



ECONOMICS & FINANCE – AN ENGINEERING PERSPECTIVE

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ABSTRACT

In Engineering Economics, formerly known as 'engineers' economy,' the use of application of economic concepts in the study of decision taking in engineering is a branch of economics. This chapter deals with the Managerial concepts and economics with the subtopics of relationship disciplines, firms, and objectives. Further, the value of particular economic goods or services to be sold at a given price is described in detail by analyzing market forces. The details research the law of supply and demand followed by the production function that determines the output of a company, an industry, or a whole economy for all input combinations. This role is indeed a supposed professional relationship that is based on the current state of the art. The price is the number of monetary units that consumers pay to purchase a single unit of good or service. It is essential to know the income account's definition as a starting point to understand the profit and loss account. The detailed research and analysis of economics and finance have been studied using this chapter.

KEYWORDS: Engineering Economics, Financial Concepts, Profit and Loss, Capital Budgeting

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1. INTRODUCTION TO ECONOMICS AND FINANCE

MANAGERIAL ECONOMICS - AN INTRODUCTION

In decision-making, economics applies to strategy. It is the economics branch that is the connection between abstract theory and management. It is based on the economic analysis of problems, information management, and alternative evaluations (Armstrong, J. Scott, and Fred Collopy, 1996).

Managerial Economics: Economic management is the business modalities for assessing the condition of firms. Market economics is the combination of economic philosophy with corporate experience to make decision making and strategic preparation simpler (Mitchell, Mark L, 2000).

Nature and Scope

1. It is microeconomic since the study of the company and not the consumer reflects only.
2. It is necessary to consider the society in which the company functions. It should be known.
3. The reaction to a question that should not be what was is pessimistic, not optimistic.
4. It's metrical as well as logical.
5. It primarily concentrates on the company's philosophy rather than production.
6. Management experience allows us to make smart, i.e., capital depletion decisions.
7. It is targeted, i.e., at achieving the goals.

Macro and Micro Economics

Both industrial and administrative systems face the same challenges, i.e., shortage issues and the redistribution of capital. Because labor and money are still small, they have to find a way to manage these tools effectively (Rosen, Benson, and Thomas H. Jerdee, 1976). Operational science and managerial economics are associated with successful decision-making. Management economics is a fundamental academic topic that seeks to understand and analyze the problems of business decision-making. At the same time, Operations Research is a task carried out by a functional expert within the company to help the manager resolve decision-making problems. Operations Research models are widely found in enterprise management models, such as queuing and linear planning. Economic models are more general and are limited to essential economic decision-making. Managers' metrical property is used to approximate and forecast important economic variables for decision-making and planning since managerial economics is mathematical, but still metric.

FIRMS: RELATIONSHIP, OBJECTIVES, AND GOALS

A small business enterprise that produces a profit is an organization that is legally approved and intends to deliver goods or services to individuals, companies, and public bodies. Corporations are standard in patriarchal economies. The majority of the companies are private. An entity is typically set up to raise wealth, which raises its owners' profits and extends the corporation itself. In return for operation and liability identification, shareholders and management of businesses have the primary goal of gaining or obtaining the financial benefit. Co-operative companies and state-owned organizations are significant exceptions (Brown,



Clifton E., and Ira Solomon, 1987). Organizations can either be non-profit companies or state-owned organizations. There are different types of firms basically,

Sole Proprietor firms: The sole owner is a company operated by a single entity. The owner may work on his own or may hire others. The owner of the company is directly responsible for the losses sustained by the company.

Partnership Firms: A collaboration is a type of company in which two or more parties collaborate towards a shared purpose, sometimes for a profit. In other types of relationship, each spouse has legal responsibility for the debts accrued by the firm. There are three common types of alliances: general partnerships, exclusive partnerships, and Limited Liability Partnerships (LLP).

Corporate firms: A company is either a restricted or unrestricted organization with a different legal identity from its owners. A business can be structured for-profit or not-for-profit purposes. A company is owned by multiple shareholders and is governed by a board of directors that hires the organization's management staff. Besides private sector models, state-owned company models are still available.

Co-operative firms: In comparison to owners who share decision-making power, a collaborating business varies from a group. Co-operatives are commonly known as business or trade co-operatives. The philosophy of economic democracy is focused on co-operatives.

