Activity Based Management and Just in Time (JIT)

4

This Module Includes

4.1 Activity Based Cost Management - Concept, Purpose, Stages, Benefits, Relevance in Decision-making and its Application in Budgeting, Responsibility Accounting, Traditional Vs. ABC System – Comparative analysis

4.2 JIT – introduction, Benefits, Use of JIT in measuring the Performance

4.3 Throughput Accounting

4.4 Back flush Accounting

4.5 Benchmarking

Activity Based Management and Just in Time (JIT)

SLOB Mapped against the Module

1. **In depth knowledge relating to Activity Based Management, JIT, Throughput Accounting and Backflush Costing.**
2. **Analysis, Evaluation and Presentation of the strategic data for decision making.**

Module Learning Objectives:

After studying this module, the students will be able to –

- In depth knowledge relating to Activity Based Management, JIT, Throughput Accounting and Backflush Costing.
- Analysis, Evaluation and Presentation of the strategic data for decision making.

Activity Based Cost Management

4.1

Concept & Purpose

Technology Trigger Cost Accounting: Activity Based Costing (ABC) system assumes that products consume activities and activities consume costs. It leads to more precise allocation of manufacturing overheads amongst the products. Activity-based costing provides a means to collect indirect costs in multiple categories and then applies the results individually to the products and services.

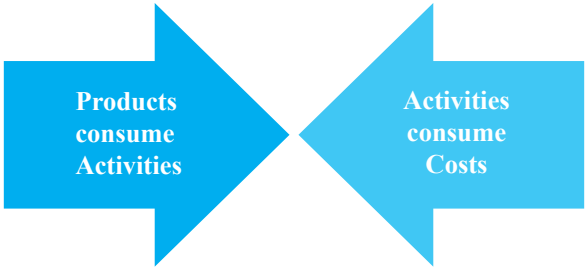

Figure 4.1: Basis of ABC

ABC is a Technology Trigger Cost Accounting that has gained popularity from around the mid nineteen eighties. ABC was aimed to improve the accuracies in the absorption of overheads adapted in traditional costing systems. ABC's ability to overcome the inherent limitations in traditional cost accounting systems enabled changes in strategy processes, operations and in turn improved competitive posture. ABC is being nurtured as an ongoing technology with incessant inputs from continuous research.

Traditional Limitations: The main objective of any costing system is to determine scientifically the cost of a product or service. Costs are of various kinds such as material, labour, utilities, consumables, financial charges, depreciation, and many others. But all of them can be segregated into two distinct categories, viz. direct costs and indirect costs.

Direct costs are the costs which are directly traceable to the products or the services that are being offered. Indirect costs, which are traditionally called 'overheads', are not directly traceable to the products or services. Hence, these overheads are first identified, classified, allocated, and apportioned to convenient service cost centres; reapportioned to production cost centres and finally absorbed by the cost units i.e. products or services.

Direct costs have traditionally been the target of management scrutiny and evaluation. Indirect costs, on the other hand, have not had the level of scrutiny they deserve. The problem with having only one or two categories for pooling indirect costs is that it is very difficult to have the visibility to know what costs are truly necessary and what are not. Also, indirect costs can impact various products or services quite differently.

Charging the direct costs to the products is comparatively simple and can be done with remarkable accuracy.

However, the absorption of indirect costs by the cost units is complex and there does exist a possibility of distortion of costs leading to hidden and unintentional inaccuracies. Distortions in the absorption of overheads may lead to several wrong decisions such as Errors in fixation of selling prices; Wrong decisions concerning product mix; Ignoring customer orientation; Missing of profitable opportunities; etc. Even though the basis of charging the overheads is quite logical, such of these limitations happen to be one of the biggest restraints for the traditional costing systems.

The limitations can be narrated by means of a simple example. Suppose XYZ Limited, a manufacturing company, is producing two products, A and B. The direct material cost for the products is ₹15,00,000 & ₹25,00,000 respectively, totalling to ₹40,00,000. Assuming that the total overheads are ₹20,00,000 and the company adopts direct material cost as the basis for absorption. The rate of absorption works out 50% as shown below:

Direct Material Cost: ₹40,00,000

Overheads: ₹20,00,000

Rate of absorption: (2000000 ÷ 4000000) × 100 = 50%

Absorption by A: 1500000 × 50% = ₹7,50,000

Absorption by B: 2500000 × 50% = ₹12,50,000

Product B is loaded with higher quantum of overheads because of the fact that it consumes more of the direct material. Assuming that in course of time, engineers have been able bring down the direct material costs of product B to ₹22,50,000, without any change in the material costs of product A and as also the total of the overheads; the revised cost computations would read as follows:

Direct Material Cost: ₹37,50,000

Overheads: ₹20,00,000

Rate of absorption: (2000000 ÷ 3750000) 100 = 53.3333%

Absorption by A: 1500000 × 53.3333% = ₹8,00,000

Absorption by B: 2250000 × 53.3333% = ₹12,00,000

Even though, there is no change as regards product A, the absorption of overheads by it has gone up by ₹50,000 from ₹7,50,000 to ₹8,00,000 which is an evident distortion. This misrepresentation in costs may propel wrong decisions in several areas like make or buy, pricing, acceptance of export offer etc. As a consequence, ABC was evolved to weed out such of these avoidable inaccuracies.

Introduction to ABC: At the initial phase, Activity Based Costing has been introduced with a view to overcome the limitations of traditional costing systems. CIMA defines Activity Based Costing as, 'cost attribution to cost units on the basis of benefit received from indirect activities e.g., ordering, setting up, and assuring quality.' One more definition of Activity Based Costing is, 'the collection of financial and operational performance information tracing the significant activities of the firm to product costs.'

By using multiple overhead pools and cost drivers, activity-based costing can provide more accurate cost figures for costing and pricing the products and services. Activity may be considered as the cost pool of convenience; and cost driver is the factor that impacts the cost of activity.

The focus of ABC is on accurate information about the true cost of products, services, processes, activities, distribution channels, customer segments, contracts, and projects. ABC can help managers make better decisions about what they offer. This process also encourages continual operating improvements. Once business process costs are known with reasonable accuracy, activity-based budgeting can set realistic goals for improving the processes and for identifying those processes that are no longer needed or are unprofitable.

Important Terms in Activity Based Costing: The operation of the ABC system involves the use of the following terms:

Activity: An activity means an aggregate of closely related tasks having some specific functions which are used for completion of a goal or objective. For example; customer order processing is an activity. It includes receiving an order from customer, interacting with production department regarding capacity to produce and giving commitment to the customer regarding delivery time. Other activities may be assembling, packaging, advertising etc.

Resource: Resources are elements that are used for performing the activities or factors helping in the activities. For example; order receiver, telephone, computers etc., are resources in customer order processing activity. It may include material, labour, equipment, office supplies, etc.

Cost: Cost is the amount paid for the resources consumed by the activity. For example; salaries, printing stationary, telephone bill, etc. are cost of customer order processing activity. It is also known as activity cost pool.

Cost Object: Cost Object refers to an item for which cost measurement is required. e.g., a product, a service, or a customer.

Cost Pool: A Cost pool is a term used to indicate grouping of costs incurred on a particular activity which drives them.

Cost Driver: Any element that would cause a change in the cost of an activity is cost driver. Cost drivers are the basis of charging cost of an activity to a cost object. Cost drivers are used to trace the costs to a product or service by using a measure of the resources consumed by each activity. For example, frequency of orders, number of orders, etc. may be the cost drivers of customer order processing activity. A Cost Driver may be a Resource Cost Driver or an Activity Cost Driver. A resource cost driver is a measure of the quantity of resources consumed by an activity. An activity cost driver is a measure of the frequency and intensity of the demand placed on activities by cost objects.

