

LOGISTICS AND SUPPLY CHAIN MANAGEMENT

UNIT 2

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CONCEPT OF TOTAL COST ANALYSIS

The essence of **total cost analysis** is to identify all relevant **costs** over the entire life of a product system or project. These **costs** are then summed to calculate the **total cost** of a decision. The visible **costs** are generally used for decision making while the hidden **costs** may be overlooked. **Total Cost Analysis** refers to the measure of the cost – output relationship, i.e. determining the cost incurred in hiring the inputs and how well these can be re-arranged to increase the productivity (output) of the firm. In other words, the cost analysis is concerned with determining money value of inputs (labour, raw material), called as the overall cost of production which helps in deciding the optimum level of production. The different cost needs to be analyzed from order to collection cycle. 1. Order placement and Communication 2. Order Entry 3. Credit check 4. Documentation 5. Order picking 6. Delivery 7. Invoicing and collection

There are several cost concepts relevant to the business operations and decisions and for the convenience of understanding these can be grouped under two overlapping categories:

1. Cost Concepts Used for Accounting Purposes: Generally, the accountants use these cost concepts to study the financial position of the firm. They are concerned with arranging the finances of the firm and therefore keep a track of the assets and liabilities of the firm. The accounting costs are used for taxation purposes and calculating the profit and loss of the firm.

These are:

- Opportunity Cost
- Business Cost
- Full Cost
- Explicit Cost
- Implicit Cost
- Out-of-Pocket Cost
- Book Cost

2. Analytical Cost Concepts Used for Economic Analysis of Business Activities: These cost concepts are used by the economists to analyze the likely cost of production in the future. They are concerned with how the cost of production can be managed or how the input and output can be re-arranged such that the overall profitability of the firm gets improved.

These costs are:

- Fixed Cost
- Variable Cost
- Total Cost
- Average Cost
- Marginal Cost
- Short-run Cost
- Long-Run Cost
- Incremental Cost
- Sunk Cost
- Historical Cost
- Replacement Cost
- Private Cost
- Social Cost

In business, the manager must have a clear understanding of the cost-output relation as it helps in cost control, marketing, pricing, profit, production, etc. The cost-output relation can be expressed as:

$$C = f(S, O, P, T)$$

Where, C =cost, S = Size of the firm, O = output, P = Price and T = Technology.

With the increase in the size of the firm, the economies of scale also increase and as a result the cost of per unit production comes down. There is a positive relation between the cost and the output, as the output increases the cost also increases and vice-versa. Likewise, the price of inputs is directly related to the price, as the input price increases the cost of production also increases. But however, the technology is inversely related to the cost, i.e. with an improved technology the cost of production decreases. Thus, the cost analysis is pivotal in business decision-making as the cost incurred in the input and output is to be carefully understood before planning the production capacity of the firm.

LOGISTICS COSTING

Logistics is defined as the management process for the movement of goods across country or across the globe. Companies map out the transportation path of their goods into a supply chain, or a path of transport that they use repeatedly to have goods shipped to them or to customers. When goods travel, they are moved using a combination of travel methods that includes ships, trucks, trains and airplanes. Companies use logistics to manage the timing and location of their goods in transport as a component of their overall supply chain management.

The basic principles of logistics costing identifies the different costs that result from servicing customers with particular product mixes. An effective costing system seeks to determine the total cost of achieving specific logistics objectives (outputs) by quantifying the various logistics inputs.

PRINCIPLES OF LOGISTICS COSTING

It will be apparent from the previous comments that the problem of developing an appropriate logistics-oriented costing system is primarily one of focus. That is the ability to focus upon the output of the distribution system, in essence the provision of customer service, and to identify the unique costs associated with that output. Traditional accounting methods lack this focus, mainly because they were designed with something else in mind.

1. One of the basic principles of logistics costing, is that the system should mirror the materials flow, i.e. it should be capable of identifying the costs that result from providing customer service in the marketplace.
2. A second principle is that it should be capable of enabling separate cost and revenue analysis to be made by customer type and by market segment or distribution channel. This latter requirement emerges because of the dangers inherent in dealing solely with averages, e.g. the average cost per delivery, since they can often conceal substantial variations either side of the mean. To operationalize these principles requires an 'output' orientation to costing. In other words, we must first define the desired outputs of the logistics system and then seek to identify the costs associated with providing those outputs.

A useful concept here is the idea of 'mission'. In the context of logistics, a mission is a set of customer service goals to be achieved by the system within a specific product/market context.