Goals of Firms

The traditional management philosophy suggests that the primary goal of commercial operations is to benefit maximization. However, a new analysis has shown that the targets sought by businesses are more than one. Besides optimizing benefit, other significant goals are:

1. Sales maximization
2. Maximizing the growth rate of the industry
3. Maxing the efficiency function of managers
4. Made an excellent benefit margin
5. Long-lasting business success
6. Admission-prevention and risk-avoidability

Optimization of the development rate of firms:

Managers optimize the company's balance of growth rate, subject to management and financial restrictions, of the balance of growth rate (G_R) specified as:

$$G_R = G_D - G_C$$

Where,

- G_D = Growing rate of demand for the commodity of the business,
- G_C = Growing rate of Capital supply for the commodity of the business

a firm growth rate is matched as the market for the goods, and the availability of resources rises at the same time.



DECISIONS:

A choice is an activity involving discretion. Decision making is often more thorough than solving issues. The words are interlinked, but cannot be interchanged.

Importance of Decision Making:

- Decisions are the only distinctive attribute of managers.
- Top administrators plan to dedicate the whole company to concrete intervention.
- Decisions reached by lower management groups reflect top managers' policy options in the organization's operational areas.
- Decisions often require systemic transition and finite capital dedication.

Management Judgment Features:

- Long-term goals for the company
- Correct alternative from a variety of choices
- Organizational transition is a judgment
- A decision needs capital dedication

System for Decision Making:

- Decision-making mechanisms are mechanism drivers.
- Decisive tasks are intertwined and interdependent.
- With many sub-processes, the mechanism is too complicated.
- Several opposing Category II assessments may be taken into consideration throughout the process.

Decision-Making Process:

- Set management goals
- Check for answers
- Comparison and comparison of alternatives
- The process of election
- Decisions to enforce
- Tracking and monitoring

MARKET FORCES – SUPPLY AND DEMAND ANALYSIS

Supply and Demand specify the quantity of a particular economic product or commodity to be purchased at a specified price by a customer or a community of consumers. If buyers continue to purchase more as rates fall, the demand curve is typically downwards. The market for products or services is influenced by several variables, such as the availability of alternative commodities and complementary goods, rather than availability. In certain situations, demand may be almost totally irrelevant or almost limitless at a certain point.

The Law of Demand:

The Rule of demand stipulates that the greater the price of a good, the fewer customers would desire the good if all other variables stay equivalent. In other terms, the higher the volume, the smaller the sum required. A product priced at a high price is less, as the price of good rises, the expense of obtaining the good becomes smaller. Therefore, consumers would stop purchasing a commodity that encourages them not to eat something else they trust. The accompanying diagram indicates that the slope is downwards (Katz, Lawrence F., and Kevin M. Murphy, 1992).



TYPES OF DEMAND:

Direct and Indirect demand:

Producer's products and customer's items: demand for goods explicitly sold by the user is considered a direct market (e.g., T-shirts market). Request, on the other side, for supplies for products and services used among manufacturers. (Example: textile mill demand for cotton)

Derived and autonomous demand:

As a commodity is utilized for any primary object, the resulting requirement is known (example: the market for tires from the demand for cars). Autonomous demand is the market for a manufactured commodity, which may be used separately (Example: Requirement for the washing machine).

Sustainable and non-sustainable goods demand:

Sustainable goods are ones that may be purchased for some time (e.g., microwave oven) Non-sustainable products should only be used once (e.g., band-aid).

Firms and Industry Demand:

Strong demand is the desire of a single business for the commodity. (Example: dove soap) The market for the output of a specific sector is consumer production (example: India's steel market).

ANTECEDENTS OF DEMAND:

- Commodity price
- Market sales
- Availability of the products involved
- Goodness and desires
- Further considerations such as profits and consumer forecasts

DEMAND FUNCTION:

It is a behavioral association between the consumption amount and an individual's overall ability to compensate for gradual changes (Giacalone, Robert A., and Paul Ed Rosenfeld, 1991). It is typically an opposite trend, where less (more) quantity is absorbed in higher (lower) rates. Other variables that affect willingness to pay include wages, tastes, and desires, and the price of replacements. The individual demand function and market demand function are the two categories.

