENTED PRICING

A) COST ORIENTED PRICING:

COST PLUS PRICING IS SIMPLEST AND MOST WIDELY USED. THE MAJOR APPROACH TO THIS IS:

- ◊ FULL COST PRICING = ALL VARIABLE COST + FIX OVERHEADS + PREDETERMINED PROFIT MARGIN. IT HAS WEAKNESS OF NO ACCOUNT TAKEN OF DEMAND, MARKET SIZE, COMPETITORS PRICE, ETC. CAN FIX IN MONOPOLISTIC CONDITIONS.

- ◊ DIRECT COST PRICING = DIRECT COST + MARKUP TO COVER ESTIMATED OVERHEADS AND LEAVE A PROFIT.

- ◊ MARGINAL COST PRICING = MOST WIDELY USED BY THE DEVELOPING COUNTRIES. EXPORT CONSIDERED AS ADDITIONAL TURNOVER AND ALL OTHER OVERHEADS (EXCLUDING DIRECT EXPORT OVERHEADS) ARE TAKEN CARE OF FOR DOMESTIC MARKET.

- ◊ BREAK EVEN PRICING = THIS EXTENDS THE USE OF MARGINAL COST PRINCIPLE.

B) MARKET ORIENTED PRICING

i) DEMAND ORIENTED PRICE

WHILE USING THIS METHOD THE PRINCIPLE FOLLOWED I S :

- HIGH PRICE IS CHARGED WHEN CONSUMERS INTEREST IS HIGH

- LOW PRICE IS CHARGED WHEN CONSUMERS IS INTEREST IS LOW

ii) COMPETITION ORIENTED PRICING

WHILE USING THIS METHOD **THE PRINCIPLE** FOLLOWED I S :

- GOING RATE PRICING = **BASED** ON COLLECTIVE WISDOM OF INDUSTRY, **WHICH WOULD** GIVE A FAIR RETRUN ON INVESTMENT. **PRICE LEADERS** ARE SUPPOSED TO KNOW WHAT MARKET CAN BEAR. **THIS** IS USED MORE HOMOGENEOUS PRODUCTS .

- SEALED BID = **MAINLY USED** IN A TENDER BASED ON HOW OTHER BIDDERS **WOULD GIVE** THEIR OFFER AND KEEP YOUR OFFER LOWER.

FOUR IMPORTANT STEPS IN PRICING PROCEDURE:

STEP 1 COST ANALYSIS

STEP2 MARKET ANALYSIS

STEP 3 DETERMINING PRICE LIMIT

STEP 4 PRICE QUOTATION

STEP 1 COST ANALYSIS = CONSIDER DUTY FREE RAW MATERIAL, MARGINAL OVERHEADS , CONSOLIDATION OF CARGO TO SAVE FREIGHT ETC.

STEP MARKET ANALYSIS = CONSIDER PAYMENT TERMS, VOLUMES, INTEREST RATE, DISTRIBUTION CHANNEL, AFTER SALES SERVICE, ETC.

STEP 3 DETERMINING PRICE LIMIT = AN UPPER LIMIT OR CEILING I.E. HIGHEST PRICE FROM THE BEST PROSPECTIVE CUSTOMERS. TO FIX A LOWER LIMIT OR FLOOR PRICE .

STEP 4 PRICE QUOTATION = TO GIVE THE QUOTATIONS BASED ON ABOVE.

PRICING AND COSTING

PRICING DECISIONS ARE A CRITICAL ELEMENT OF THE MARKETING MIX. WHILE DECIDING EXPORT PRICE FOR A PRODUCT FOLLOWING INFORMATION IS REQUIRED:

1. **COST**

   THE COST IS MADE UP FROM MANUFACTURING COST WHICH INCLUDES COST OF RAW MATERIAL, FACTORY OVERHEADS, ETC. ADDED TO THIS COST ARE SELLING AND DISTRIBUTION COST WHICH INCLUDES DIRECT COST SUCH AS COMMISSION TO AGENT, FREIGHT AND INDIRECT COST SUCH AS SALARIES OF SELLING STAFF, ADVERTISING ETC. TO ARRIVE AT THE FINAL COST OF A PRODUCT WE HAVE TO FURTHER ADD UP COST OF MARKETING, ADMINISTRATIVE ETC.

2. THE SIZE AND NATURE OF DEMAND OF THE PRODUCT IN A PARTICULAR COUNTRY.

3. **COMPETITORS PRICE**

   THIS COULD BE AVAILABLE FROM PRINTED LIST IF AVAILABLE, DATA OF GOVERNMENT DEPARTMENT OR ASSOCIATION ETC. IT IS ALSO NECESSARY TO KNOW THE SPECIAL DISCOUNTS , VOLUME REBATES ETC.