Missions can be defined in terms of the type of market served, by which products and within what constraints of service and cost. A mission by its very nature cuts across traditional company lines. The successful achievement of defined mission goals involves inputs from a large number of functional areas and activity centres within the firm. Thus an effective logistics costing system must seek to determine the total systems cost of meeting desired logistic objectives (the 'output' of the system) and the costs of the various inputs involved in meeting these outputs.

LOGISTICS AND THE BOTTOM LINE

Logistics and the bottom line

- Bottom line
 - Financial dimension of decision making
 - Resource utilization and specifically the use of fixed and working capital
 - The pressure in most organizations is to improve the productivity of capital – 'to make the assets sweat'

$$\text{ROI} = \frac{\text{Profit}}{\text{Capital employed}}$$
$$\text{ROI} = \frac{\text{Profit}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Capital employed}}$$

Today's turbulent business environment has produced an ever-greater awareness amongst managers of the financial dimension of decision making. 'The bottom line' has become the driving force which, perhaps erroneously, determines the direction of the company. In some cases this has led to a limiting, and potentially dangerous, focus on the short term. Hence we find that investment in brands, in R&D and in capacity may well be curtailed if there is no prospect of an immediate payback. Just as powerful an influence on decision making and management horizons is cash flow. Strong positive cash flow has become as much a desired goal of management as profit. The third financial dimension to decision making is resource utilization and specifically the use of fixed and working capital. The pressure in most organizations is to improve the productivity of capital i.e. 'to make the assets sweat'. In this

regard it is usual to utilize the concept of return on investment (ROI). Return on investment is the ratio between the net profit and the capital that was employed to produce that profit, thus

$$\text{ROI} = \text{profit} / \text{Capital employed}$$

This ratio can be further expanded:

$$\text{ROI} = \text{Profit} / \text{Sales} * \text{Sales} / \text{Capital employed}$$

It will be seen that ROI is the product of two ratios: the first, profit/sales, being commonly referred to as the margin and the second, sales/capital employed, termed capital turnover or asset turn. Thus to gain improvement on ROI one or other, or both, of these ratios must increase. Typically many companies will focus their main attention on the margin in their attempt to drive up ROI, yet it can often be more effective to use the leverage of improved capital turnover to boost ROI. For example, many successful retailers have long since recognized that very small net margins can lead to excellent ROI if the productivity of capital is high, e.g. limited inventory, high sales per square foot, premises that are leased rather than owned and so on.

IMPACT OF LOGISTICS ON SHAREHOLDER VALUE

Impact of Logistics Management on return on Shareholder Value

- Shareholder value is a key component in measuring corporate performance.
- It is the sum of all strategic decisions that affect the firm's ability to efficiently increase the amount of free cash flow over time.
- Market Value Added (MVA) can be used to measure shareholder value,

$$\text{MVA} = (\text{Share price} * \text{No. of issued shares}) \text{ minus book value of capital added}$$

One of the key measures of corporate performance today is shareholder value. In other words, what is the company worth to its owners? Increasingly senior management within the business is being driven by the goal of enhancing shareholder value. There are a number of complex issues involved in actually calculating shareholder value but at its simplest it is determined by the net present value of future cash flows. These cash flows are defined as:

$$\begin{aligned}
& \text{Net operating income} \\
& \quad \textit{less} \\
& \text{Taxes} \\
& \quad \textit{less} \\
& \text{Working capital investment} \\
& \quad \textit{less} \\
& \text{Fixed capital investment} \\
& \quad = \\
& \text{After-tax free cash flow}
\end{aligned}$$

More recently there has been a further development in that the concept of economic value added (EVA) has become widely used and linked to the creation of shareholder value. The term EVA originated with the consulting firm Stern Stewart, although its origins go back to the economist Alfred Marshall who, over 100 years ago, developed the concept of 'economic income'. Essentially EVA is the difference between operating income after taxes less the true cost of capital employed to generate those profits. Thus:

$$\begin{aligned}
& \text{Economic value added (EVA)} \\
& = \text{Profit after tax} - \text{True cost of capital employed}
\end{aligned}$$