Examples of activities, resources, cost pools and cost drivers are tabulated below:

Activities	Resources	Cost pools	Cost driver
Consulting	Consultant, Computer	Employee cost, Maintenance cost	Level of consultant, Time spent
Laser Printing	Printing Staff, Printer	Colour cost, Maintenance cost, Printing stationary	No. of pages printed, Font
Accounting & Administration	Administration Staff	Salaries	No. of times account is produced
Customer Service	Telephone, Staff	Telephone bill, Salaries	Frequency of orders, No. of orders, Time spent in servicing, No. of service calls
Research & Development	Staff, Equipment, Material	Salaries, Maintenance cost, Material cost	No. of research projects, Time spent on a project, Technical complexities of project

The cost drivers for some of the other functional avenues such as production, marketing and customer service may be stated as:

Production: Number of units, Number of set-ups

Marketing: Number of sales personnel, Number of sales orders

Customer Service: Number of service calls, Number of products serviced, Hours spent on servicing products.

Taking forward the example of XYZ Limited, cited in the earlier paragraphs, after adopting ABC the company has identified the activities and cost drivers, as furnished in table 1, in relation to product A and product B.

Table 1

Sl	Activity	Cost Driver	Units of Consumption		
			Product A	Product B	Total
1	Mould Cleaning	Direct Tracing			
2	Material Inspection	Number of Receipts	400	600	1000
3	Machine Set up	Number of Set ups	3500	6500	10000
4	Machine Maintenance	Machine Hours	15000	35000	50000
5	Quality Control	Inspections	5000	10000	15000
6	Packing	Orders	375	625	1000

In order to facilitate the distribution of the overheads of ₹20,00,000, the cost driver rates of absorption are computed as detailed in table 2; and the apportionment of overheads to product A and product B is computed in table 3.

Table 2

Sl	Activity	Rupees	Cost Driver	Units	Cost Driver Rate
1	Mould Cleaning	2,50,000	Direct Tracing		
2	Material Inspection	2,00,000	Number of Receipts	1000	200
3	Machine Set up	4,50,000	Number of Set ups	10000	45
4	Machine Maintenance	6,25,000	Machine Hours	50000	12.50
5	Quality Control	3,00,000	Inspections	15000	20
6	Packing	1,75,000	Orders	1000	175
7	Total	20,00,000			

Note: Cost Driver Rate = (Cost of Activity ÷Units of Cost Driver)

Table 3

Activity	Product A		Product B		Total
	Workings	(₹)	Workings	(₹)	(₹)
Mould Cleaning	Direct Tracing	1,00,000	Direct Tracing	1,50,000	2,50,000
Material Inspn.	400 @ ₹200	80,000	600 @ ₹200	1,20,000	2,00,000

Activity	Product A		Product B		Total
	Workings	(₹)	Workings	(₹)	(₹)
Machine Set up	3500 @ ₹45	1,57,500	6500 @ ₹45	2,92,500	4,50,000
Machine Mtce.	15000 @ ₹12.5	1,87,500	35000 @ ₹12.5	4,37,500	6,25,000
Quality Control	5000 @ ₹20	1,00,000	10000 @ ₹20	2,00,000	3,00,000
Packing	375 @ ₹175	65,625	625 @ ₹175	1,09,375	1,75,000
Total		**6,90,625**		**13,09,375**	**20,00,000**

The results of adoption of ABC are obvious from table 3. It has enabled XYZ Limited to refine the distribution of costs between product A and product B, and thereby better the accuracy. In fact, the company has been able to trace the mould cleaning costs to the extent of ₹2,50,000 as direct costs (i.e., ₹1,00,000 to product A and ₹1,50,000 to product B). An activity-based costing system, thus, first traces costs to activities and then to products and other cost objects.

The absorption rates are dependent on the cost drivers which bear a direct influence on the activities whereby overhead rates would change only if there is a change in the relevant cost driver. Till such time there is a change any of the activities or cost drivers; product A would continue to bear a overhead distribution of ₹5,90,625 (i.e, 6,90,625 reduced by direct costs of 1,00,000 relating to mould cleaning); and product B would be loaded with ₹11,59,375 (i.e,1309375 reduced by direct costs of 1,50,000 relating to mould cleaning).

Technological advancements in Information Technology facilitated convenient application of the ABC in a cost-effective manner. New methods are evolved that reduced the cost of implementation and operation of ABC systems. Enterprise Resource Planning (ERP) systems and Business Intelligence (BI) tools made it easier to build and modify advanced ABC models and report the information to management. Enhanced functionality and reduced cost opened up entirely new applications for ABC.

ABC has emerged as an integral component of a new generation of business performance management solutions. These new solutions include profitability management, performance measurement, financial management, sustainability and human capital management. Today, ABC is considered as the foundation of performance management.

CIMA, London, goes on to assert that ABC is not a method of costing, but a technique for managing the organisation better. It is a one-off exercise which measures the cost and performance of activities, resources, and the objects which consume the resources in order to generate more accurate and meaningful information for decision-making.

Stages

There are eight vital stages (steps) to the implementation of ABC.

1. **Identification of Cost Objects:** The process to ABC starts with the identification of the cost objects. The cost objects of any organisation are the products or services.
2. **Identification of Activities:** Identification of the activities is the next step. Identification of the main activities can be done by carrying out an in-depth analysis of the operating processes of each responsibility segment. Usually, the number of activities in ABC will be much more as compared to traditional overhead system. The exact number will depend on how the management subdivides the organisations activities.
3. **Tracing the Direct Costs:** The third step relates to identification of Direct Costs. The direct costs of products or objects may comprise direct material cost, direct labour cost and direct expenses. Classification of as many of the total costs as direct costs as is economically feasible should be made. Classification as direct costs reduces the amount of costs to be classified as indirects.

4. **Relating the Indirect Costs to the Activities:** The fourth step is relating the indirect costs to activities. Here, various items of indirect costs are related to activities, viz. both support and primary, which caused them. As a result of relating the items of indirect costs to various activities, cost pools or cost buckets are created.
5. **Distribution of Support Activities:** Then comes the distribution of support activities. The spreading of support activities (i.e., activities which support or assist manufacturing) across the primary activities (correlated to the number of units produced) is done on some suitable base which reflects the use of support activity. The base is the cost driver and is a measure of the support activities that are used.
6. **Determining the Activity Cost Drivers:** The determination of the activity cost drivers is done in order to relate the overheads collected in cost pools to the cost objects of products. It is done on the basis of the factor that drives the consumption of the activities.
7. **Calculating the Activity Cost Driver Rates:** The activity cost driver rates for each activity are calculated in the way in which overhead absorption rates would be calculated under the traditional system. It can be formulated as: Activity Cost Driver Rate = (Total Cost of Activity ÷ Activity Driver). These activity cost driver rates are to be used for ascertaining the amount of overhead chargeable to various cost objects or products.
8. **Computing the Total Cost:** The last step is computing the total cost. The total costs of the products shall be computed by adding all direct and indirect costs assigned to them. The amount of overhead chargeable to a product or cost object shall be calculated by multiplying the respective activity cost driver rate by the quantum of the activity that the product or other cost object consumes.

Figure 4.2: Stages of ABC Implementation

The introduction of ABC system in an organisation can be either supplementary to the traditional cost accounting system as an offline system or it can be fully integrated with the decision support systems such as ERP. Management practices and methods have changed a lot over the last decades and will continue to change. Organisations are moving from managing vertically to managing horizontally. It is a move from a function orientation to a process orientation. Total quality management (TQM), just-in-time (JIT), benchmarking and business process reengineering (BPR) are all examples of horizontal management improvement initiatives. These initiatives are designed to improve an organisation's work processes and activities to effectively and efficiently meet or exceed changing customer requirements. ABC continues to maintain the momentum of change.

Benefits

The benefits and advantages attributable to ABC are manifold. The following list reflects the results of several surveys of practice in the United States, the United Kingdom, and Canada to determine why companies choose ABC.