4. **CHECK LIST OF INFORMATION REQUIRED**

   DETAILS AS COPY ENCLOSED

5. **EXPORT PRICE STRUCTURE**

   A. FACTORY COST
   B. PROFIT
   C FACTORY COST (A+B)

D PACKING AND MARKING

E. LOADING AT FACTORY

F TRANSPORT TO DOCKS

G. PORT CHARGES

H. DOCUMENT COST

I. LEGALIZATION/CERTIFICATE OF ORIGIN

J. EXPORT DUTY IF ANY

K. FOB PRICE = (C TO J)

L. SEA/AIR FREIGHT

M. C&F = (K+L)

N. INSURANCE PREMIUM

O. CIF = (M+N)

P. UNLOADING CHARGES AT DESTINATION

Q. IMPORT DUTIES

R. CLEARING AGENT CHARGES

S. LANDED PRICE = (O+P TO R)

6. INCOTERMS - THE TERMS AT WHICH NORMALLY THE PRICES ARE GIVEN TO OVERSEAS BUYERS ARE AS UNDER:

* FOB - FREE ON BOARD
* C&F - COST AND FREIGHT
* CIF - COST INSURANCE AND FREIGHT
* FAS - FREE ALONG SITE
* CFRFO- COST, FREIGHT,. AND FREE OUT
* DDP - DELIVERED DUTY PAID
* DDU - DELIVERED DUTY UNPAID

TECHNICAL APPRAISAL

1. Manufacturing process/technology

2. Technical arrangement

3. Size of the plant

4. Product mix

5. Selection of plant and machinery

6. Procurement of plant & machinery

7. Plant lay out

8. Location of the project

   a) Land
   b) Raw material
   c) Makret
   d) Labour
   e) Utilities such as water power fuel etc.
   f) Effluent disposal
   g) transportation
   h) Community infrastructure
   i) Development of other industries

9. Schedule of project implementaion

Technical Analysis

Analysis of technical and engineering aspects is done continually when a project is being examined and formulated. Other types of analysis are closely intertwined with technical analysis.

The broad purpose of technical analysis is (a) to ensure that the project is technically feasible in the sense that all the inputs required to set up the project are available, and (b) to facilitate the most optimal formulation of the project in terms of technology, size, location, and so on.

While technical analysis is essentially the preserve of the technical expert, the financial analyst participating in the project appraisal exercise should be able to raise basic issues relating to technical analysis using common sense and economic logic.

This chapter covers these issues very broadly. It is organised into twelve sections as follows:

- Manufacturing process/technology
- Technical arrangements
- Materials and inputs
- Product mix
- Plant capacity
- Location and site
- Machineries and equipments
- Structures and civil works
- Environmental aspects
- Project charts and layouts
- Project implementation schedule
- Need for considering alternatives

5.1 MANUFACTURING PROCESS/TECHNOLOGY

For manufacturing a product/service often two or more alternative technologies are available. For example:

- Steel can be made either by the Bessemer process or the open hearth process.
- Cement can be made either by the dry process or the wet process.
- Soda can be made by the electrolysis method or the chemical method.
- Paper, using bagasse as the raw material, can be manufactured by the kraft process or the soda process or the Simon Cusi process.
- Vinyl chloride can be manufactured by using one of the following reactions: acetylene on hydrochloric acid or ethylene on chlorine.
- Soap can be manufactured by the semi-boiled process or the fully boiled process.

Choice of Technology

The choice of technology is influenced by a variety of considerations:

- Plant capacity
- Principal inputs
- Investment outlay and production cost
- Use by other units
- Product mix
- Latest developments
- Ease of absorption

Plant Capacity Often, there is a close relationship between plant capacity and production technology. To meet a given capacity requirement perhaps only a certain production technology may be viable.

Principal Inputs The choice of technology depends on the principal inputs available for the project. In some cases, the raw materials available influence the technology chosen. For example, the quality of limestones determines whether the wet or dry process should be used for a cement plant.

Investment Outlay and Production Cost The effect of alternative technologies on investment outlay and production cost over a period of time should be carefully assessed.

Use by Other Units The technology adopted must be proven by successful use by other units, preferably in India.

Product Mix The technology chosen must be judged in terms of the total product-mix generated by it, including saleable by-products.

Latest Developments The technology adopted must be based on the latest developments in order to ensure that the likelihood of technological obsolescence in the near future, at least, is minimised.

Ease of Absorption The ease with which a particular technology can be absorbed can influence the choice of technology. Sometimes a high-level technology may be beyond the absorptive capacity of a developing country which may lack trained personnel to handle that technology.

Appropriateness of Technology

Appropriate technology refers to those methods of production which are suitable to local economic, social, and cultural conditions. In recent years, the debate about appropriate technology has been sparked off mainly by Schumacher and others. The advocates of appropriate technology urge that the technology should be evaluated in terms of the following questions:

- Whether the technology utilises local raw materials?
- Whether the technology utilises local man power?
- Whether the goods and services produced cater to the basic needs?
- Whether the technology protects ecological balance?
- Whether the technology is harmonious with social and cultural conditions?