Equally improvements in EVA will lead to an enhancement of shareholder value. If the net present value of expected future EVAs were to be calculated this would generate a measure of wealth known as market value added (MVA), which is a true measure of what the business is worth to its shareholders. A simple definition of MVA is:

$$\begin{aligned}
& \text{Stock price} \times \text{Issued shares} \\
& \quad \textit{less} \\
& \text{Book value of total capital invested} \\
& \quad = \\
& \text{Market value added}
\end{aligned}$$

$$\text{MVA} = \text{Net present value of expected future EVA}$$

Clearly, it will be recognized that there are a number of significant connections between logistics performance and shareholder value. Not only the impact that logistics service can have upon net operating income (profit) but also the impact on capital efficiency (asset turn). Many companies have come to realize the effect that lengthy pipelines and highly capital-intensive logistics facilities can have on EVA and hence shareholder value. As a result they have focused on finding ways in which pipelines can be shortened and, consequently,

working capital requirements reduced. At the same time they have looked again at their fixed capital deployment of distribution facilities and vehicle fleets and in many cases have moved these assets off the balance sheet through the use of third-party logistics service providers.

The drivers of shareholder value

The five basic drivers of enhanced shareholder value are revenue growth, operating cost reduction, fixed capital efficiency, working capital efficiency and tax minimization. All five of these drivers are directly and indirectly affected by logistics management and supply chain strategy.

1. Revenue growth

The critical linkage here is the impact that logistics service can have on sales volume and customer retention. Whilst it is not generally possible to calculate the exact correlation between service and sales there have been many studies that have indicated a positive causality. It can also be argued that superior logistics service (in terms of reliability and responsiveness) can strengthen the likelihood that customers will remain loyal to a supplier. It was suggested that higher levels of customer retention lead to greater sales. Typically this occurs because satisfied customers are more likely to place a greater proportion of their purchases with that supplier.

2. Operating cost reduction

The potential for operating cost reduction through logistics and supply chain management is considerable. Because a large proportion of costs in a typical business are driven by logistics decisions and the quality of supply chain relationships, it is not surprising that in the search for enhanced margins many companies are taking a new look at the way they manage the supply chain. It is not just the transportation, storage, handling and order processing costs within the business that need to be considered. Rather a total pipeline view of costs on a true 'end-to-end' basis should be taken. Often the upstream logistics costs can represent a significant proportion of total supply chain costs embedded in the final product. There is also a growing recognition that time compression in the supply chain not only enhances customer service but can also reduce costs through the reduction of non-value-adding activities.

3. Fixed capital efficiency

Logistics by its very nature tends to be fixed asset 'intensive'. Trucks, distribution centres and automated handling systems involve considerable investment and, consequently, will often depress return on investment. In conventional multi-echelon distribution systems, it is not unusual to find factory warehouses, regional distribution centres and local depots, all of

which represent significant fixed investment. One of the main drivers behind the growth of the third-party logistics service sector has been the desire to reduce fixed asset investment. At the same time the trend to lease rather than buy has accelerated. Decisions to rationalize distribution networks and production facilities are increasingly being driven by the realization that the true cost of financing that capital investment is sometimes greater than the return it generates.

4. Working capital efficiency

Supply chain strategy and logistics management are fundamentally linked to the working capital requirement within the business. Long pipelines by definition generate more inventory; order fill and invoice accuracy directly impact accounts receivable and procurement policies also affect cash flow. Working capital requirements can be dramatically reduced through time compression in the pipeline and subsequently reduced order-to-cash cycle times. Surprisingly few companies know the true length of the pipeline for the products they sell. The 'cash-to-cash' cycle time (i.e. the elapsed time from procurement of materials /components through to sale of the finished product) can be six months or longer in many manufacturing industries. By focusing on eliminating non-value-adding time in the supply chain, dramatic reduction in working capital can be achieved.

5. Tax minimization

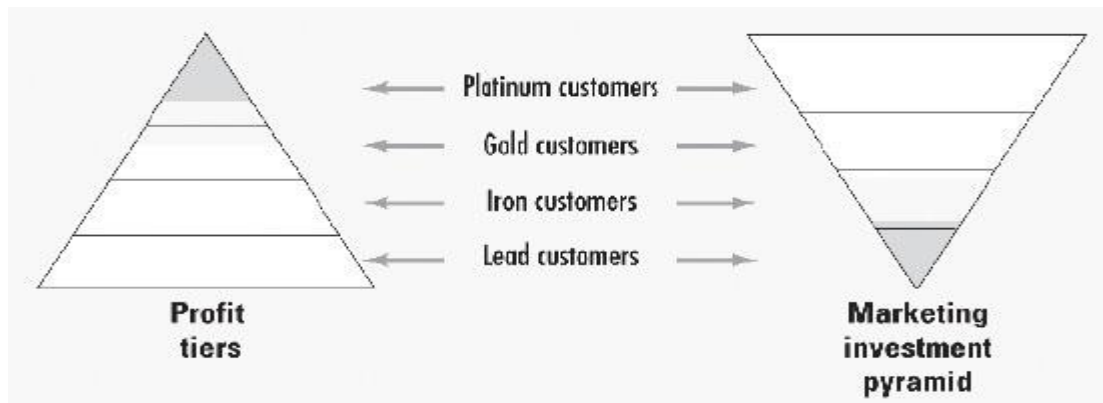
In today's increasingly global economy organizations have choices as to where they can locate their assets and activities. Because tax regimes are different country by country, location decisions can have an important impact on after-tax free cash flow. It is not just corporate taxes on profits that are affected, but also property tax and excise duty on fuel. Customs regulations, tariffs and quotas become further considerations, as do rules and regulation on transfer pricing. For large global companies with production facilities in many different countries and with dispersed distribution centres and multiple markets, supply chain decisions can significantly affect the total tax bill and hence shareholder value.

