

Economics for Engineers Unit: 4**Credits: 3****Course Code: 18HSS03****What Is the Theory of the Firm**

The theory of the firm is the microeconomic concept founded in neoclassical economics that states that firms exist and make decisions to maximize profits. The theory holds that the overall nature of companies is to maximize profits meaning to create as much of a gap between revenue and costs. The firm's goal is to determine pricing and demand within the market and allocate resources to maximize net profits.

Definition: Production is the method of turning raw materials or inputs into finished goods or products in a manufacturing process. In other words, it means the creation of something from basic inputs.

What Does Production Mean?

What is the definition of production? Production may also refer to the goods being produced. For instance, some business call a set of products being produced at the same time a production run. Both of these definitions are interchangeable. Basically, it just means a manufacturing process or the end result of a manufacturing process.

Economists call businesses that produce goods producers. These companies create products to sell to their customers. For example, a clothing company produces clothing for consumers. Today, however, companies are leaning toward the trend of outsourcing their production capacities, so that they do not need to perform it themselves.

Production Function: Meaning, Definitions and Features

Production is the result of co-operation of four factors of production viz., land, labour, capital and organization. This is evident from the fact that no single commodity can be produced without the help of any one of these four factors of production. Therefore, the producer combines all the four factors of production in a technical proportion. The aim of the producer is to maximize his profit. For this sake, he decides to maximize the production at minimum cost by means of the best combination of factors of production.

The producer secures the best combination by applying the principles of equi-marginal returns and substitution. According to the principle of equi-marginal returns, any

producer can have maximum production only when the marginal returns of all the factors of production are equal to one another. For instance, when the marginal product of the land is equal to that of labour, capital and organisation, the production becomes maximum.

Meaning of Production Function:

In simple words, production function refers to the functional relationship between the quantity of a good produced (output) and factors of production (inputs). "The production function is purely a technical relation which connects factor inputs and output." Prof. Koutsoyiannis Defined production function as "the relation between a firm's physical production (output) and the material factors of production (inputs)." Prof. Watson

In this way, production function reflects how much output we can expect if we have so much of labour and so much of capital as well as of labour etc. In other words, we can say that production function is an indicator of the physical relationship between the inputs and output of a firm.

The reason behind physical relationship is that money prices do not appear in it. However, here one thing that becomes most important to quote is that like demand function a production function is for a definite period.

It shows the flow of inputs resulting into a flow of output during some time. The production function of a firm depends on the state of technology. With every development in technology the production function of the firm undergoes a change.

The new production function brought about by developing technology displays same inputs and more output or the same output with lesser inputs. Sometimes a new production function of the firm may be adverse as it takes more inputs to produce the same output.

Mathematically, such a basic relationship between inputs and outputs may be expressed as:

$$Q = f(L, C, N)$$

Where Q = Quantity of output

L = Labour

C = Capital

N = Land.

Hence, the level of output (Q), depends on the quantities of different inputs (L, C, N) available to the firm. In the simplest case, where there are only two inputs, labour (L) and capital (C) and one output (Q), the production function becomes.

$$Q = f(L, C)$$

Definitions:

“The production function is a technical or engineering relation between input and output. As long as the natural laws of technology remain unchanged, the production function remains unchanged.” Prof. L.R. Klein

“Production function is the relationship between inputs of productive services per unit of time and outputs of product per unit of time.” Prof. George J. Stigler

“The relationship between inputs and outputs is summarized in what is called the production function. This is a technological relation showing for a given state of technological knowledge how much can be produced with given amounts of inputs.” Prof. Richard J. Lipsey

Thus, from the above definitions, we can conclude that production function shows for a given state of technological knowledge, the relation between physical quantities of inputs and outputs achieved per period of time.

Features of Production Function:

Following are the main features of production function:

1. Substitutability:

The factors of production or inputs are substitutes of one another which make it possible to vary the total output by changing the quantity of one or a few inputs, while the quantities of all other inputs are held constant. It is the substitutability of the factors of production that gives rise to the laws of variable proportions.