- **Cost Reduction:** ABC measures how much costly are the activities and then takes steps to reduce their costs by changing the productions process or outsourcing those activities.
- **Product Pricing:** ABC implementers generally believe that ABC provides more accurate cost information

than conventional costing does. Management can use this information to negotiate price increases with customers or to drop unprofitable products.

- **Budgeting:** Management can use more accurate cost information to improve budgets and measures of department and division performance.

A research work on "Activity-Based Cost Management Practices in India: An Empirical Study" by Dr Manoj Anand, Dr B S Sahay, and Subhashish Saha revealed that the firms who have adopted ABC were significantly more successful in capturing accurate cost information for value chain analysis and supply chain analysis vis-à-vis the firms who had not adopted ABC. The need for customer profitability analysis and budgeting led the corporate India to extend their ABC-systems from basic level to advanced level, extending it to facility level and customer level activities.

Product, customer, and business-unit profitability are the objectives of the activity-based cost systems. The top management support, Activity Based Cost Management (ABCM) linked performance valuation and compensation plans, number of applications of ABCM in the organisation and time-in-use of application have been found to be ABCM success determinants by Foster and Swanson (1997).

The firms using activity-based costing systems are found to be more successful in capturing:

1. Accurate cost and profit information for:
   a. product pricing;
   b. customer profitability;
   c. inventory valuation;
   d. value chain analysis;
   e. supply chain analysis; and
   f. outsourcing decisions
2. Accurate profit analysis by product, process, department, and customer
3. Better insight for benchmarking and budgeting
4. Better insight about manufacturing performance
5. Linking up cause and effect relationship

Application of activity-based costing has resulted in changes in various management decision areas; prominent among them being focus on profitable customers, pricing strategies, and sourcing decisions.

Application of ABCM has impact not only on the decisions within the firm but also on the decisions beyond the boundaries of the firm. The decision areas beyond the boundaries of the firm include focus on the profitable customers, sourcing decisions, elimination of redundant activities, distribution channel, and strategic focus. The product mix, process simplification, and product pricing are included in decisions within the boundaries of firm.

Actual costs could consist of intrinsic costs and legacy costs. Intrinsic costs refer to the normal costs at normal capacity. Legacy costs refer to tangible and intangible costs attributable to the policies and procedures being inherited by the enterprise. The legacy costs do not add any value to the deliverables. Most of the avoidable costs could fall under this category. Implementation of ABC is reported to have enabled pruning down the legacy costs inherited by the U.S. shipyards from decades of building ships for the U.S. government.

The benefits drawn from ABC may be summed up as follows:

i. It provides more accurate product costing information by reducing arbitrary cost allocations.
ii. It improves the quality of information available for decision making by answering the questions such as what activities and events are driving cost and where should the efforts be made to control cost?

iii. It is the easiest way to allocate overheads to the product.

iv. It helps to identify the activities that can be eliminated.

v. It links up the cause-and-effect relationship.

vi. It helps to identify the 'value-added activities' (that increase the customer's satisfaction) and 'non-value-added activities' (that creates problems to customer's satisfaction)

vii. ABC translates costs in to a language that people can understand and that can be linked up to business activities.

Activity-based costing has equal opportunities in both the manufacturing as well as service sectors and the motivations are uniform over the stages of adoption. However, the major difficulties faced by the ABCM-user firms while designing activity-based cost systems are the challenges in developing activity dictionary & cost drivers and lack of review of ABCM implementation initiative.

Relevance in Decision-Making and Application in Budgeting

Convenient Enabler: ABC is a convenient means of Cost Management. ABC enables to Unbundle the Costs & Break them to pieces for better and easier controls. The key to using activity-based costing, as a philosophy outside of operational realms, is by means of focusing on the relevant steps in business process that add better value as compared to their cost.

Assuming that a purchasing department has a set of steps: receiving the purchase requisition, obtaining approval, making the purchase order and ordering the material in question, sending payment, receiving the object and recording the receipt. Activity-based costing philosophy would create a cost for each step, based on the salaries of employees involved and the time each step takes to be completed, and then would look at the costs of each step to determine where value is being wasted. For example, while approval of a purchase requisition may only take each manager a few seconds, if the entire approval process takes two weeks, that's a significant amount of cost to the company in time wasted waiting for the order to be made. Or, as an alternate example, if the receiving process has to be done manually while everything else is automated, it might make sense for the company to look into the cost of automating that step as well, if ABC calculations show it as a significant expense.

Overall, activity-based costing allows a company to better break down the elements of their business process that actually add cost, be it operational costs like machinery and manufacturing, or more administrative costs like interpersonal processes or company policies. The success of the process, however, depends on how the company evaluates and uses the data that comes out of this type of accounting calculation.

Activity Based Management: Activity Based Management is a tool of management that involves analysing and costing activities with the goal of improving efficiency and effectiveness. Activity Based Management is a set of actions that management can take, based on information from an Activity Based Costing system, to improve profitability. Towards a continuous improvement, Activity Based Management keeps on attempting Cost Driver Analysis, Activity Analysis, and Performance Analysis, on a continuous basis.

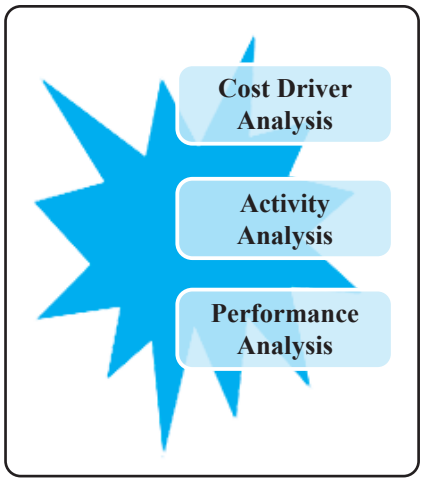

Figure 4.3: Various Analysis under Activity Based Management

Cost Driver Analysis: The factors that cause activities to be performed need to be identified in order to manage activity costs. Cost driver analysis identifies these casual factors. For example, in a stores department, it may be observed that slow moving and obsolete stock is not disposed off in

time, the reason being the staff in the stores are not trained properly in this area. Managers have to address this cost driver to correct the root cause of this problem and take proper action.

Activity Analysis: Activity Analysis identifies value added and non-value-added activities and efforts are made to eliminate the non-value adding activities.

Performance Analysis: Performance analysis involves the identification of appropriate measures to report the performance of activity centers or other organisational units consistent with each unit's goals and objectives. Performance Analysis aims to identify the best ways to measure the performance of factors that are important to organisations in order to stimulate continuous improvement.

Managers and employee teams are seeking more transparency and visibility of their costs. Just reliably knowing ABCM's per-each-unit costs of their outputs of work is useful for benchmarking to search for best practices or monitor trends to measure performance improvement. ABCM removes the illusion that support overhead (i.e., indirect) expenses are necessary and, therefore, appear to be free—they are not free.

The costs of an output, product, or service (i.e., a final cost object) can be reduced by:

- Reducing the quantity, frequency, and/or intensity of the activity driver (e.g., fewer inspections reduce the 'Inspection Cost / Inspect product' activity cost);
- Lowering the activity driver cost rate by productivity improvements (e.g., shorten the time for each 'Inspection Time/inspect product' event); and
- Understanding the sources and causes of waste leading to nonvalue-adding activities to reduce or eliminate them (e.g., solve the problem that requires an inspection in the first place).

These three are examples of how ABCM data leads to cost management for productivity improvement. The idea is to do more with less (or at least with the same). That is, produce more outputs with the same amount of resources or the same amount of outputs with fewer resources. Note how these actions support the continuous improvement principles of the Six Sigma quality and lean management initiatives that are embraced by the operations and quality communities.