CUSTOMER PROFITABILITY ANALYSIS (CPA)

Customer Profitability Analysis (CPA) is a management accounting and a credit underwriting method, allowing businesses and lenders to determine the profitability of each customer or segments of customers, by attributing profits and costs to each customer separately.

Customer profitability analysis is best conducted with a technique known as Activity based costing or ABC analysis. Customer profitability analysis helps the company understand the net profit coming from each customer which can be calculated by revenue less costs. These

costs are not only manufacturing and distribution costs but also sales costs, marketing costs, services cost and any other related costs which have to be undertaken to service the customer.



Once the costs are finalized, the customer can be classified into different profit tiers. This principle is best observed in the banking industry with credit card as a product. Customers are basically classified into four types

- Platinum customers – Most profitable
- Gold customers – Profitable
- Iron Customers – Low profit but desirable
- Lead customers – unprofitable and undesirable

Customer Profitability Formula

To calculate CPA, you need the annual profit per customer, and the total duration a customer stays with your business.

- Annual profit = (Total revenue generated by the customer in a year) – (Total expenses incurred to serve the customer in a year)

The total revenue can be generated by the following sources that you need to include:

- Recurring revenue
- Upgrades to the higher plans
- Cross-buying relevant products

And, expenses can be incurred from the following sources which also you need to consider:

- Cost of customer service
- Maintaining a customer success team
- Loyalty perks
- Operational cost

Finally, when you have the annual profit, the customer profitability analysis calculation goes like this:

- $CPA = (\text{Annual profit}) \times (\text{no. of years customer stays with company})$

John Murphy and his colleagues recommend that before getting started the senior management have to realise that they have an issue with customer profitability. Without the right level of sponsorship CPA cannot be done, especially as it crosses departmental boundaries.

The first step of CPA is to create a simple model of revenue by customer on the one hand, and total business unit costs and overheads on the other.

Subtract the direct product and service costs from each customer (costs of good sold/cost of sales) to arrive at a gross margin per customer.

It should be possible to identify other costs specific to the customer such as a particular sales campaign or servicing and retention costs. Orders of magnitude will do rather than getting hung up on 100% accuracy. Be consistent if applying any proxy.

Sort customers by net profit and draw a cumulative profitability curve starting with the most profitable to the least. This is an effective way to visualise the relative profitability of customers and it soon becomes apparent which customers are critical to the business.

Before taking any decision on non-profitable customers, make sure that you have strong retention activities in place to secure your most valuable customers.

Get behind the real reasons why some customers are unprofitable and determine the appropriate strategies and tactics to enhance the profitability of your customer portfolio.

Benefits of Customer Profitability Analysis

Trim out the cost factors

One of the most common exercises to analyze customers is customer segmentation. After segmentation, businesses can segregate the group of customers that are costing more than others. It is still viable to do business with a low-profit generating group. But if group of customers that are costing more than the revenue they are generating, then it is advisable to shut services to them. By letting them go, you are making your customer base more efficient in your growth engine.

Marketing to the right segment

When the customer segmentation according to profit range has been identified, they can be used for further operations. The attributes of the most profit-generating customer group must

be recorded and used for further acquisition. Marketing teams can design their campaigns based on those attributes to attract more such customers. Furthermore, based on their profitability range, marketers can decide what deals and discounts they can offer to the prospects.

Customized retention strategy

After finding the customer group with different profitability, companies can customize their retention strategies for each group. For the customers with the highest profitability, companies can afford to give a service of the highest quality. That means, they can spend more on serving those elite customers.