5.2 TECHNICAL ARRANGEMENTS

Satisfactory arrangements must be made to obtain the technical know-how needed for the proposed manufacturing process. When collaboration is sought, *inter alia*, the following aspects of the agreement must be worked out in detail:

- The nature of support to be provided by the collaborators during the designing of the project, selection and procurement of equipment, installation and erection of the plant, operation and maintenance of the plant, and training of the project personnel.
- Process and performance guarantees in terms of plant capacity, product quality, and consumption of raw materials and utilities.
- The price of technology in terms of one-time licensing fee and periodic royalty fee.
- The continuing benefit of research and development work being done by the collaborator.
- The period of the collaboration agreement.
- The assistance to be provided and the restrictions to be imposed by the collaborator with respect to exports.
- The level of equity participation and the manner of sharing management control, especially if the technical collaboration is backed by financial collaboration.

- Assignment of the agreement by either side in case of change of ownership.
- Termination of the agreement or other remedies when either party fails to meet its obligation.
- Approach to be adopted in *force majeure* situations.

5.3 MATERIAL INPUTS AND UTILITIES

An important aspect of technical analysis is concerned with defining the materials and utilities required, specifying their properties in some detail, and setting up their supply programme. There is an intimate relationship between the study of materials and utilities and other aspects of project formulation, particularly those concerned with location, technology, and equipments.

Material inputs and utilities may be classified into four broad categories: (i) raw materials, (ii) processed industrial materials and components, (iii) auxiliary materials and factory supplies, and (iv) utilities.

Raw Materials

Raw materials (processed and/or semi-processed) may be classified into four types: (i) agricultural products, (ii) mineral products, (iii) livestock and forest products, and (iv) marine products.

Agricultural Products In studying agricultural products, the quality must first be examined. Then, an assessment of the quantities available, currently and potentially, is required. The questions that may be raised in this context are: What is the present marketable surplus? What is the present area under cultivation? What is the likely increase in yield per acre?

Mineral Products In assessing mineral raw materials, information is required on the quantum of exploitable deposits and the properties of the raw materials. The study should provide details of the location, size, and depth of the deposits and the viability of open cast or underground mining. In addition, information should be generated on the composition of the ore, level of impurities, need for beneficiation, and physical, chemical and other properties.

Livestock and Forest Products Secondary sources of data on livestock and forest products often do not provide a dependable basis for estimation. Hence, in general, a specific survey may be required to obtain more reliable data on the quantum of livestock produce and forest products.

Marine Products Assessing the potential availability of marine products and the cost of collection is somewhat difficult. Preliminary marine operations, essential for this purpose, have to be provided for in the feasibility study.

company to expand its market and enjoy higher profitability. For example, a toilet soap manufacturing unit may, by variation in raw material, packaging, and sales promotion, offer a high profit margin soap to consumers in the upper-income brackets.

While planning the production facilities of the firm, some flexibility with respect to the product mix must be sought. Such flexibility enables the firm to alter its product mix in response to changing market conditions and enhances the power of the firm to survive and grow under different situations. The degree of flexibility chosen may be based on a careful analysis of the additional investment requirement for different degrees of flexibility.

5.5 PLANT CAPACITY

Plant capacity (also referred to as production capacity) refers to the volume or number of units that can be manufactured during a given period. Plant capacity may be defined in two ways: feasible normal capacity (FNC) and nominal maximum capacity (NMC). The feasible normal capacity refers to the capacity attainable under normal working conditions. This may be established on the basis of the installed capacity, technical conditions of the plant, normal stoppages, downtime for maintenance and tool changes, holidays, and shift patterns. The nominal maximum capacity is the capacity which is technically attainable and this often corresponds to the installed capacity guaranteed by the supplier of the plant. Our discussion will focus on the feasible normal capacity. Several factors have a bearing on the capacity decision. These are:

- Technological requirement
- Input constraints
- Investment cost
- Market conditions
- Resources of the firm
- Governmental policy

Technological Requirement

For many industrial projects, particularly in process type industries, there is a certain minimum economic size determined by the technological factor. For example a cement plant should have a capacity of at least 300 tonnes per day in order to use the rotary kiln method; otherwise, it has to employ the vertical shaft method which is suitable for lower capacity.

Input Constraints

In a developing country like India, there may be constraints on the availability of certain inputs. Power supply may be limited; basic raw materials may be scarce; foreign exchange available for imports may be inadequate. Constraints of these kinds should be borne in mind while choosing the plant capacity.

Investment Cost

When serious input constraints do not exist, the relationship between capacity and investment cost is an important consideration. Typically, the investment cost per unit of capacity decreases as the plant capacity increases. This relationship may be expressed as follows:

$$C_1 = C_2\left(\frac{Q_1}{Q_2}\right)^{\alpha} \tag{5.1}$$

where C_1 = derived cost for Q_1 units of capacity

C_2 = known cost for Q_2 units of capacity

α = a factor reflecting capacity–cost relationship. This is usually between 0.2 and 0.9.

Example Suppose the known investment cost for 5,000 units of capacity for the manufacturer of a certain item is Rs 1,000,000. What will be the investment cost for 10,000 units of capacity if the capacity-cost factor is 0.6.