2. Complementarily:

The factors of production are also complementary to one another, that is, the two or more inputs are to be used together as nothing will be produced if the quantity of either of the inputs used in the production process is zero.

The principles of returns to scale is another manifestation of complementarity of inputs as it reveals that the quantity of all inputs are to be increased simultaneously in order to attain a higher scale of total output.

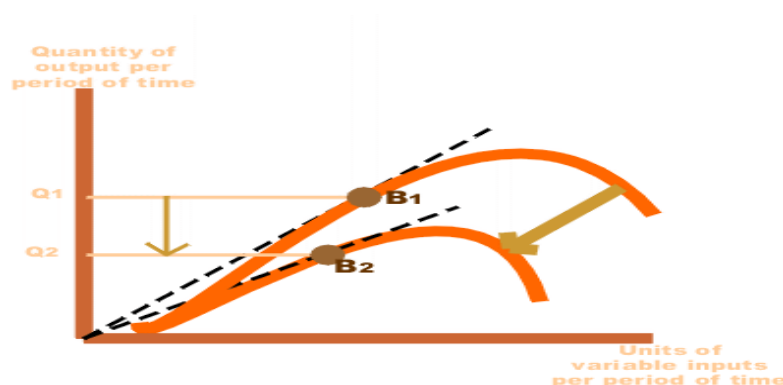
3. Specificity:

It reveals that the inputs are specific to the production of a particular product. Machines and equipment's, specialized workers and raw materials are a few examples of the specificity of factors of production. The specificity may not be complete as factors may be used for production of other commodities too. This reveals that in the production process none of the factors can be ignored and in some cases ignorance to even slightest extent is not possible if the factors are perfectly specific.

Production involves time; hence, the way the inputs are combined is determined to a large extent by the time period under consideration. The greater the time period, the greater the freedom the producer has to vary the quantities of various inputs used in the production process.

In the production function, variation in total output by varying the quantities of all inputs is possible only in the long run whereas the variation in total output by varying the quantity of single input may be possible even in the short run.

Time Period and Production Functions



The production function is differently defined in the short run and in the long run. This distinction is extremely relevant in microeconomics. The distinction is based on the nature of factor inputs. Those inputs that vary directly with the output are called variable factors. These are the factors that can be changed. Variable factors exist in both, the short run and the long run. Examples of variable factors include daily-wage labour, raw materials, etc.

On the other hand, those factors that cannot be varied or changed as the output changes are called fixed factors. These factors are normally characteristic of the short run or short period of time only. Fixed factors do not exist in the long run. Consequently, we can define two production functions: short-run and long-run. The short-run production function defines the relationship between one variable factor (keeping all other factors fixed) and the output. The law of returns to a factor explains such a production function.

For example, consider that a firm has 20 units of labour and 6 acres of land and it initially uses one unit of labour only (variable factor) on its land (fixed factor). So, the land-labour ratio is 6:1. Now, if the firm chooses to employ 2 units of labour, then the land-labour ratio becomes 3:1 (6:2).

The long-run production function is different in concept from the short run production function. Here, all factors are varied in the same proportion. The law that is used to explain this is called the law of returns to scale. It measures by how much proportion the output changes when inputs are changed proportionately.

Comparison Chart

Basis For Comparison	Short-Run Production Function	Long-Run Production Function
Meaning	Short run production function alludes to the time period, in which at least one factor of production is fixed.	Long run production function connotes the time period, in which all the factors of production are variable.
Law	Law of variable proportion	Law of returns to scale
Scale of	No change in scale of	Change in scale of production.

Basis For Comparison	Short-Run Production Function	Long-Run Production Function
production	production.	
Factor-ratio	Changes	Does not change.
Entry and Exit	There are barriers to entry and the firms can shut down but cannot fully exit.	Firms are free to enter and exit.