Activity Based Budgeting (ABB): A budget is defined as a statement expressed in quantitative and monetary terms prepared prior to a defined period of time for the policy to be pursued during that period for the purpose of achieving a given objective. In other words, a budget is always prepared ahead of time; it is expressed either in quantitative terms or monetary terms or both; it reflects the objective to be achieved during that period and hence the policy to be followed during that period is put in the budget.

Budget helps in planning for the future. It also helps in controlling as there is a continuous comparison of actual with budget. Any deviation between the two is identified for taking suitable action. In simple terms, budget is a plan of action expressed in terms of money.

The traditional budgeting is based on traditional cost accounting whereas the activity-based budgeting is based on activity-based costing. Activity-based budgeting is a budgeting method where activities are thoroughly analysed to predict costs. ABB does not take historical costs into account when creating a budget. Every cost incurred by a business will be looked at closely to determine if efficiencies can be created and costs reduced. It can be in the form of a reduction in activity levels or complete removal of unnecessary activities. Ultimately, ABB aims to analyse business cost drivers and enable the business to become more profitable.

The following are the features of Activity Based Budgeting.

1. It uses the activity analysis to relate costs to activities.
2. It identifies cost improvement opportunities.
3. There is a clear link between strategic objectives, planning and the tactical planning of the ABC process.

There are three main steps in ABB viz. identifying cost drivers, projecting total units, and estimating the cost per unit.

Identifying the cost drivers of various activities: For example, the cost drivers for a manufacturing facility can be the total labour hours and wages paid to employees.

Projecting the number of units required within each cost driver: For example, the manufacturing facility may always need three people on the production line, translating to 240 labour hours per week.

Estimating the cost per unit of activity relating to that cost driver: For example, wages for warehouse labour can be ₹150 per hour.

Activity Based Budgeting provides a strong link between the objectives of organisation and objectives of a particular activity. In other words, it involves identification of activities and dividing them into value adding and non-value adding activities. The non-value adding activities are eliminated in due course of time.

Responsibility Accounting

Responsibility accounting involves separate reporting of revenues and expenses for each responsibility center in a business. Doing so improves the management of operations. For example, the cost of rent can be assigned to the person who negotiates and signs the lease, while the cost of an employee's salary is the responsibility of that person's direct manager. This concept also applies to the cost of products, for each component part has a standard cost (as listed in the item master and bill of materials), which is the responsibility of the purchasing manager to obtain at the correct price. Similarly, scrap costs incurred at a machine are the responsibility of the shift manager.

Taking it forward, an activity-based responsibility accounting system assigns responsibility to processes and uses both financial and non-financial measures of performance. It is the responsibility accounting system developed for those firms operating in continuous improvement environments. Traditional responsibility accounting uses budgets and variances to hold individuals responsible for those costs that they have the authority to incur causing them to manage cost rather than the activities that cause the cost. Activity-based accounting redefines accountability from costs to team-based activities.

The activity-based approach recognizes the need to manage interdependence. Explicit recognition of interdependence shifts management's focus from individual performance to the performance of the organisation as a holistic system, from cost control to analysing the activities that cause the costs, and from meeting engineered standards to continuous improvement in the trended performance of the process in both operational and financial terms. An Activity-based responsibility accounting system provides a database that identifies interrelated activities and the resources required. This results in a matrix form of accounting that replaces the rigid structure of the general ledger and supports decisions related to performance evaluation, product costing, and strategic planning.

The responsibility accounting model is defined by four essential elements:

i. Assigning responsibility

ii. Establishing performance measures or benchmarks

iii. Evaluating performance

iv. Assigning rewards

Activity-based responsibility accounting avoids the after-the-fact rationalizations, finger pointing, gamesmanship, defensive actions, and myopic behaviour produced by traditional responsibility accounting. Using the new forms of activity accounting and control offered by ABC, managers can learn about the interrelationships and interdependences between activities, and change management's role in the organisation. Activity-based responsibility accounting is one of the need-based sunrise avenues for every cost manager

Traditional vs. ABC System – Comparative Analysis

Activity-Based Costing (ABC) is a system that focuses on activities as the fundamental cost objects and uses the cost of these activities for computing the costs of products. There are several reasons why managers are preferring ABC to traditional system.

I. In the traditional system cost analysis is done on the basis product. In ABC managers focus attention on activities rather than products because activities in various departments may be combined and costs of similar activities ascertained, e.g., quality control, handling of materials, repairs to machines etc. If detailed costs are kept by activities, the total company costs for each activity can be obtained, analysed, planned and controlled.

II. Managers manage activities and not products. Changes in activities lead to changes in costs. Therefore, if the activities are managed well, costs will fall and resulting products will be more competitive.

III. Allocating overhead cost to production based on a single cost driver (allocation base, such as unit basis, percentage of material, percentage of prime cost, labour hour rate, machine hour rate etc.) can result in an unrealistic product cost because the traditional system fails to capture cause-and-effect relationships. To manage activities better and to make wiser economic decisions, managers need to identify the relationships of causes (activities) and effects (costs) in a more detailed and accurate manner.

IV. ABC highlights problem areas that deserve management's attention and more detailed analysis. Many actions are possible, on pricing, on process technology, on product design, on operational movements and on product mix.

Traditional costing can lead to under-costing or over-costing of products or services. Over or under costing of products distorts cost information. A poor quality of cost information causes management to make poor decisions for pricing, product emphasis, make or buy etc. ABC differs from the traditional system only in respect of allocations of overheads or indirect costs. Direct costs are identified with, or assigned to, the cost object, in the same manner as is done in case of traditional costing system. Overhead costs are linked to the cost objects based on activities.

Assimilation

Activity based costing has revolutionized product costing, planning, and forecasting in the last decade. It is based on a philosophy of estimation that: "it is better to be approximately right, than precisely wrong." In summary, activity-based costing is a management decision-making tool. It provides financial support data structured in a fashion fundamentally different from accounting data provided in the general ledger. By associating cost to the activity, a clear relationship can be established between sources of activity demand and the related costs. This association can benefit the distributor in determining where costs are being incurred, what is initiating the costs and where to apply efforts to curb inflationary costs. This can be of particular value in tracking new products or customers.

Caselet 1: How Xu Ji achieved standardisation in working practices and processes (CIMA case study, 2011)

The Chinese electricity company Xu Ji used ABC to capture direct costs and variable overheads, which were lacking in the state-owned enterprise's (SOE) traditional costing systems. The ABC experience has successfully induced standardisation in their working practices and processes. Standardisation was not a common notion in Chinese culture or in place in many Chinese companies. ABC also acts as a catalyst to Xu Ji's IT developments – first accounting and office computerisation, then ERP implementation.

Prior to the ABC introduction in 2001, Xu Ji operated a traditional Chinese state-enterprise accounting system. A large amount of manual bookkeeping work was involved. Accounting was driven predominantly by external

financial reporting purposes, and inaccuracy of product costs became inevitable. At this time, Xu Ji underwent a series of flotations following China's introduction of free market competition.

The inaccuracy of the traditional costing information seriously impeded Xu Ji's ability to compete on pricing. The two main tasks for the ABC system were to: trace direct labour costs directly to product and client contracts; and allocate manufacturing overheads on the basis of up-to-date direct labour hours to contracts.

The learning was that the common 'top-down' management style and organisational culture among SOEs worked well when instigating innovative ideas and inducing corporate-wide learning. Top management's commitment to trying out new management ideas and investing in new technology has been the unique feature.

Caselet 2: ABC in Automobile Industry:

Many automotive companies use activity-based costing to determine their costs and pricing. For example, Ford decided the company needed this sort of determined, specific look into individual cost steps to see which steps could be eliminated or improved. Chrysler has seen hundreds of millions of dollars saved using activity-based costing to identify and eliminate useless, inefficient or redundant steps in its production, which has also significantly streamlined product development. Since car and truck manufacturing is an established industry, where the manufacturing process has many steps that combine to make the final product, activity-based costing is the ideal analysis.