Individual Demand Function:

$$Qd_x = \text{Fun} (P_x, Y, P_1, P_2, P_3, \dots, P_{n-1}, T, A, E_y, E_p, u)$$

- Qd_x = quantity of substance X ordered
- P_x = commodity price
- Y = household revenue standard
- $P_1, P_2, P_3, \dots, P_{n-1}$ = all other goods relevant prices
- T = the consumer's preferences
- A = marketing Ads
- E_y = potential profits for the user
- E_p = the potential estimated price of the market
- U = all the variables which are not included in the list



Market Demand Function:

$$Qd_x = \text{Fun} (P_x, Y, P_1, P_2, P_3, \dots, P_{n-1}, T, A, E_y, E_p, P, D, u)$$

- Qd_x = quantity of substance X ordered
- P_x = commodity price
- Y = household revenue standard
- $P_1, P_2, P_3, \dots, P_{n-1}$ = all other goods relevant prices
- T = the consumer's preferences
- A = marketing Ads
- E_y = potential profits for the user
- E_p = the potential estimated price of the market
- U = all the variables which are not included in the list
- P = population
- D = Market representation in various categories, including wealth, age, sex

ELASTICITY OF DEMAND:

What occurs as rates increase by 10 percent?

We realize demand is going to decline

- For more than 10 percent?
- For less than 10 percent?

The degree to which demand varies, elasticity tests

Elasticity is the average of the increases in percent in one component to the shift in percent in another. It is a method to calculate the reaction ability of a system in a unitless way to adjust parameters. Frequently utilized elasticities include market price elasticity, supply price elasticity, inventory revenue elasticity, swap elasticity between output factors, and inter temporary substitute elasticity.

FORMULA FOR PRICE ELASTICITY:

Price demand elasticity measures improve in consumer transition variables. As such, the demand curve acceleration is calculated. Nearly all this elasticity is harmful and is represented in general by absolute meaning. If the demand is more significant than one, it's considered elastic; there's no demand from 0 to 1, and the demand for the unit is equivalent.

$$E = \frac{\text{The proportionate quantitative shift needed from goods X}}{\text{The proportionate market shift for good X}}$$

Calculation of the improvement in the sum demanded:

The method for measuring the required percentage shift is:

$$\text{Percent Change in Quantity} = \frac{\text{Quantity (New Demand)} - \text{Quantity(Old Demand)}}{\text{Quantity(Old Demand)}}$$

Calculate shift in market percentage:

The method used to measure the rate shift percentage is identical to the previous:

$$\text{Percent Change in Price} = \frac{\text{MRP (New Price)} - \text{MRP (Old Price)}}{\text{MRP (Old Price)}}$$

$$\text{Price Elasticity of Demand} = \frac{\text{Percent Change in Quantity}}{\text{Percent Change in Price}}$$

DEMAND ELASTIC: A market shift that results in an $ED > 1$ adjustment in quantity, which is greater than the proportion.



DEMAND INELASTIC: A market shift would contribute to an $ED < 1$ adjustment of below proportionality. If the price elasticity of demand is greater than 1, then it is scheduled under Elastic demand. If the price elasticity of demand is lesser than 1, then it is scheduled under inelastic demand.

MEANING OF SUPPLY

The availability of a product applies to the various amounts of a product that a vendor is eager and capable of selling in one specific market at individual rates at a particular moment, whereas all items are the same. Supply is what the seller is capable of offering for sale. The quantity paid consists of the volume of a specific product in which a business is prepared to sell for sale at a specific price for a specified period.

ANTECEDENTS OF SUPPLY:

1. Cost of production factors: Cost differs due to factor volume. The cost of output rises, and availability declines with a rise in factor prices.
2. State of the art: The usage of state-of-the-art innovations improves the company's efficiency and production.
3. Variables related to the framework are environmental factors such as temperature. When flooding occurs, the availability of different agricultural goods may be limited.
4. Increased budget funding results in 43 new products and services.
5. Transportation: Stronger transport services would improve availability.
6. Price: Vendors tend to deliver more products to lift their profit if costs are high.

SUPPLY ELASTICITY:

Supply Elasticity speaks about producers' reactions to market increases in their products or services. Generally speaking, production rises as costs grow. Supply elasticity is determined by the combination of relative increases in the volume given to the associated price shift. Strong elasticity implies that the product is pricing-sensitive; low elasticity suggests poor market change-sensitivity and no trade-relationship, often regarded as market price elasticity.

Kinds of Supply Elasticity

1. Price supply elasticity: Market supply elasticity tests the response to shifts in the amount provided to a shift in rates.
2. Relatively inelastic: if the supply does not react to a price adjustment ($E_s=0$).
3. Inelastic production: the proportionate production shift is smaller than the market adjustment ($E_s=0-1$).
4. Unitary elastic: The percentage shift in the volume given correlates to the price adjustment ($E_s=1$).
5. Elastic: The quantity shift given is more than the price change ($E_s=1 - \text{infinity}$).