The derived investment cost for 10,000 units of capacity may be obtained as follows:

$$C_1 = 1{,}000{,}000 \times \left(\frac{10{,}000}{5{,}000}\right)^{0.6} = \text{Rs } 1{,}516{,}000$$

Market Conditions

The anticipated market for the product/service has an important bearing on the plant capacity. If the market for the product is likely to be very strong, a plant of higher capacity is preferable. If the market is likely to be uncertain, it might be advantageous to start with a smaller capacity. If the market, starting from a small base, is expected to grow rapidly, the initial capacity may be higher than the initial level of demand—further additions to capacity may be effected with the growth of the market.

Resources of the Firm

The resources, both managerial and financial, available to a firm define a limit on its capacity decision. Obviously, a firm cannot choose a scale of operations beyond its financial resources and managerial capability.

Government Policy

The capacity level may be influenced by the policy of the government. Traditionally, the policy of the government was to distribute the additional capacity to be created in a certain industry among several firms, regardless of economies of scale. This policy has been substantially modified in recent years and the concept of 'minimum economic capacity' has been adopted in several industries.

5.6 LOCATION AND SITE

The choice of location and site follows an assessment of demand, size, and input requirement. Though often used synonymously, the terms 'location' and 'site' should be distinguished. Location refers to a fairly broad area like a city, an industrial zone, or a coastal area; site refers to a specific piece of land where the project would be set up.

The choice of location is influenced by a variety of considerations: proximity to raw materials and markets, availability of infrastructure, labour situation, governmental policies, and other factors.

Proximity to Raw Materials and Markets

An important consideration for location is the proximity to the sources of raw materials and nearness to the market for the final products. In terms of a basic locational model, the optimal location is one where the total cost (raw material transportation cost plus production cost plus distribution cost for the final product) is minimised. This generally implies that:
(i) a resource-based project like a cement plant or a steel mill should be located close to the source of the basic material (for example, limestone in the case of a cement plant and iron-ore in the case of a steel plant); (ii) a project based on imported material may be located near a port; and (iii) a project manufacturing a perishable product should be close to the centre of consumption.

However, for many industrial products proximity to the source of raw material or the centre of consumption may not be very important. Petro-chemical units or refineries, for example, may be located close to the source of raw material, or close to the centre of consumption, or at some intermediate point.

Availability of Infrastructure

Availability of power, transportation, water, and communications should be carefully assessed before a location decision is made.

Adequate supply of power is a very important condition for location—insufficient power can be a major constraint, particularly in the case of an electricity-intensive project like an aluminium plant. In evaluating power supply the following should be looked into: the quantum of power available, the stability of the power supply, the structure of the power tariff, and the investment required by the project for a tie-up in the network of the power supplying agency.

For transporting the inputs of the project and distributing the outputs of the project, adequate transport connections—whether by rail, road, sea, inland water, or air—are required. The availability, reliability, and cost of transportation for various alternative locations should be assessed.

Given the plant capacity and the type of technology, the water requirement for the project can be assessed. Once the required quantity is estimated, the amount to be drawn from the public utility system and the amount to be provided by the project from surface or sub-surface sources may be determined. For doing this the following factors may be examined: relative costs, relative dependabilities, and relative qualities.

In addition to power, transport, and water, the project should have adequate communication facilities like telephone and internet.

Labour Situation

In labour-intensive projects, the labour situation in a particular location becomes important. The key factors to be considered in evaluating the labour situation are:

- Availability of labour, skilled, semi-skilled and unskilled
- Prevailing labour rates
- Labour productivity
- State of industrial relations judged in terms of the frequency and severity of strikes and lockouts
- Degree of unionisation

Governmental Policies

Government policies have a bearing on location. In the case of public sector projects, location is directly decided by the government. It may be based on a wider policy for regional dispersion of industries.

In the case of private sector projects, location is influenced by certain governmental restrictions and inducements. The government may prohibit the setting up of industrial projects in certain areas which suffer from urban congestion. More positively, the government offers inducements for establishing industries in backward areas. These inducements consist of subsidies, concessional finance, sales tax loans, power subsidy, income tax benefits, lower promoter contribution, and so on.

Other Factors

Several other factors have to be assessed as well before arriving at a location decision. These are:

- Climatic conditions

- General living conditions
- Proximity to ancillary units
- Ease in coping with pollution

Climatic Conditions The climatic conditions like temperature, humidity, wind, sunshine, rainfall, snowfall, dust, flooding, and earthquakes have an important influence on location decision. They have a bearing on the cost as they determine the extent of air-conditioning, de-humidification, refrigeration, special drainage, and so on required for the project.

General Living Conditions The general living conditions like the cost of living, housing situation, safety, and facilities for education, health care, transportation and recreation need to be assessed carefully.

Proximity to Ancillary Units Most firms depend on ancillary units for components and parts. If the ancillary units are located nearby coordination becomes easy, transportation costs are lower, and inventory requirements become considerably less.

Ease in Coping with Environmental Pollution A project may cause environmental pollution in various ways: it may throw gaseous emissions; it may produce liquid and solid discharges; it may cause noise, heat, and vibrations. The location study should analyse the cost of mitigating environmental pollution to tolerable levels at alternative locations.