Caselet 3: Activity-Based Costing of Coca-Cola

Coca-Cola is another company that uses activity-based costing to determine its price points. Coca-Cola offers a large portfolio of products and carries a huge amount of inventory, which can be a significant portion of production cost that is often overlooked. Coca-Cola has used activity-based costing to evaluate the differences between its bigger, world-wide products and its specialty, regionalized products that it may not offer on the global market. This understanding of how production costs are different between established, familiar types and specialized types has enabled them to set price points in each market that ensure them significant profit.

Illustration 1

A company manufactures 500 units of product AX. The following details are available:

Material cost to manufacture: ₹ 1,50,000

Labour cost: ₹2,65,000

Material Reordering Cost: ₹ 4,500

Material Handling Cost: ₹2,500

Material orders: 35

Material movements: 20

What is the Total Material cost under Activity based costing?

Solution:

Total Material Cost under Activity Based Costing

Serial	Particulars	(₹)
1	Material cost to manufacture	1, 50,000
2	Material Reordering Cost	4,500

Serial	Particulars	(₹)
3	Material Handling Cost	2,500
4	Total Material Cost-	1, 57,000

Explanatory Comment: Material Reordering Cost and Material Handling Cost are directly traced to the Total Material Cost under the system of ABC.

Illustration 2

Production overheads of XYZ Manufacturers Pvt. Ltd. for 500 units of product X are

Machine oriented activity cost: ₹1,35,400

Material ordering overheads: ₹69,570

Machine hours are 1.50 hrs per unit and No. of material orders are 6 per unit.

Raw material cost ₹300 per unit and labour cost ₹150 per unit. What is the Total cost of X per Unit?

Solution:

(i) Machine Oriented Cost per Unit

Machine oriented activity cost for 500 units = ₹ 1,35,400

Machine hours for 500 units = 1.5 × 500 = 750

Machine Oriented Cost per hour = (135400 ÷ 750) = ₹180.53

Machine Oriented Cost per Unit = (180.53 × 1.5) = ₹ 270.80

(ii) Material Ordering Cost per Unit

Material Ordering Cost = ₹ 69,570

Material Orders per unit = 6

Material Orders for 500 units = 6 × 500 = 3000

Material Ordering Cost per Order = (69570 ÷ 3000) = ₹23.19

Material Ordering Cost per Unit = (23.19 × 6) = ₹ 139.14

(iii) Total Cost of X per Unit

Serial	Particulars	(₹)
1	Raw Material cost	300.00
2	Labour cost	150.00
3	Machine Oriented Cost	270.80
4	Material Ordering Cost	139.14
5	**Total Cost**	**859.94**

Explanatory Comment: Costs of activities, viz. Material Orientation and Material Ordering have been computed per unit of Cost Driver.

Illustration 3

A company produces four products, viz. P, Q, R and S. The data relating to production activity are as under

Product	Quantity of production	Material cost/ ₹. per unit	Direct labour hours/unit	Machine hours/ unit	Direct Labour cost/₹ per unit
P	4,500	12	2	1.50	8
Q	13,640	15	2	0.75	9
R	2,340	25	5	2.50	27
S	18,350	21	4	4.00	25

Production overheads are as under: ₹

(i)	Overheads applicable to machine-oriented activity:	1,65,900
(ii)	Overheads relating to ordering materials	8,760
(iii)	Set up costs	21,400
(iv)	Administration overheads for spare parts	44,690
(v)	Material handling costs	25,545

The following further information have been compiled:

Product	No. of set up	No. of materials orders	No. of times materials handled	No. of spare parts
P	3	3	6	6
Q	18	12	30	15
R	5	3	9	3
S	24	12	36	12
Total	**50**	**30**	**81**	**36**

Required:

(i) Select a suitable cost driver for each item of overhead expense and calculate the cost per unit of cost driver.

(ii) Using the concept of activity-based costing, compute the factory cost per unit of each product.

Solution:

(i) Computation of Cost Driver Rates

(a) Overheads relating to Machinery oriented activity

Cost Driver: Machine Hour Rate

Machine Oriented Overheads = ₹ 1,65,900

Total Machine hours = {(4500 × 1.5) + (13640 × 0.75) + (2340 × 2.5) + (18350 × 4)}

= 6750 + 10230 + 5850 + 73400 = 96230

Cost Driver Rate = (1,65,900 ÷ 96,230) = ₹ 1.724 per hour

(b) Overheads relating to ordering materials

Material Ordering Overheads = ₹8,760

Cost driver: No. of Material orders

Cost Driver Rate = (8760÷30) = ₹292 per order

(c) Set up costs

Set Up Overheads = ₹21,400

Cost driver: No. of set ups

Cost Driver Rate = (21,400÷50) = ₹428 per set up

(d) Administrative Overheads for spare parts

Administrative Overheads = 44,690

Cost driver: No. of spare parts

Cost Driver Rate = (44690÷36) = ₹1241.39 per spare part

(e) Material Handling costs

Material Handling Overheads = 25,545

Cost driver: No. of times materials are handled

Cost Driver Rate = (25545÷81) = ₹ 315.37 per material handling

(ii) Computation of factory cost for each product

(a) Apportionment of Overheads on the basis of Cost Driver Rate

Sl.	Activity	P	Q	R	S
	Number of Units of Production	4,500	13,640	2,340	18,350
1.	Machinery oriented activity				
	Number of Machine Hours	6750	10230	5850	73400
	Total Cost @ ₹1.724 per hour	11,637	17,637	10,085	1,26,542
	Cost per Unit (₹)	2.586	1.293	4.31	6.896
2.	Material Ordering				
	Number of Material Orders	3	12	3	12
	Total Cost @ ₹292 per order	876	3,504	876	3,504
	Cost per Unit (₹)	0.195	0.257	0.374	0.191
3.	Set Up Cost				
	Number of Set Ups	3	18	5	24
	Total Cost @ ₹428 per set up	1,284	7,704	2,140	10,272
	Cost per Unit (₹)	0.285	0.565	0.915	0.56
4.	Admn. Costs for Spare Parts				
	No. of spare parts	6	15	3	12
	Total Cost @ ₹1241.39 per spare part	7,449	18,621	3,724	14,897
	Cost per Unit (₹)	1.655	1.365	1.591	0.812

Sl.	Activity	P	Q	R	S
5.	Material Handling Costs				
	No. of times materials are handled	6	30	9	36
	Total Cost @ ₹315.37 per handling	1,892	9,461	2,838	11,353
	Cost per Unit (₹)	0.42	0.694	1.213	0.619
6.	Total Overheads	23,138	56,927	19,663	1,66,568
7.	Overhead Cost per Unit (₹)	5.142	4.174	8.403	9.077

(b) Cost per Unit (₹)

Particulars	P		Q		R		S	
Materials		12.00		15.00		25.00		21.00
Labour		8.00		9.00		27.00		25.00
Overheads								
Machine oriented activity	2.586		1.293		4.310		6.896	
Ordering of Materials	0.195		0.257		0.374		0.191	
Set up costs	0.285		0.565		0.915		0.560	
Administrative Spare Parts	1.655		1.365		1.591		0.812	
Material handling	0.420	5.14	0.694	4.17	1.213	8.40	0.619	9.08
Factory Cost (₹)		**25.14**		**28.17**		**60.40**		**55.08**

Illustration 4

The budgeted overheads and cost driver volumes of XYZ are as follows.