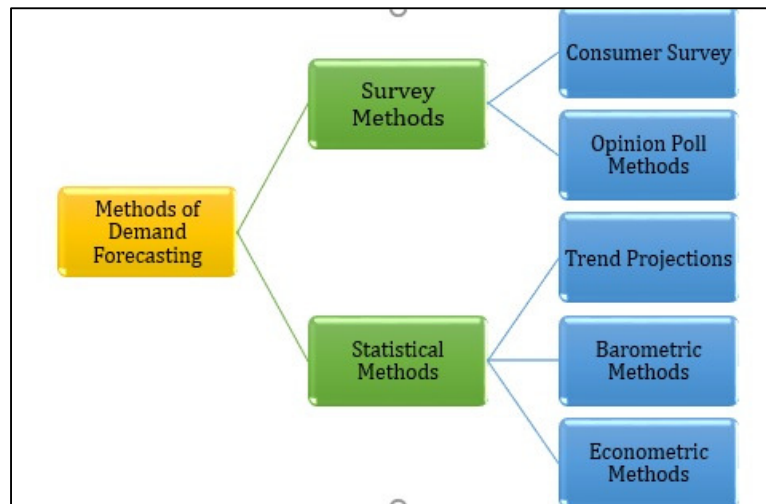
Completely elastic: Manufacturers can offer whatever sum for a specific price ($E_s= \text{infinity}$). The fundamental causes of the supply elasticity are the abundance of alternatives on the market, and the more, the more, the longer, the more elastic, the better.



DEMAND FORECASTING

Demand forecasting is also known as Market projections are methods to build an estimation of the current consumer demand outlook using historical sales evidence. The Market Forecast offers firms an estimation of the number of products and services their consumers buy in advance. A realistic and empirical calculation of the potential market of a commodity is the market prediction. It is called market forecasting to predict the sales income or market for a commodity in the future.

Figure 1: Methods of Demand Forecasting Chart



Source: Author compilation

ANALYSIS OF COSTS AND PRICING

An isoquant is a contour line drawn along the spectrum of points on which the same output amount is produced as two or more inputs are increased. This is extracted from numbers and equivalents in Greek iso. It is a question in economics. While indifference curve mapping appears to resolve consumers' practical problems, isoquant mapping solves producers' cost-minimization problem. Isoquants are typically taken from the capital expenditure charts, which display the technical exchange of capital-labor production and the decreased marginal returns of both inputs. Adding an element with the other constant effectively decreases the residual performance and represents the isoquant form. An isoquant map, a diagram that combines several isoquants describing a given amount of output, may be depicted in a family of isoquants.

PRODUCTION OPTIMIZATION

A realistic estimation of potential cash flows and relevant uncertainties

1. Cost reduction by reducing undue attention on non-critical areas and growing emphasis on value-added areas
2. Discovery of ways to strengthen the conceptual and planning stages instead of the life cycle of the project where the costs of transition are much higher



3. Setting goals for potential technical growth, training, and testing (to minimize and mitigate the risks) Rigorous recognition of main technological threats for a given concept;
4. Improved visibility into technological and administrative challenges that may contribute to crucial errors and loss of output

COST CONCEPTS

Money and Actual Costs

If costs are represented as income, they are called money costs. It involves the costs of business to manufacture a product in different factor inputs. In a capitalist system, just capital makes all manner of expense forecasts and projections. Awareness of the cost of capital is, thus, of considerable economic value. It is essential to calculate cash expenses reliably. When an individual produces a commodity, where the costs are reflected in physical or emotional activity, they are considered actual costs.

Implicit and Explicit Costs

Explicit costs are such expenses that are, in essence, in negotiated contracts incurred by a company in the context of rent, salaries, debt that taxes, energy costs, raw materials charges. to the factors of output [excluding themselves]. They may be accurately measured, determined, and reported in the accounts' records. Costs are identified or imputed. They are not cash invested and are not listed on the statements of accounting as such. The profits of the owner of the capital

Direct and Indirect Costs

Direct costs, which are also known as Direct costs, are individual costs that can be traced directly to a single commodity, organization, or manufacturing process. Example: Expenses for natural products, electricity, employees' salaries, a section manager's pay. On the other hand, indirect expenses are certain expenses that cannot be attributed to a particular operating entity. It is not due to a manufacturer, organization, or process—for example, power costs and water charges, telecommunications charges, overhead costs.