Site Selection

Once the broad location is chosen, attention needs to be focussed on the selection of a specific site. Two to three alternative sites must be considered and evaluated with respect to cost of land and cost of site preparation and development.

The cost of land tends to differ from one site to another in the same broad location. Sites close to a city cost more whereas sites away from the city cost less. Sites in an industrial area developed by a governmental agency may be available at a concessional rate.

The cost of site preparation and development depends on the physical features of the site, the need to demolish and relocate existing structures, and the work involved in obtaining utility connections to the site. The last element, viz., the work involved in obtaining utility connections and the cost associated with it should be carefully looked into. It may be noted in this context that the cost of the following may vary significantly from site to site: power transmission lines from the main grid, railway siding from the nearest railroad, feeder road connecting with the main road, transport of water, and disposal of effluents.

5.7 MACHINERIES AND EQUIPMENT

The requirement of machineries and equipment is dependent on production technology and plant capacity. It is also influenced by the type of project. For a process-oriented industry, like a petrochemical unit, machineries and equipment required should be such that the various stages are matched well. The choice of machineries and equipment for a manufacturing industry is somewhat wider as various machines can perform the same function with varying degrees of accuracy. For example, the configuration of machines required for the manufacture of refrigerators could take various forms. To determine the kinds of machinery and equipment required for a manufacturing industry, the following procedure may be followed: (i) Estimate the likely levels of production over time. (ii) Define the various machining and other operations. (iii) Calculate the machine hours required for each type of operation. (iv) Select machineries and equipment required for each function.

The equipment required for the project may be classified into the following types: (i) plant (process) equipment, (ii) mechanical equipment, (iii) electrical equipment, (iv) instruments, (v) controls, (vi) internal transportation system, and (vii) others.

In addition to the machineries and equipment, a list should be prepared of spare parts and tools required. This may be divided into: (i) spare parts and tools to be purchased with the original equipment, and (ii) spare parts and tools required for operational wear and tear.

Constraints in Selecting Machineries and Equipment

In selecting the machineries and equipment certain constraints should be borne in mind: (i) there may be a limited availability of power to set up an electricity-intensive plant like, for example, a large electric furnace; (ii) there may be difficulty in transporting heavy equipment to a remote location; (iii) workers may not be able to operate, at least in the initial periods, certain sophisticated equipment such as numerically controlled machines; (iv) the import policy of the government may preclude the import of certain machineries and equipment.

Procurement of Plant and Machinery

For procuring the plant and machinery, orders for different items of the plant and machinery may be placed with different suppliers or a turnkey contract may be given for the entire plant and machinery to a single supplier. The factors to be considered in selecting the supplier (s) of the plant and machinery are the desired quality of machinery, the level of technological sophistication, the relative reputation of the various suppliers, the expected delivery schedules, the preferred payment terms, and the required performance guarantees[2]. If inhouse technical expertise is inadequate, external consultant (s) may be employed to select the plant and machinery and supervise the installation of the same.

2. Performance guarantees provided by machinery suppliers are of three types: mechanical guarantees, input guarantees, and output guarantees.

5.8 STRUCTURES AND CIVIL WORKS

Structures and civil works may be divided into three categories: (i) site preparation and development, (ii) buildings and structures, and (iii) outdoor works.

Site Preparation and Development

This covers the following: (i) grading and leveling of the site; (ii) demolition and removal of existing structures; (iii) relocation of existing pipelines, cables, roads, power lines, etc.; (iv) reclamation of swamps and draining and removal of standing water; (v) connections for the following utilities from the site to the public network: electric power (high tension and low tension), water for drinking and other purposes, communications (telephone, telex, internet, etc.), roads, railway sidings; and (vi) other site preparation and development work.

Buildings and Structures

Buildings and structures may be divided into: (i) factory or process buildings; (ii) ancillary buildings required for stores, warehouses, laboratories, utility supply centres, maintenance services, and others; (iii) administrative buildings; (iv) staff welfare buildings, cafeteria, and medical service buildings; and (v) residential buildings.

Outdoor Works

Outdoor works cover (i) supply and distribution of utilities (water, electric power, communication, steam, and gas); (ii) handling and treatment of emission, wastages, and effluents; (iii) transportation and traffic signals; (iv) outdoor lighting; (v) landscaping; and (vi) enclosure and supervision (boundary wall, fencing, barriers, gates, doors, security posts, etc.)

5.9 ENVIRONMENTAL ASPECTS

A project may cause environmental pollution in various ways: it may throw gaseous emissions; it may produce liquid and solid discharges; it may cause noise, heat, and vibrations.

Projects that produce physical goods like cement, steel, paper, and chemicals by converting natural resource endowments into saleable products are likely to cause more environmental damage. Hence the environmental aspects of these projects have to be properly examined. The key issues that need to be considered in this respect are:

- What are the types of effluents and emissions generated?
- What needs to be done for proper disposal of effluents and treatment of emissions?
- Will the project be able to secure all environmental clearances and comply with all statutory requirements?