Costs are the necessary expenditures that must be made in order to run a business. Every factor of production has an associated cost. The cost of labor, for example, used in the production of goods and services is measured in terms of wages and benefits. The cost of a fixed asset used in production is measured in terms of depreciation. The cost of capital used to purchase fixed assets is measured in terms of the interest expense associated with raising the capital.

Businesses are vitally interested in measuring their costs. Many types of costs are observable and easily quantifiable. In such cases there is a direct relationship between cost of input and quantity of output. Other types of costs must be estimated or allocated. That is, the relationship between costs of input and units of output may not be directly observable or quantifiable. In the delivery of professional services, for example, the quality of the output is usually more significant than the quantity, and output cannot simply be measured in terms of the number of patients treated or students taught. In such instances where qualitative factors play an important role in measuring output, there is no direct relationship between costs incurred and output achieved.

COSTS

Costs can have different relationships to output. Costs also are used in different business applications, such as financial accounting, cost accounting, budgeting, capital budgeting, and valuation. Consequently, there are different ways of categorizing costs according to their relationship to output as well as according to the context in which they are used. Following this summary of the different types of costs are some examples of how costs are used in different business applications.

Fixed and Variable Costs

The two basic types of costs incurred by businesses are fixed and variable. Fixed costs do not vary with output, while variable costs do. Fixed costs are sometimes called overhead costs. They are incurred whether a firm manufactures 100 widgets or 1,000 widgets. In preparing a budget, fixed costs may include rent, depreciation, and supervisors' salaries. Manufacturing overhead may include such items as property taxes and insurance. These fixed costs remain constant in spite of changes in output.

Variable costs, on the other hand, fluctuate in direct proportion to changes in output. In a production facility, labor and material costs are usually variable costs that increase as the volume of production increases. It takes more labor and material to produce more output, so the cost of labor and material varies in direct proportion to the volume of output.

For many companies in the service sector, the traditional division of costs into fixed and variable does not work. Typically, variable costs have been defined primarily as "labor and materials." However, in a service industry labor is usually salaried by contract or by managerial policy and thus does not fluctuate with production. It is, therefore, a fixed and not a variable cost for these companies. There is no hard and firm rule about what category (fixed or variable) is appropriate for particular costs. The cost of office paper in one company, for example, may be an overhead or fixed cost since the paper is used in the administrative offices for administrative tasks. For another company, that same office paper may well be a variable cost because the business produces printing as

a service to other businesses, like Kinkos, for example. Each business must determine based on its own uses whether an expense is a fixed or variable cost to the business.

In addition to variable and fixed costs, some costs are considered mixed. That is, they contain elements of fixed and variable costs. In some cases the cost of supervision and inspection are considered mixed costs.

Direct and Indirect Costs

Direct costs are similar to variable costs. They can be directly attributed to the production of output. The system of valuing inventories called direct costing is also known as variable costing. Under this accounting system only those costs that vary directly with the volume of production are charged to products as they are manufactured. The value of inventory is the sum of direct material, direct labor, and all variable manufacturing costs.

Indirect costs, on the other hand, are similar to fixed costs. They are not directly related to the volume of output. Indirect costs in a manufacturing plant may include supervisors' salaries, indirect labor, factory supplies used, taxes, utilities, depreciation on building and equipment, factory rent, tools expense, and patent expense. These indirect costs are sometimes referred to as manufacturing overhead.

Under the accounting system known as full costing or absorption costing, all of the indirect costs in manufacturing overhead as well as direct costs are included in determining the cost of inventory. They are considered part of the cost of the products being manufactured.

Product and Period Costs

The concepts of product and period costs are similar to direct and indirect costs. Product costs are those that the firm's accounting system associates directly with output and that are used to value inventory. Period costs are charged as expenses to the current

period. Under direct costing, period costs are not viewed as costs of the products being manufactured, so they are not associated with valuing inventories.

If the firm uses a full cost accounting system, however, then all manufacturing costs—including fixed manufacturing overhead costs and variable costs—become product costs. They are considered part of the cost of manufacturing and are charged against inventory.