Fixed costs and variable costs:

Fixed costs are those where neither raise nor decrease production differ. They are consistent independent of the production stage. Also, without development, they are optimistic. These are often referred to as extra or operating charges. On the other hand, variable costs are costs that directly increase or decrease concerning the output amount produced—often defined as direct costs or equivalent expenses.

Accounting Costs:

Accounting costs are those expenses already accrued before a given product is made. Just the production charges are considered. It is the real cost of the manufacture of a good. The economic effects of multiple development schemes, on the other side, represent the expenses borne by an individual. In decision making, it requires the consideration of the cost of opportunity (Srivastava, Uma K., G. V. Shenoy, and Subhash C. Sharma, 1989).

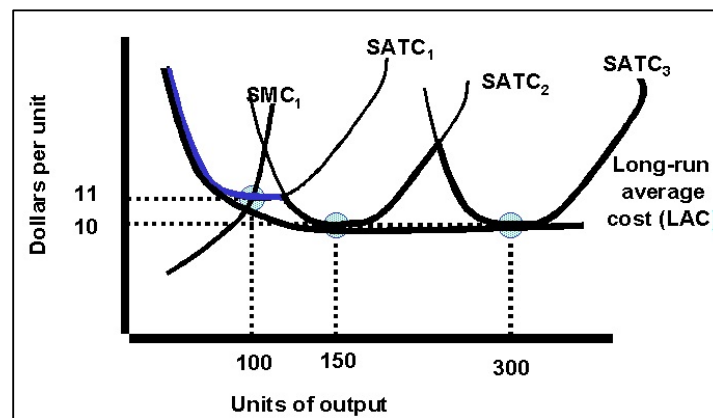


SHORT AND LONG RUN COST CURVES

Short cost curves are typically centered on a product feature with a variable output factor, which indicates that marginal efficiency rises and then decreases. The negative sloping part of the marginal cost curve is related to improved marginal productivity, whereas the lively sloping section is correlated with a reduction in marginal productivity. The typical fixed cost (AFC) curve is the fixed production factor rate separated by the number of output units (Baird, Bruce F, 1989).

The long-term cost curves, typically illustrated in a separate diagram, are often most frequently represented on average, or per unit size, as seen in Figure 2. The long-distance average cost curve (LDC) is a short-distance average cost matrix situated under and tangent to the short-distance courts. It is limited in the short term to choose the best combination of output variables, such that a better combination can never be sought because there are no restrictions on a long-term basis.

Figure 2: Relationship between Short and Long-run curves



Source: Author compilation

Analytical Research I: Suppose next week you create 50 bottles of wine. You are sure of this, You have paid up to \$300 to your fixed expense, plus \$900 for your variable cost. You realize, too, that you would increase the overall cost by \$60 if you had to produce five additional bottles. How high is the gross cost, overall average costs; mean variable costs, estimated fixed costs; and marginal costs?

- Gross Cost: $\$300 + \$900 = \$1200$
- Total Estimated Cost: $\$1200/50 = \24
- Variable means Cost: $\$900/50 = \18
- Estimated Fixed Cost: $\$300/50 = \6
- Marginal Cost: $\$60/5 = \12

CASH FLOW STATEMENT

The cash flow statement, a necessary component of an enterprise's 1987 financial reporting, documents the quantities of cash and cash equivalents that reach and leave the companies, to supplement the balance sheet and income statement. The CFS helps customers consider how the activities of a business work, where the capital comes from, and how invested. You



can read here how the CFS is organized and how it can be used for business research. Each of the primary accounting results for a corporation or company is a cash balance document. The statement may be so clear as a page review or may include a variety of schedules that feed information into a critical statement.