5.10 PROJECT CHARTS AND LAYOUTS

Once data is available on the principal dimensions of the project—market size, plant capacity, production technology, machineries and equipment, buildings and civil works, conditions obtaining at the plant site, and supply of inputs to the project—project charts and layouts may be prepared. These define the scope of the project and provide the basis for detailed project engineering and estimation of the investment and production costs.

The important charts and layout drawings are briefly described as follows:

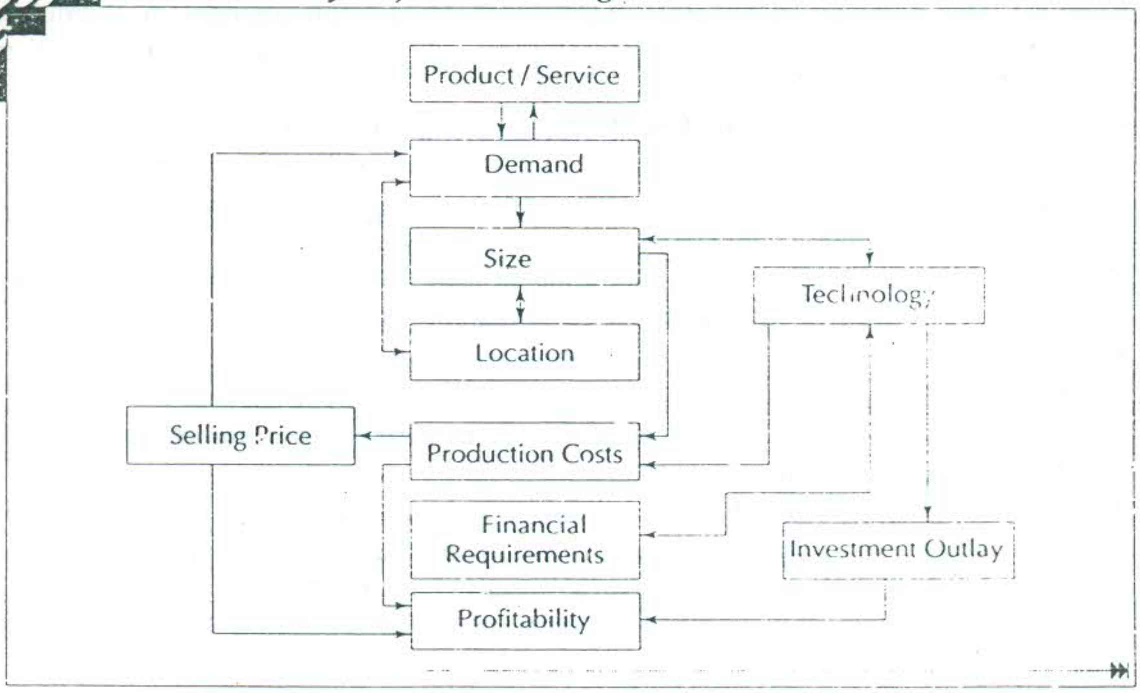
1. *General Functional Layout* This shows the general relationship between equipment, buildings, and civil works. In preparing this layout, the primary consideration is to facilitate smooth and economical movement of raw materials, work-in-process, and finished goods. This means that:
   (a) The layout should seek to allow traffic flow in one direction to the extent possible, with a minimum of crossing.
   (b) Godowns, workshops, and other services must be functionally situated with respect to the main factory building.
2. *Material Flow Diagram* This shows the flow of materials, utilities, intermediate products, final products, by-products, and emissions. Along with the material flow diagram, a quantity flow diagram showing the quantities of flow may be prepared.
3. *Production Line Diagrams* These show how the production would progress along with the key information for the main equipment.
4. *Transport Layout* This shows the distances and means of transport outside the production line.
5. *Utility Consumption Layout* This shows the principal consumption points of utilities (power, water, gas, compressed air, etc.) and their required quantities and qualities. These layouts provide the basis for developing specifications for utility supply installations.
6. *Communication Layout* This shows how the various parts of the project will be connected with telephone, internet, intercom, etc.
7. *Organisational Layout* This shows the organisational set-up of the project along with information on personnel required for various departments and their inter-relationship.
8. *Plant Layout* The plant layout is concerned with the physical layout of the factory. In certain industries, particularly process industries, the plant layout is dictated by the production process adopted. In manufacturing industries, however, there is much greater flexibility in defining the plant layout. The important considerations in preparing the plant layout are:
   - Consistency with production technology

Location Location and size are closely interrelated. Perhaps the same demand could be satisfied by: (i) a single plant for the entire market; or (ii) one large plant for the bulk of the market with a few smaller plants for the remaining market; or (iii) several plants of a similar size spread over the market areas. The choice would depend mainly on the trade-off between economies of scale in manufacturing and economies of distribution.

Key Project Inter-linkages

While evaluating various alternatives, the inter-linkages among key facts of the project like product (or service), demand, plant capacity, production technology, location, investment outlay, financial resources, production costs, selling price, and profitability must be borne in mind. Exhibit 5.1 shows these inter-linkages pictorially.