Other Types of Costs

These are the basic types of costs as they are used in different accounting systems.

Controllable and Uncontrollable Costs—

In budgeting it is useful to identify controllable and uncontrollable costs. This simply means that managers with budgetary responsibility should not be held accountable for costs they cannot control.

Out-of-pocket and Sunk Costs—

Financial managers often use the concepts of out-of-pocket costs and sunk costs when evaluating the financial merits of specific proposals. Out-of-pocket costs are those that require the use of current resources, usually cash. Sunk costs have already been incurred. In evaluating whether or not to increase production, for example, financial managers may take into account the sunk costs associated with tools and machinery as well as the out-of-pocket costs associated with adding more material and labor.

Incremental and Opportunity Costs—

Financial planning efforts utilize the concepts of incremental and opportunity costs. Incremental costs are those associated with switching from one level of activity or course of action to another. Incremental costs represent the difference between two alternatives. Opportunity costs represent the sacrifice that is made when the means of production are used for one task rather than another, or when capital is used for one investment rather than another. Nothing can be produced or invested without incurring

an opportunity cost. By making one investment or production decision using limited resources, one necessarily forgoes the opportunity to use those resources for a different purpose. Consequently, opportunity costs are not usually factored into investment and production decisions involving resource allocation.

Imputed Costs –

Also of use to financial planners are imputed costs. These are costs that are not actually incurred, but are associated with internal transactions. When work in process is transferred from one department to another within an organization, a method of transfer pricing may be needed for budgetary reasons. Although there is no actual purchase or sale of goods and materials, the receiving department may be charged with imputed costs for the work it has received. When a company rents itself a building that it could have rented to an outside party, the rent may be considered an imputed cost.

BUSINESS APPLICATIONS USE DIFFERENT TYPES OF COSTS

Costs as a business concept are useful in measuring performance and determining profitability. What follows are brief discussions of some business applications in which costs play an important role.

Financial Accounting

One of the major objectives of financial accounting is to determine the periodic income of the business. In manufacturing firms a major component of the income statement is the cost of goods sold (COGS). COGS is that part of the cost of inventory that can be considered an expense of the period because the goods were sold. It appears as an expense on the firm's periodic income statement. COGS is calculated as beginning inventory plus net purchases minus ending inventory.

Depreciation is another cost that becomes a periodic expense on the income statement. Every asset is initially valued at its cost. Accountants charge the cost of the asset to depreciation expense over the useful life of the asset. This cost allocation approach

attempts to match costs with revenues and is more reliable than attempting to periodically determine the fair market value of the asset.

In financial accounting, costs represent assets rather than expenses. Costs only become expenses when they are charged against current income. Costs may be allocated as expenses against income over time, as in the case of depreciation, or they may be charged as expenses when revenues are generated, as in the case of COGS.

Cost Accounting

Cost accounting, also sometimes known as management accounting, provides appropriate cost information for budgeting systems and management decision making. Using the principles of general accounting, cost accounting records and determines costs associated with various functions of the business. These data are used by management to improve operations and make them more efficient, economical, and profitable.

Two major systems can be used to record the costs of manufactured products. They are known as job costing and process costing. A job cost system, or job order cost system, collects costs for each physically identifiable job or batch of work as it moves through the manufacturing facility and disregards the accounting period in which the work is done. With a process cost system, on the other hand, costs are collected for all of the products worked on during a specific accounting period. Unit costs are then determined by dividing the total costs by the number of units worked on during the period. Process cost systems are most appropriate for continuous operations, when like products are produced, or when several departments cooperate and participate in one or more operations. Job costing, on the other hand, is used when labor is a chief element of cost, when diversified lines or unlike products are manufactured, or when products are built to customer specifications.

When costs are easily observable and quantifiable, cost standards are usually developed. Also known as engineered standards, they are developed for each physical

input at each step of the production process. At that point an engineered cost per unit of production can be determined. By documenting variable costs and fairly allocating fixed costs to different departments, a cost accounting system can provide management with the accountability and cost controls it needs to improve operations.