The layout of the Cash Flow Statement

1. Activities
2. Purchase
3. Financial assistance
4. Capital Budgeting

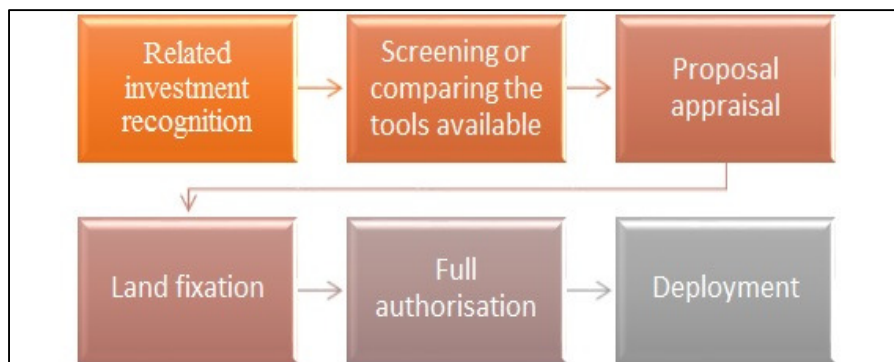
It is the investment decision-making phase of capital spending. The capital investment is described as an expense that is intended to gain more than one year's benefits. It happens at one stage, and the rewards can be earned in the future at various periods.

1. Cost of permanent property purchase, including land and development, factory, and equipment.
2. Added, increased, enhanced, or modified fixed assets costs
3. Price of permanent asset substitution
4. Plan expenses for research and production

Cash Flows & Capital budgeting method Recognition

It is a challenging method for capital budgeting to spend the usable funds. The gain can only be reached in the immediate term, but the outlook remains unclear. The following measures for the budgeting of resources observed, though, could be simpler to obey.

Figure 3: Capital Budgeting Process



Source: Author compilation

INVESTMENT PLAN ASSESSMENT

There are various types of Investment plan assessment. Few of them are,

1. Pay-Back Period (P-BP)
2. Annual Rate of Return (IRR)
3. Accounting Method



Pay-Back Period (P-BP)

This ensures the total savings in fixed properties are reimbursed. It estimates the period for a project's initial expenses to be repaid from a project's added revenue. Investment is rated based on the payback time; investment is chosen based on the shorter payback duration.

$$P-BP = \frac{\text{Plan capital outlay or actual asset expense}}{\text{Cash balances monthly}}$$

Analytical Research 2: Genuine Groups intends to buy a computer known as Computer X. Computer X would have cost Rs. 30,000 and would have a lifetime of 10 years with zero recycle value. The estimated annual cash inflow for the computer is Rs. 10,000.

Appropriate: Calculate the payback period of computer X and decide if the computer will be bought if the Genuine Group of the company's estimated desirable payback period is three years.

Even though this project, the annual cash inflow is, we can easily divide the original expenditure by the annual cash inflow to determine the payback duration, which is displayed below:

$$P-BP = \frac{\text{Rs.30,000}}{\text{Rs.10,000}}$$

$$P-BP = 3 \text{ Years}$$

According to the payback period review, it is beneficial to buy computer X because the payback period is **three years**, which is less than its overall payback period.

Annual Rate of Return (IRR)

This approach brings the projected return from the project into consideration for its whole existence. That is also a cost of return accounting. The higher return cost project is chosen in conjunction with one with a lower return cost.

$$IRR = \frac{\text{Yearly Analysis}}{\text{Investment first (Original Investment)}} \times 100$$

Net Present Value (NPV)

It is a new means of reviewing plans for projects. The time value of the capital is perceived, and the return on the expenditure is determined by joining the time variable dimension. If there is a positive or empty current value, the proposal will hit the agreed amount, and the proposal will be rejected if the negative value does not meet the approved standard.

$$NPV = \frac{\text{Present currency inflow worth} - \text{Cash outflow existing value}}{\text{Original Investment}}$$

CONCLUSION

The following findings are distilled from this chapter's overall analysis: Corporate administration plays a vital part in businesses. It is beneficial in decision making and strategic planning concerning a company's internal activities since it offers a good analysis of business dynamics and practical resources to analyze competitiveness in the marketplace when forecasting consumer behavior. It helps the study of market details under which an



organization is operated. The demand legislation explains the purchasers' actions. Generally, more products or services are offered that's bought-for a low price than for a higher price. The result is a demand curve when this relationship is diagrammed. Sellers' actions can be defined in the supply rule. Recall sellers, and both start supplying s . Sellers can usually produce more items at prices higher than at lower prices. The product of this relationship is a downward supply curve.

Together with supply and demand influence the value of the economy. In the charts, market balance is the crossroads of supply and demand. At this crossroads, the price is the value, and the quantity is the sum of support. There are no surpluses and no deficits, while the demand is healthy for product or service. Finance practitioners' decision-making method develops, evaluates, examines, picks, and executes long-term investment initiatives that fulfill firm-specific requirements and are compatible with the organizational strategic priorities before making decisions on capital budgeting.

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