Exhibit 5.1 *Key Project Inter-linkages*



SUMMARY

- For manufacturing a product/service often two or more alternative technologies are available. The choice of technology is influenced by a variety of considerations: plant capacity, principal units, investment outlay, production cost, use by other units, product mix, latest developments, and ease of absorption.
- Satisfactory arrangements have to be made to obtain the technical know-how needed for the proposed manufacturing process.

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- An important aspect of technical analysis is concerned with defining the materials and inputs required, specifying their properties in some detail, and setting up their supply programme. Materials may be classified into four broad categories: (i) raw materials, (ii) processed industrial materials and components, (iii) auxiliary materials and factory supplies, and (iv) utilities.
- The acquisition of technology from some other enterprise may be by way of (i) technology licensing, (ii) outright purchase, or (iii) joint venture arrangement.
- Appropriate technology refers to those methods of production which are suitable to local, economic, social, and cultural conditions.
- Several factors have a bearing on the plant capacity decision: technological requirements, input constraint, investment cost, market conditions, resources of the firm, and governmental policy.
- The choice of location is influenced by a variety of considerations: proximity to raw materials and markets, availability of infrastructure facilities, and other factors. Once a broad location is chosen, the attention needs to be focussed on the selection of a site—a specific piece of land where the project would be set up.
- The requirement of machinery and equipment is dependent on production technology and plant capacity. Further, it is influenced by the type of product.
- Structures and civil works may be divided into three categories: (i) site preparation and development, (ii) buildings and structures, and (iii) outdoor works.
- A project may cause environmental pollution in various ways. Hence the environmental aspects have to be properly examined.
- Once data is available on the principal dimensions of the project, project charts and layout may be prepared. The important charts and layout drawings are: (i) general functional layout, (ii) material flow diagram, (iii) production line diagram, (iv) transport layout, (v) utility consumption layout, (vi) communication layout, (vii) organisational layout, and (viii) plant layout.
- As part of the technical analysis, a project implementation is also prepared.
- The work schedule reflects the plan of work concerning installation as well as initial operation.
- There are alternative ways of transforming an idea into a concrete project. These alternatives may differ in one or more of the following aspects: nature of project, production process, quality of products, scale of operation, time phasing, and location.

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[redacted]

The checklist is given under Statement 11.

STATEMENT - 11

CHECKLIST FOR LOCATION AND SITE SELECTION

Dimension I : Basic Considerations

1. Location (city/town/village)
2. Population
3. Nearest large city (name and distance)
4. Connections to major cities (rail, road, air-distance, connection, frequency)
5. Climate (minimum/maximum temperature, humidity, minimum / maximum rainfall)
6. Distance from important geographical markets.
7. Distance from major raw material sources and significance (or lack of it) of enterprise proximity to such sources.
8. Distance and connection to relevant ports (in case of export/import oriented enterprises)
9. Manpower availability of required skills and prevailing wage rates.
10. Overall industrial relations (strike/lockout/dispute) in the area.
11. Law and order position in the area.
12. Level of industrial development in the area and anticipated tempo.
13. Composition of industrial development in terms of types of industry and size/health of existing enterprises.[1])
14. Proposed enterprise and govt. preference for type of industries at proposed location.[2])
15. Whether ready built up factory shed is available at the location and whether its size confirms to your need.

1. An electronic enterprise may suffer from an environmental hazard if industries in the area are predominantly chemical. A strong presence of large industries may ensure quick development of facilities but push up housing cost and wage levels. Wide-spread industrial sickness in an area may dilute governmental interest in area development programmes.

2. The Government may wish concentrated growth of a particular industry - electronics or ceramic or any other - at a given location. The facilities meant specifically for such industry will develop quickly there. Likewise, the Government may wish to keep certain industries - water intensive or noise-intensive - away from certain locations.

Dimension II : Physical Infrastructure Position

1. Land : Availability and price.
2. Whether there exists an organized industrial estate.
3. Water Supply : Source (river, canal, tubewell), distance, quality (PH, hardness), rate, common storage facility, operating authority (Public Works Department, Estate - corporation, municipality).
4. Power supply : nearest substation, feeder type (industrial/rural), availability, quality of power, etc.
5. Effluent treatment and disposal (if relevant) : Disposal point (land, sea, river), arrangement for treatment (individual, common), drainage arrangement for conveying the effluent (open, underground), treatment and conveyance charge.
6. Approach road/internal roads.
7. Street lighting.
8. Responsibility for maintaining roads, drainage and street lighting (a single or multiple agencies).
9. Annual maintenance charges.

Dimension III : Commercial Infrastructure Position

1. Telecommunication (availability of new telephone connections, manual or automatic exchange, STD facility, telex facility, etc.).
2. Postal and telegram facility.
3. Bank facility.
4. Transport - operator facility.
5. Weighbridge.
6. Courier.
7. Typing/photocopying.

8. Warehousing.

9. Nearest offices of law-enforcing agencies (excise, sales tax, labour laws, factory inspection, pollution control etc.).

10. Nearest offices of industry - assisting agencies (State finance corporation, industrial infrastructure corporation, raw material/marketing corporation, District Industries Centres which sanction and disburse financial incentives).