Enhancing operational efficiency

The lower profit customer group is consuming a lot of resources to deal with the same issue in a product over and over again. Instead of allocating resources to that recurring issue, it might be beneficial for the company to build a feature in the product itself that resolves the issue. This would not only lower the operational cost but would also make your product better for future customers.

Customer profitability analysis can be done in the following way:

Segmenting customers

The base for a profitability analysis is customer segmentation. This will differ across industries and companies. It can be demographic- based on customer age, income, area, etc. It can also be psychographic that is based on customer needs, behaviours, values, interests, and attitude.

Revenue Attribution

Once segmentation is done, you need to calculate revenue for each segment. The annual revenue is a sum of all segments. Adjustments like discounts, fees, service charges must be included and adjusted accordingly.

Cost attribution

Calculate the annual cost per segment. This will be customer costs, service costs, product costs, sales, marketing, and distribution costs. These costs are usually hidden and need to be added to determine the cost attribute.

Analysis – Profit, Less profitable, unprofitable

Profitable customer segmenting also requires analysis of segments. Classifying those segments that have better revenues over costs is necessary. It must include calculating profitability over the lifetime of customers.

Develop strategies to maximise profits based on focus on specific segments

The next step is to create strategies that increase revenues, create long term relationships, and enhance customer retention and loyalty programs. Strategies can include elimination of least profitable aspects, re-engineering customer groups into profitable ones by increasing revenue and decreasing costs.

Review the Impact

Any new strategy or practice needs to be implemented and worked up accordingly. This needs to be reviewed after appropriate periods of time to understand impact on customers.

DIRECT PRODUCT PROFITABILITY

Direct Product Profitability (DPP) is a technique of allocating all of the appropriate costs and allowances to a given product. All distribution costs (storage, transport, etc) are therefore assigned to a specific product rather than taking an average over a whole product range. Thus, in the same way that a budgetary system operates, the actual costs of distributing a product are monitored and compared to a standard cost determined using DPP. In this way, areas of inefficiency throughout the whole logistics operation can be identified. DPP techniques can identify the costs of specific products to individual customers and so provide invaluable information for effective marketing strategies.

DPP Goal

The goal of a Direct Product Profitability (DPP) project is to:

- Improve sales and gross margin by changing: product assortment, article presentation in the store and consumer prices
- Reduce costs by changing: process (logistics, store handling) and product characteristics (package size, item size)

DPP Formula

This metric quantifies the adjusted gross margin, less direct product costs, as

- $\text{Direct product profitability (\%)} = \text{Gross margin (\$)} - \text{Direct product costs (\$)}$

The basic DPP formula is:

- $\text{Sales Price} - \text{Purchase Cost} = \text{Gross Margin}$
- $\text{Warehouse Costs} + \text{Transport Costs} + \text{Store Costs} = \text{Direct Product Costs}$
- $\text{Gross Margin} - \text{Direct Product Cost} = \text{Direct Product Profit}$

The Seven Step DPP process

The DPP model is capable of calculating net profitability of individual items of fast-moving consumer goods. Working with the DPP model is a seven-step process:

- DPP model fine tuning: the classical DPP model is adapted to specific product characteristics of your industry
- Input of process characteristics: process characteristics of the logistics chain are entered as activity drivers in the DPP model (examples: delivery frequency, productivity ratios)
- Input of general ledger resource costs: resource costs of the central depot, transportation and the store (examples: transportation cost per km, costs per working hour)
- Calculation of activity costs: activity costs are calculated in the DPP model
- Input of product characteristics: all characteristics of individual products are entered as cost drivers
- Calculation of direct product costs: activity costs are allocated to products
- Calculation and presentation of direct product profitability ratios

The Benefits of DPP, are summarized as follows:

- Better cost analysis;
- Better pricing decisions;
- Better management of store and warehouse space;
- The rationalisation of product ranges;
- Better merchandising decisions.

COST DRIVERS AND ACTIVITY-BASED COSTING (ABC)

Activity-Based Costing (ABC) is one in which costs are first identified to activities and then to the products. It is a system which focuses on activities performed to produce products. ABC system assumes that activities that are responsible for the incurrence of costs and products create the demand for activities. Costs are charged to the products based on individual product's use of each activity. The advantage of using activity-based costing is that it enables each customer's unique characteristics in terms of ordering behaviour and distribution requirements to be separately accounted for. Once the cost attached to each level of activity is identified (e.g. cost per line item picked, cost per delivery, etc.) then a clearer

picture of the true cost-to-serve will emerge. While ABC is still strictly a cost allocation method it uses a more logical basis for that allocation than traditional methods.