Cost Pool	Budgeted Overheads (₹)	Cost Driver	Budgeted Volume
Material procurement	5,80,000	No. of orders	1,100
Material handling	2,50,000	No. of movements	680
Set-up	4,15,000	No. of set ups	520
Maintenance	9,70,000	Maintenance hours	8,400
Quality control	1,76,000	No. of inspections	900
Machinery	7,20,000	No. of machine hours	24,000

The company has produced a batch of 2,600 components of AX-15; its material cost was ₹1,30,000 and labour cost ₹2,45,000. The usage activities of the said batch are as follows:

Material orders – 26, maintenance hours – 690, material movements – 18, inspections – 28, set ups – 25, machine hours – 1,800

Calculate – cost driver rates that are used for tracing appropriate amount of overheads to the said batch and ascertain the cost of batch of components using Activity Based Costing.

Solution:

Step1: Computation of Cost Driver Rates

Cost Pool	Budgeted (₹)	Cost Driver	Budgeted Volume	Workings	Cost Driver Rate
Material procurement	5,80,000	No. of orders	1,100	580000 ÷ 1100	527.27
Material handling	2,50,000	No. of movements	680	250000 ÷ 680	367.65
Set-up	4,15,000	No. of set ups	520	415000 ÷ 520	798.07
Maintenance	9,70,000	Maintenance hours	8,400	970000 ÷ 8400	115.48
Quality control	1,76,000	No. of inspection	900	176000 ÷ 900	195.56
Machinery	7,20,000	No. of machine hours	24,000	720000 ÷ 24000	30.00

Step 2: Apportionment of overheads to AX-15

Cost Pool	Cost Driver	Usage Volume	Cost Driver Rate	Workings	Overheads (₹)
Material procurement	No. of orders	26	527.27	26 × 527.27	13,709
Material handling	No. of movements	18	367.65	18 × 367.65	6,618
Set-up	No. of set ups	25	798.07	25 × 798.07	19,952
Maintenance	Maintenance hours	690	115.48	690 × 115.48	79,681
Quality control	No. of inspections	28	195.56	28 × 195.56	5,476
Machinery	No. of machine hours	1800	30.00	1800 × 30	54,000
Total					1,79,436

Step 3: Computation of Batch Cost of 2600 units of AX-15

Sl	Element	(₹)	(₹)
1	Material cost		1,30,000
2	Labour Cost		2,45,000
3	Prime Cost (1 + 2)		3,75,000

Sl	Element	(₹)	(₹)
4	Overheads		
	a. Material orders	13,709	
	b. Material handling	6,618	
	c. Set-up	19,952	
	d. Maintenance	79,681	
	e. Quality Control	5,476	
	f. Machinery	54,000	
	g. Sub Total		1,79,436
5	**Total Cost (3 + 4)**		**5,54,436**

Illustration 5

AML Ltd is engaged in the production of three types of ice-cream products viz. Coco, Strawberry & Vanilla. The Company presently sells 50,000 units of Coco @ ₹25 per unit, Strawberry 20,000 units @ ₹20 per unit and Vanilla 60,000 units @ ₹15 per unit. The demand is sensitive to selling price and it has been observed that every reduction of ₹1 per unit in selling price increases the demand for each product by 10% to the previous level. The company has the production capacity of 60,500 units of Coco, 24,200 units of Strawberry, and 72600 units of Vanilla. The company marks up 25% of the cost of product.

The management decides to apply ABC analysis. For this purpose, it identifies four activities as store support costs. The cost driver rates are as follows.

Activity	Cost Driver Rate
Ordering	₹800 per purchase order
Delivery	₹700 per delivery
Shelf Stocking	₹199 per hour
Customer Support and Assistance	₹1.10 per unit sold

The other relevant information for the products is as follows

	Coco	Strawberry	Vanilla
Direct Material p.u. (₹)	8	6	5
Direct Wages p.u. (₹)	5	4	3
No. of purchase orders	35	30	15
No. of Deliveries	112	66	48
Shelf stocking hours	130	150	160

Under the traditional costing system, store support costs are charged @ 30% of prime cost.

Required:

(i) Calculate the unit cost and total cost of each product at the maximum level using traditional costing.

(ii) Calculate the unit cost and total cost of each product at the maximum level using activity-based Costing.

Solution:

(i) Computations under Traditional Costing

Element	Coco	Strawberry	Vanilla
Unit Cost (₹ per Unit)			
Direct Material	8	6	5
Direct Labour	5	4	3
Prime Cost	13	10	8
Store Support Costs @ 30% on PC	3.90	3.00	2.40
Total	**16.90**	**13.00**	**10.40**
Number of Units	60,500	24,200	72,600
Total Cost (₹)			
Direct Material	4,84,000	1,45,200	3,63,000
Direct Labour	3,02,500	96,800	2,17,800
Prime Cost	7,86,500	2,42,000	5,80,800
Store Support Costs	2,35,950	72,600	1,74,240
Total	**10,22,450**	**3,14,600**	**7,55,040**

(ii) Computations under Activity Based Costing

a. Computation of Store Support Costs per Unit

Activity	Coco	Strawberry	Vanilla
Ordering Cost			
Number of Purchase Orders	35	30	15
Cost @ ₹800 per order	28,000	24,000	12,000
Delivery Cost			
Number of Deliveries	112	66	48
Cost @ ₹700 per delivery	78,400	46,200	33,600
Shelf Stocking Cost			
Shelf stocking hours	130	150	160
Cost @ ₹199 per hour	25,870	29,850	31,840
Customer Support Cost			
Number of Units Sold	60,500	24,200	72,600
Cost @ ₹1.10 per unit	66,550	26,620	79,860

Activity	Coco	Strawberry	Vanilla
Total Cost (₹)	**1,98,820**	**1,26,670**	**1,57,300**
Number of Units	60,500	24,200	72,600
Store Support Costs per Unit (₹)	3.286	5.234	2.167

b. Statement of Costs

Element	Coco	Strawberry	Vanilla
Unit Cost (₹ per Unit)			
Direct Material	8	6	5
Direct Labour	5	4	3
Prime Cost	13	10	8
Store Support Costs	3.286	5.234	2.167
Total (Prime Cost + Store Support Cost)	**16.286**	**15.234**	**10.167**
Number of Units	60,500	24,200	72,600
Total Cost (₹)			
Direct Material	4,84,000	1,45,200	3,63,000
Direct Labour	3,02,500	96,800	2,17,800
Prime Cost	7,86,500	2,42,000	5,80,800
Store Support Cost	1,98,803	1,26,663	1,57,324
Total	**9,85,303**	**3,68,663**	**7,38,124**

Explanatory Comments: The following statement draws comparison of unit costs and total costs under the traditional and ABC systems

Statement of Comparison

Particulars	Coco	Strawberry	Vanilla
Unit Costs			
Under Traditional System	16.90	13.00	10.40
Under ABC System	16.286	15.234	10.167
Total Costs			
Under Traditional System	10,22,450	3,14,600	7,55,040
Under ABC System	9,85,303	3,68,663	7,38,124

The differences between the cost computations under the two systems are obvious and self-explanatory. Prime cost remaining the same, the differences arose on account of bettering the accuracy in the distribution of store support costs under ABC.

Illustration 6

XYZ Limited makes three main products, using broadly the same production methods and equipment for each.

A conventional product costing system is used at present, although Activity Based Costing (ABC) system is being considered. Details of the three products, for a typical period are:

Product	Labour Hours per Unit	Machine Hours per unit	Material (₹ Per unit)	Volume Units
X	1 ½	3 ½	25	3,500
Y	½	2	15	2,250
Z	2	5	30	6,000

Direct labour costs are ₹8 per hour and production overheads are absorbed on machine hour rate basis. The rate for the period is ₹ 18 per machine hour. Further analysis shows that the total of production overheads can be divided as follows:

Activity	%
Costs relating to set-ups	30
Costs relating to machinery	25
Costs relating to materials handling	22
Costs relating to inspection	23
Total production overhead	100

The following activity volumes are associated with the product line for the period as a whole.