11. Building/Electrical/Fabrication contractor facility.

12. Building material, spares, parts and such other shops.

13. Motor-rewinding, painting, gas-supply and such other industrial services.

14. Technical educational facility (e.g. industrial training institute, polytechnic)

15. Professional resource position (management/industrial consultants, financial/legal advisers, management/productivity associations).

Dimension IV : Social Infrastructure Position

1.	Housing	:	Availability, quality, price (ownership and rent), public housing (actual and planned housing by state housing board, infrastructure corporation or such other agencies.)
2.	Education	:	Primary, secondary and university education facility (quality, number of seats, ease of admission, medium of instruction)
3.	Health	:	Dispensary, hospitals, specialities.
4.	Recreational facility	:	Cinema, restaurant, library, parks, etc.

5. Hotel accommodation.

6. Service organizations : Rotary, Lion, etc.

Dimension V : Financial Incentive Position

1. Investment subsidy (central govt./state govt.).

2. Income-tax concession.

Sales tax exemption/interest-free sales-tax loan.

Promoter contribution (margin) and interest-rate policy followed by state financial corporation.

Octroi-exemption, electricity-duty exemption, local-tax exemption and such other incentives.

Dimension VI : Site-Specific Considerations

Whether the proposed site is a part of an organized industrial estate.

Direction of town-growth with reference to the site.

Non-agricultural status of the site.

Site-contours (levelled, hilly, pits, ravines, brick-kilns).

Site-shape (regular/irregular)

Immediate proximity of railway line, national highway, state highway *

Overhead telephones or powerlines or underground water/drainage/gas line passing through the site *

Access to national/state highway or other roads provided by the state.

Wind direction in relation to the site #

Soil-type +

This may imply leaving out some portions of a plot for building purpose.

In India, normal wind-direction, except during winter, is north-south. If there is a dense-population concentration in south, the factory involving gas/smell emission may cause a problem.

Loose soil may increase construction cost.

SOURCES OF TECHNOLOGY AND ITS EVALUATION

Science and Technology Entrepreneurs may set up projects having an investment upto Rs.25 lacs. Most of them may be having proper technology to set up an industrial unit. However, sometimes it is necessary to buy a ready-technology to avoid the risk and undue delay in the implementation of the project. The sources of process know-how are as under:

1) N.R.D.C./C.S.I.R. Laboratories

2) Private Research Laboratories recognised by C.S.I.R. like Shri Ram Research Institute, New Delhi, Gharda Research Centre, Bombay or Shroff Technical Services, Bombay.

3) From Turn-key Supplier of Plant & Equipments.

4) Individuals who have worked in similar line for several years and

5) Foreign Technology.

Experienced Science and Technology Entrepreneurs may not require any of the above sources as they can set up their unit on their own or with little training in a similar unit. They may also set up the project by employing some experienced persons in the line. This is more so in projects like Textile Auxiliary Manufacturing or simple fabrication work or assembly of electronic products.

There are certain national/state level institutions involved in product development and scaling up of the laboratory scale process. These institutions are equipped with the facilities of pilot plant, prototype product manufacturing facilities, testing of product, research and development of new products. Some of these Institutions are:

1) Industrial Research Laboratories in states like Gujarat, Maharashtra etc. set up by state governments.

2) Central Institute for Plastics Engineering and Training Madras/Ahmedabad.

3) Hosiery Training Institute, Ahmedabad.

4) Prototype Training Centres of SISI located at different places in the country.

Whenever possible entrepreneurs can use the above institutions for product development/process upgradation and avoid the purchase of technology.

While selecting the source on technology, it is necessary to evaluate thoroughly the competence and the reliability of the supplier. For this purpose, it is necessary to take help of a technical consultant experienced in such line. Usually, the process-know-how supplied by research laboratories needs scaling up from laboratory stage to commercial scale. The evaluation of product must also focus on the market potentiality in particular region, availability of various raw materials and inputs. In case of a chemical product, proper disposal of effluents in the form of gas, liquid or solid, must also be taken into consideration while selecting a package of technology.

Whenever it is necessary to select a consultant for a project, it should be ensured that he must have all-round capability of advising in implementation of the Project. For small projects, the consultant may be an individual or a group of two or three persons having specilisation in various disciplines. There is no need of appointing a consulting firm whose charges may be exhorbitant and will have less interest in small project. The consultant appointed should be in a position to guide the entrepreneur in selection of proper plant and equipment, process route, sources of raw material at cheaper rate and proper disposal of waste products. In addition to this, he must be able to guide regarding policies and procedures to set up an industry.

The agreement between a consultant and an entrepreneur must contain in broad the following:

1) Specifications of each and every item of plant and equipments supported by detailed drawings, plant layout and operting instructions.

2) Specifications of raw materials, norms of consumption and wastages.

3) Product quality; specifications, type of packaging, storage requirements, handling instructions and degree of hazards.

4) Installed capacity of plant; guarantee for capacity utilisation; key factors effecting the production; requirements of various utilities and their norms of consumptions.

5) Type of effluent; treatment facilities; method of disposal and recurring cost of treatment process.