Cost Budgeting Systems

Budgeting systems rely on accurate cost accounting systems. Using cost data collected by the business's cost accounting system, budgets can be developed for each department at different levels of output. Different units within the business can be designated cost centers, profit centers, or departments. Budgets are then used as a management tool to measure performance, among other things. Performance is measured by the extent to which actual figures deviate from budgeted amounts.

In using budgets as measures of performance, it is important to distinguish between controllable and uncontrollable costs. Managers should not be held accountable for costs they cannot control. In the short run, fixed costs can rarely be controlled. Consequently, a typical budget statement will show sales revenue as forecast and the variable costs associated with that level of production. The difference between sales revenue and variable costs is the contribution margin. Fixed costs are then deducted from the contribution margin to obtain a figure for operating income. Managers and departments are then evaluated on the basis of costs and those elements of production they are expected to control.

Cost of Capital

Capital budgeting and other business decisions—such as lease-buy decisions, bond refunding and working capital policies—require estimates of a company's cost of capital. Capital budgeting decisions revolve around deciding whether or not to purchase a particular capital asset. Such decisions are based on a cost-benefit analysis, an estimate of the net present value of future revenues that would be generated by a particular capital asset. An important factor in such decisions is the company's cost of capital.

Cost of capital is a percentage that represents the interest rate the company would pay for the funds being raised. Each capital component—debt, equity, and retained earnings—has its own cost. Each type of debt or equity also has a different cost. While a particular purchase or project may be funded by only one kind of capital, companies are likely to use a weighted average cost of capital when making financial decisions. Such practice takes into account the fact that the company is an ongoing concern that will need to raise capital at different rates in the future as well as at the present rate.

Other Applications

Costs are sometimes used in the valuation of assets that are being bought or sold. Buyers and sellers may agree that the value of an asset can be determined by estimating the costs associated with building or creating an asset that could perform similar functions and provide similar benefits as the existing asset. Using the cost approach to value an asset contrasts with the income approach, which attempts to identify the present value of the revenues the asset is expected to generate.

Finally, costs are used in making pricing decisions. Manufacturing firms refer to the ratio between prices and costs as their markup, which represents the difference between the selling price and the direct cost of the goods being sold. For retailers and wholesalers, the gross margin is the difference between their invoice cost and their selling price. While costs form the basis for pricing decisions, they are only a starting point, with market conditions and other factors usually determining the most profitable price.

Fixed Costs (FC). The costs which don't vary with changing output. Fixed costs might include the cost of building a factory, insurance and legal bills. Even if your output changes or you don't produce anything, your fixed costs stay the same. In the above example, fixed costs are always £1,000.

Variable Costs (VC). Costs which depend on the output produced. For example, if you produce more cars, you have to use more raw materials such as metal. This is a variable cost.

Semi-Variable Cost. Labour might be a semi-variable cost. If you produce more cars, you need to employ more workers; this is a variable cost. However, even if you didn't produce any cars, you may still need some workers to look after empty factory.

Total Costs (TC) – Fixed + Variable Costs

Marginal Costs – Marginal cost is the cost of producing an extra unit. If the total cost of 3 units is 1550, and the total cost of 4 units is 1900. The marginal cost of the 4th unit is 350.

Opportunity Cost – Opportunity cost is the next best alternative foregone. If you invest £1million in developing a cure for pancreatic cancer, the opportunity cost is that you can't use that money to invest in developing a cure for skin cancer.

Economic Cost. Economic cost includes both the actual direct costs (accounting costs) plus the opportunity cost. For example, if you take time off work to a training scheme. You may lose a weeks pay of £350, plus also have to pay the direct cost of £200. Thus the total economic cost = £550.

Accounting Costs – this is the monetary outlay for producing a certain good. Accounting costs will include your variable and fixed costs you have to pay.