Product	Number of Set-ups	Number of movements of materials	Number of Inspections
X	65	15	150
Y	110	26	190
Z	485	79	570
Total	**660**	**120**	**910**

You are required to:

(a) Calculate the cost per unit for each product using conventional method

(b) Calculate the cost per unit for each product using ABC principles

Solution:

(a) Computation of Cost per unit using Conventional Method

Element	X	Y	Z
Materials	25	15	30
Labour @ ₹8 per hour	12 (8 ×1 ½)	4 (8 × ½)	16 (8 × 2)

Element	X	Y	Z
Overheads @ ₹18 per machine hour	63 (18 ×3 ½)	36 (18 ×2)	90 (18 ×5)
Total	**100**	**55**	**136**

(b) Computation of Cost per unit using ABC principles

Step (i): Computation of Total Overheads

Product	Number of Units	Machine Hours per Unit	Overheads @ ₹18 per machine hour	Total Machine Hours
X	3,500	3 ½	2,20,500 (3500 × 3 ½ × 18)	12,250 (3500 × 3 ½)
Y	2,250	2	81,000 (2250 × 2 × 18)	4,500 (2250 × 2)
Z	6,000	5	5,40,000 (6000 × 5 × 18)	30,000 (6000 × 5
Total			**8,41,500**	**46,750**

Step (ii): Computation of Cost Driver Rates

Activity	%	Cost of Activity (₹)	Cost Driver	Units of Cost Driver	Cost Driver Rate (₹)
Set-ups	30	2,52,450	No. of setups	660	382.50
Machinery	25	2,10,375	Machine hours	46750	4.50
Materials handling	22	1,85,130	No. of Moment of Materials	120	1542.75
Inspection	23	1,93,545	No. of Inspections	910	212.69
Total	**100**	**8,41,500**			

Note : Total Machine Hours = (3500 × 3 ½) + (2250 × 2) + (6000 × 5) = 46,750

Step (iii): Computation of Overheads per Unit

Activity	X	Y	Z	Total
Units	3500	2250	6000	

Activity	X	Y	Z	Total
Set-up Cost				
Number of Set-ups	65	110	485	660
Total Cost @ ₹382.50 per set-up	24862.50	42075.00	185512.50	252450
Cost per Unit (₹)	7.10	18.70	30.92	
Machinery Cost				
Number of Machine Hours	12250	4500	30000	46750
Total Cost @ ₹4.50 hour	55125	20250	135000	210375
Cost per Unit (₹)	15.75	9.00	22.50	
Material Handling Cost				
Number of Material Movements	15	26	79	120
T.C. @ ₹1542.75 per movement	23141.25	40111.50	121877.25	185130
Cost per Unit (₹)	6.61	17.83	20.31	
Inspection Cost				
Number of Inspections	150	190	570	910
Total Cost @ ₹212.69 per Inspn.	31903.50	40411.10	121233.30	193548
Cost per Unit (₹)	9.12	17.96	20.21	

Step (iv): Computation of Cost per Unit

Element / Product	X		Y		Z	
	Conventional (₹)	ABC (₹)	Conventional (₹)	ABC (₹)	Conventional (₹)	ABC (₹)
Materials		25.00		15.00		30.00
Labour		12.00		4.00		16.00
Overheads						
Setup Cost	7.10		18.70		30.92	
Machine cost	15.75		9.00		22.50	
Material Handling Cost	6.61		17.83		20.31	
Inspection Cost	9.12	38.58	17.96	63.49	20.21	93.94
Total Cost		**75.58**		**82.49**		**139.94**

Explanatory Comments: The following statement draws comparison of unit costs under the traditional and ABC systems

Statement of Comparison

Element / Product	X		Y		Z	
	Conventional (₹)	ABC (₹)	Conventional (₹)	ABC (₹)	Conventional (₹)	ABC (₹)
Materials	25.00	25.00	15.00	15.00	30.00	30.00
Labour	12.00	12.00	4.00	4.00	16.00	16.00
Prime Cost	**37.00**	**37.00**	**19.00**	**19.00**	**46.00**	**46.00**
Overheads	63.00	38.58	36.00	63.49	90.00	93.94
Total Cost	**100.00**	**75.58**	**55.00**	**82.49**	**136.00**	**139.94**

The differences between the two systems are obvious. Prime cost remaining the same, the differences arose on account of the better methodology adopted under ABC principles for the distribution of Overheads.

Illustration 7

Vikas Associates, a firm of Cost and Management Accountants, offers three different types of services, namely, Accounting and Auditing, Taxation and Management Consultancy. Each service is charged on the basis of number of billable hours. The average charge per billable hours is ₹ 500. For the year ending 31.03.2024 the firm projects the following estimate of direct and indirect costs:

Costs	Particulars	(₹ Lakhs)	(₹ Lakhs)
Direct Costs:	Accounting & Auditing	100.00	
	Taxation	100.00	
	Management Consultancy	50.00	250.00
Indirect Costs:	Planning & Review	7.50	
	Computer Processing	7.20	
	Professional Salaries	5.60	
	Books, Seminars & Periodicals	1.80	
	Programming Costs	8.00	
	Building Costs	4.90	
	General Administration Costs	15.00	50.00
Total			300.00

Until 31.03.2023 the firm has been allocating the indirect costs on the basis of billable hours. For the year ending 31.03.2024 it was decided to introduce a system of activity based costing to capture the indirect costs more accurately. The following data were gathered accordingly:

Particulars	Accounting & Auditing	Taxation	Management Consultancy
Billable Hours	55000	35000	10000
EDP Hours / CEP Hours	5000	2500	500
Professionals (Nos.)	30	16	10
Books, Seminars & Periodicals (₹)	57500	62500	60000
Programming Hours	1250	500	2250
Building (Sqft.) space occupied	8000	4000	2000
Administration (No. of clients)	150	250	100

Required:

(i) Prepare a profitability statement on the basis of conventional costing

(ii) Prepare a profitability statement on the basis of activity- based costing

(iii) Draw a comparative Statement of Indirect Costs & Profits

(iv) Any suggestion for improving the billable charge on the basis of ABC assuming the same rate of margin of 66.667% on total cost?

Solution:

(i) Profitability Statement on the basis of Conventional Costing **(₹ Amount in Lakhs)**

Activity	Accounting & Auditing	Taxation	Managemt. Consult.	Total (₹ Lakhs)
Number of Billable Hours	55,000	35,000	10,000	1,00,000
Revenue in ₹ Lakhs @ ₹500 per hour	275.00	175.00	50.00	500.00
Direct Costs	100.00	100.00	50.00	250.00
Indirect Costs in ₹Lakhs @ ₹50 per hour	27.50	17.50	5.00	50.00
Total	127.50	117.50	55.00	300.00
Profit	147.50	57.50	(5.00)	200.00

(ii) Profitability Statement on the basis of Activity Based Costing

Step 1: Computation of Cost Driver Rates

Cost Pool	Cost Driver			Cost Driver Rate (₹ per Unit)
	Base	Units	Cost (₹Lakhs)	
Planning and Review	Billable Hrs	1,00,000	7.50	7.50
Computer Processing	EDP Hours / CEP Hour	8,000	7.20	90.00
Professional Salaries	Number of Professionals	56	5.60	10,000.00
Programming Costs	Programming Hours	4,000	8.00	200.00

Cost Pool	Cost Driver			Cost Driver Rate (₹ per Unit)
	Base	Units	Cost (₹ Lakhs)	
Building Costs	Sq.ft. Occupied	14,000	4.90	35.00
Administration Costs	Number of Clients	500	15.00	3000.00