Objectives of Activity Based Costing

1. To bring more accuracy in calculation of cost of products and services as compared with traditional costing system, since all products are not produced equally,
 - As some products are produced in large batches and some in small batches.
 - As manufacturing overhead costs have increased significantly and they no longer correlate with the productive machine hours or direct labour hours.
2. To understand product and customer cost
3. To understand profitability based on the production or performing processes
4. To have a structured analysis in respect of complex processes
5. To provide wealth of information to the management in order to help in decision making
6. To eliminate non-value adding activities due to diversity of products
7. To increase value adding activities since diversity of customer demands are growing rapidly

There are four stages in the implementation of an effective ABC process:

1. Define the customer service segment: identify the different service needs of different customer types. The basic principle is that because not all customers share the same service requirements and characteristics they should be treated differently.
2. Identify the factors that produce variations in the cost of service: This step involves the determination of the service elements that will directly or indirectly impact upon the costs of service, e.g. the product mix, the delivery characteristics such as drop size and frequency or incidence of direct deliveries, merchandising support, special packs and so on.
3. Identify the specific resources used to support customer segments: This is the point at which the principles of activity-based costing and mission costing coincide. The basic tenet of ABC is that the activities that generate cost should be defined and the specific cost drivers involved identified. These may be the number of lines on an order, the people involved, the inventory support or the delivery frequency.
4. Attribute activity costs by customer type or segment: Using the principle of 'avoidability' the incremental costs incurred through the application of a specific resource to meeting service needs are attributed to customers. It must be emphasized that this is not cost

allocation but cost attribution. In other words, it is because customers use resources that the appropriate share of cost is attributed to them.

The Benefits of ABC

Traditional cost accounting can hide or distort information on the costs of individual products and services especially where local cost allocation rules misrepresent actual resource usage. As a result, the move to ABC usually motivated by a desire to understand the "true costs" of individual products and services more accurately. Companies implement activity-based costing to:

- Identify specific products that are unprofitable.
- Improve production process efficiency.
- Price products appropriately, with the help of accurate product cost information.
- Reveal unnecessary costs that become targets for elimination.
- Firms that use ABC consistently to pursue these objectives are practicing **activity-based management ABM**.

Activity Based Costing concepts

1. Cost Objects:

Generally, the products are cost objects, but the customers, services or locations can also be the cost objects.

2. Activities:

These consist of the aggregate of different tasks and are concerned with functions associated with cost objects. There are two types of activities-

(A) support activities,

(B) Production process activities.

Support activities are, for example, schedule production, set up machine, purchase materials, inspect items, customer orders, supplier records etc. Under the production process activity, machine products and assembled products are included within this production process.

3. Cost centres

Cost centres are, sometimes, similar to cost centres used under traditional costing system. In case the purchase department and purchasing activity, both are treated as cost centres, the support activity cost centre also becomes identical to cost centre taken under traditional costing system.

4. Cost Pool:

It is another name given to a cost centre and, therefore, an activity cost centre may also be termed as an activity cost pool.

5. Cost Drivers:

A cost driver, also known as an activity driver, is used to refer to an allocation base. The causes for incurrence of overhead costs are known as cost drivers. A cost driver is a factor the change of which results in a consequential change in the total cost of a related object. If its level changes, it brings a corresponding change in the level of total cost of the related cost object. A cost driver is a factor that creates or drives the cost of the activity. It is the root cause of why a particular cost occurred. Activities consume resources while customers, products, and channels of production consume activities. Understanding this is fundamental to the cost allocation concept using cost drivers.

Following are some of the examples of cost drivers:

- i. Machine setups
- ii. Purchase orders
- iii. Quality inspections
- iv. Production orders (Scheduling)
- v. Engineering change orders
- vi. Shipments
- vii. Material receipts

The activity cost drivers can broadly be classified into following three categories:

A. Transaction drivers: These Include types of transactions which result in overhead costs e.g., purchase orders processed, customer orders processed, inspections performed and the set-ups undertaken, all count the number of times an activity is performed.

B. Duration drivers: Mean the amount of time required to perform an activity. Examples of duration drivers are set-up hours and inspection hours.

C. Intensity drivers: Refer to drivers which directly charge for the resources used each time as activity is performed. Duration drivers establish an average hourly rate of performing an activity while intensity drivers involve direct charging based on the actual activity resources relevant to a product.