Sunk Costs. These are costs that have been incurred and cannot be recouped. If you left the industry, you could not reclaim sunk costs. For example, if you spend money on advertising to enter an industry, you can never claim these costs back. If you buy a machine, you might be able to sell if you leave the industry. See: Sunk cost fallacy

Avoidable Costs. Costs that can be avoided. If you stop producing cars, you don't have to pay for extra raw materials and electricity. Sometimes known as an escapable cost

BREAK EVEN ANALYSIS

Break-Even Analysis – Definition, Formula & Examples

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- What is a Break-Even Analysis?
- Components of Break Even Analysis
- Calculation of Break-Even Analysis
- Contribution Margin
- When is Break even analysis used?
- Breakeven analysis is useful for the following reasons:
- Ways to monitor Break even point
- Benefits of Break-even analysis

What is a Break-Even Analysis?

A break-even analysis is a financial tool which helps you to determine at what stage your company, or a new service or a product, will be profitable. In other words, it's a financial calculation for determining the number of products or services a company should sell to cover its costs (particularly fixed costs). Break-even is a situation where you are neither making money nor losing money, but all your costs have been covered. Break-even analysis is useful in studying the relation between the variable cost, fixed cost and revenue. Generally, a company with low fixed costs will have a low break-even point of sale. For an example, a company has a fixed cost of Rs.0 (zero) will automatically have broken even upon the first sale of its product.

Components of Break Even Analysis

Fixed costs

Fixed costs are also called as the overhead cost. These overhead costs occur after the decision to start an economic activity is taken and these costs are directly related to the level of production, but not the quantity of production. Fixed costs include (but are not limited to) interest, taxes, salaries, rent, depreciation costs, labour costs, energy costs etc. These costs are fixed no matter how much you sell.

Variable costs

Variable costs are costs that will increase or decrease in direct relation to the production volume. These cost include cost of raw material, packaging cost, fuel and other costs that are directly related to the production.

Calculation of Break-Even Analysis

The basic formula for break-even analysis is driven by dividing the total fixed costs of production by the contribution per unit (price per unit less the variable costs).

For an example:

Variable costs per unit: Rs. 400 Sale price per unit: Rs. 600 Desired profits: Rs. 4,00,000
Total fixed costs: Rs. 10,00,000 First we need to calculate the break-even point per unit, so we will divide the Rs.10,00,000 of fixed costs by the Rs. 200 which is the contribution per unit (Rs. 600 – Rs. 400). Break Even Point = $\text{Rs. } 10,00,000 / \text{Rs. } 200 = 5000 \text{ units}$ Next, this number of units can be shown in rupees by multiplying the 5,000 units with the selling price of Rs. 600 per unit. We get Break Even Sales at 5000 units x Rs. 600 = Rs. 30,00,000. (Break-even point in rupees)

Contribution Margin

Break-even analysis also deals with the contribution margin of a product. The excess between the selling price and total variable costs is known as contribution margin. For an example, if the price of a product is Rs.100, total variable costs are Rs. 60 per product and fixed cost is Rs. 25 per product, the contribution margin of the product is Rs. 40 (Rs. 100 – Rs. 60). This Rs. 40 represents the revenue collected to cover the fixed costs. In the calculation of the contribution margin, fixed costs are not considered.

Breakeven analysis is useful for the following reasons:

- It helps to determine remaining/unused capacity of the concern once the breakeven is reached. This will help to show the maximum profit on a particular product/service that can be generated.
- It helps to determine the impact on profit on changing to automation from manual (a fixed cost replaces a variable cost).
- It helps to determine the change in profits if the price of a product is altered.
- It helps to determine the amount of losses that could be sustained if there is a sales downturn.

Additionally, break-even analysis is very useful for knowing the overall ability of a business to generate a profit. In the case of a company whose breakeven point is near to the maximum sales level, this signifies that it is nearly impractical for the business to earn a profit even under the best of circumstances. Therefore, it's the management responsibility to monitor the breakeven point constantly. This monitoring certainly reduces the breakeven point whenever possible.

Ways to monitor Breakeven point

- **Pricing analysis:** Minimize or eliminate the use of coupons or other price reductions offers, since such promotional strategies increase the breakeven point.
- **Technology analysis:** Implementing any technology that can enhance the business efficiency, thus increasing capacity with no extra cost.
- **Cost analysis:** Reviewing all fixed costs constantly to verify if any can be eliminated can surely help. Also, review the total variable costs to see if they can be eliminated. This analysis will increase the margin and reduce the breakeven point.
- **Margin analysis:** Push sales of the highest-margin (high contribution earning) items and pay close attention to product margins, thus reducing the breakeven point.

- **Outsourcing:** If an activity consists of a fixed cost, try to outsource such activity (whenever possible), which reduces the breakeven point.

Benefits of Break-even analysis

- **Catch missing expenses:** When you're thinking about a new business, it's very much possible that you may forget about few expenses. Therefore, if you do a break-even analysis you have to review all your financial commitments to figure out your break-even point. This analysis certainly restricts the number of surprises down the road.
- **Set revenue targets:** Once the break-even analysis is complete, you will get to know how much you need to sell to be profitable. This will help you and your sales team to set more concrete sales goals.
- **Make smarter decisions:** Entrepreneurs often take decisions in relation to their business based on emotion. Emotion is important i.e. how you feel, though it's not enough. In order to be a successful entrepreneur, your decisions should be based on facts.
- **Fund your business:** This analysis is a key component in any business plan. It's generally a requirement if you want outsiders to fund your business. In order to fund your business, you have to prove that your plan is viable. Furthermore, if the analysis looks good, you will be comfortable enough to take the burden of various ways of financing.
- **Better Pricing:** Finding the break-even point will help in pricing the products better. This tool is highly used for providing the best price of a product that can fetch maximum profit without increasing the existing price.
- **Cover fixed costs:** Doing a break-even analysis helps in covering all fixed cost

What Is Capital Budgeting?

Capital budgeting is the process a business undertakes to evaluate potential major projects or investments. Construction of a new plant or a big investment in an outside venture are examples of projects that would require capital budgeting before they are approved or rejected.

As part of capital budgeting, a company might assess a prospective project's lifetime cash inflows and outflows to determine whether the potential returns that would be generated meet a sufficient target benchmark. The process is also known as investment appraisal. Ideally, businesses would pursue any and all projects and opportunities that enhance shareholder value. However, because the amount of capital any business has

available for new projects is limited, management uses capital budgeting techniques to determine which projects will yield the best return over an applicable period.

Some methods of capital budgeting companies use to determine which projects to pursue include throughput analysis, net present value (NPV), internal rate of return, discounted cash flow, and payback period.

Types of Capital Budgeting: Through *input* Analysis

Throughput analysis is the most complicated form of capital budgeting analysis but also the most accurate in helping managers decide which projects to pursue. Under this method, the entire company is considered as a single profit-generating system. Throughput is measured as an amount of material passing through that system.

The analysis assumes that nearly all costs are operating expenses, that a company needs to maximize the throughput of the entire system to pay for expenses, and that the way to maximize profits is to maximize the throughput passing through a bottleneck operation. A bottleneck is the resource in the system that requires the longest time in operations.

This means that managers should always place a higher priority on capital budgeting projects that will increase throughput passing through the bottleneck.

DCF Analysis

Discounted cash flow (DCF) analysis looks at the initial cash outflow needed to fund a project, the mix of cash inflows in the form of revenue, and other future outflows in the form of maintenance and other costs.

These costs, except for the initial outflow, are discounted back to the present date. The resulting number from the DCF analysis is the net present value (NPV). Projects with the highest NPV should rank over others unless one or more are mutually exclusive.

Payback Analysis

Payback analysis is the simplest form of capital budgeting analysis but it's also the least accurate. It's still widely used because it's quick and can give managers a "back of the envelope" understanding of the real value of a proposed project.

This analysis calculates how long it will take to recoup the costs of an investment. The payback period is identified by dividing the initial investment in the project by the average yearly cash inflow that the project will generate.