Step 2: Apportionment of Indirect Costs on the basis of Cost Driver Rate

Activity	Accounting & Auditing	Taxation	Management Consultancy
Planning and Review			
Number of Billable Hours	55,000	35,000	10,000
Cost @ ₹7.50 per hour	4,12,500	2,62,500	75,000
Computer Processing			
EDP Hours / CEP Hours	5,000	2,500	500
Cost @ ₹90 per hour	4,50,000	2,25,000	45,000
Professional Salaries			
Number of Professionals	30	16	10
Cost @ ₹10,000 per professional	3,00,000	1,60,000	1,00,000
Books, Seminars & Periodicals			
Actuals	57,500	62,500	60,000
Programming Costs			
Programming Hours	1,250	500	2,250
Cost @ ₹200 per hour	2,50,000	1,00,000	4,50,000
Building Costs			
Sq.ft. Occupied	8,000	4,000	2,000
Cost @ ₹35 per sq.ft.	2,80,000	1,40,000	70,000
Administration Costs			
Number of Clients	150	250	100
Cost @ ₹3,000 per client	4,50,000	7,50,000	3,00,000
Total Indirect Costs	**22,00,000**	**17,00,000**	**11,00,000**

Step 3: Profitability Statement on the basis of ABC

Activity	Accounting & Auditing	Taxation	Managmt. Consultancy	Total (₹ Lakhs)
Number of Billable Hours	55,000	35,000	10,000	1,00,000

Activity	Accounting & Auditing	Taxation	Managmt. Consultancy	Total (₹ Lakhs)
Revenue in ₹ Lakhs @ ₹ 500 per hour	275.00	175.00	50.00	500.00
Direct Costs	100.00	100.00	50.00	250.00
Indirect Costs (Step 2)	22.00	17.00	11.00	50.00
Total Costs	122.00	117.00	61.00	300.00
Profit (Revenue – Total Costs)	**153.00**	**58.00**	**(11.00)**	**200.00**

(iii) Comparative Statement

Activity	Accounting & Auditing	Taxation	Managmt. Consult.	Total (₹ Lakhs)
Indirect Costs (₹ Lakhs)				
Conventional	27.50	17.50	5.00	50.00
ABC	22.00	17.00	11.00	50.00
Difference (Conventional – ABC)	5.50	0.50	(6.00)	
Profits (₹ Lakhs)				
Conventional	147.50	57.50	(5.00)	200.00
ABC	153.00	58.00	(11.00)	200.00
Difference (Conventional – ABC)	(5.50)	(0.50)	6.00	

(iv) Suggestions

The comparative statement highlights the fact that the difference in profits between the Conventional and ABC systems is on account of the difference in indirect costs. It is, therefore, desirable to change the billing rates in line with ABC system.

Computation of Revised Billing Rates

Activity	Accounting & Auditing	Taxation	Management Consultancy
Number of Billable Hours	55,000	35,000	10,000
Direct Costs			
Total (₹ Lakhs)	100.00	100.00	50.00
Costs per Billable Hour (₹)	181.818	285.714	500.00
Indirect Costs			
Total (₹ Lakhs)	22.00	17.00	11.00
Costs per Billable Hour (₹)	40.000	48.571	110.00
Total Costs			
Total (₹ Lakhs)	122.00	117.00	61.00
Costs per Billable Hour (₹)	221.818	334.285	610.00

Activity	Accounting & Auditing	Taxation	Management Consultancy
Target Profit @ 66.667% on Costs			
Total (₹ Lakhs)	81.374	78.039	40.687
Profit per Billable Hour (₹)	147.953	222.968	406.870
Revised Billing			
Total (₹ Lakhs)	203.374	195.039	101.687
₹ per Billable Hour	369.771	557.253	1016.87
Suggested Billing Rate (₹ per hour) by rounding off to the next multiple of five.	370	560	1020

Explanatory Comments: The three different types of services, viz. (i) Accounting and Auditing, (ii) Taxation and (iii) Management Consultancy, are the cost objects for which cost measurement is under taken. Planning & Review; Computer Processing; Professional Salaries; Books, Seminars and Periodicals; Programming; Building; and General Administration are the cost pools under which the indirect costs are accumulated.

Under the conventional system the indirect costs are apportioned by means of a single base, viz. billable hours. Under the ABC system, a seperate base is adopted for each of the cost pools. The revised billing rate prevents the under or over billing of any of the services.

Illustration 8

Precision Auto company Ltd. manufactures and sells two automobile components A and B. Both are identical with slight variation in design. Although the market for both the products is the same, the market share of the company for product A is very high and that of product B very low. The company's accountant has prepared the following profitability statement for the two products (Cost of production: same for both the products)

Direct Material	₹	125
Direct Labour	₹	24
Direct Expenses (sub-contract charges)	₹	36
Overheads (400% of direct labour)	₹	96
Total Cost	₹	281

Particulars		Product A	Product B	Total
Quantity sold (in Unit)	No.	1,24,000	23,150	1,47,150
Unit sale price	₹	300	290	
Total sales realization (Quantity Sold × Unit S.P.)	₹			4,39,13,500
Cost of sales as above	₹			4,13,49,150
Margin	₹			25,64,350

The company's marketing manager, after attending a workshop on activity-based costing challenges the accountant's figures. The nearest competitor's prices for the two products are ₹330 and ₹275 per unit respectively

and, if the company can match the competitor's prices, it can sell 75,000 nos. each of the two products. The Production Manager confirms that he can produce this product mix with the existing facilities.

The management engages you as consultant, and the following facts have been identified by you:

a. Product A undergoes 5 operations and product B undergoes two operations by sub-contractors, although the total subcontract charges are the same for both the products, and

b. 75% of the overheads is accounted for under three major heads relating to sub-contracting operations, *viz.,* ordering, inspection and movement of components, to and from the sub-contractor's works.

Prepare a revised profitability statement to find out if the marketing manager's proposal is viable.

Solution:

Step (i): Segregation of Overheads

Total Overheads = (1,47,150 units × ₹96) = ₹1,41,26,400

Overheads relating to sub-contracting operations = 75% of the total overheads

= (14126400 × 75/100) = ₹1,05,94,800

Balance of 25% of the overheads, viz. other Overheads = (14126400 × 25/100)

= ₹35,31,600

Step (ii): Revision in apportionment of Overheads

Under the ABC refinement, Overheads relating to sub-contracting operations may be apportioned on the basis of number of operations and Factory Overheads may be apportioned on per unit basis. Considering the revised product mix of 75,000 units of A and 75,000 units of B, and the total overheads remaining unchanged, the apportionment of overheads may be reworked as follows:

Sub-contacting overheads for A = (1,05,94,800 × 5/7) = ₹75,67,714

Or (75,67,714 ÷ 75,000) = ₹100.90 per unit

Sub-contacting overheads for B = (1,05,94,800 × 2/7) = ₹30,27,086

Or (30,27,086 ÷ 75,000) = ₹40.36 per unit

Factory Overheads = (35,31,600 ÷ 1,50,000) = ₹23.54 per unit

Step (iii): Computation of profit under Activity Based Costing

Particulars No. of units	A		B		Total
	75000		75000		
	Total	P.U.	Total	P.U.	
Materials	93,75,000	125	93,75,000	125	1,87,50,000
Labour	18,00,000	24	18,00,000	24	36,00,000
Direct expenses	27,00,000	36	27,00,000	36	54,00,000
Prime Cost	1,38,75,000	185	1,38,75,000	185	2,77,50,000

Particulars No. of units	A		B		Total
	75000		75000		
	Total	P.U.	Total	P.U.	
Sub-con trading Overheads	75,67,714	100.90	30,27,086	40.36	1,05,94,800
Factory Overheads	17,65,800	23.54	17,65,800	23.54	35,31,600
Total Cost	2,32,08,514	309.44	1,86,67,886	248.90	4,18,76,400
Profit	15,41,486	20.56	19,57,114	26.10	34,98,600
Sales	2,47,50,000	330	2,06,25,000	275	4,53,75,000

Step (iv): Viability Comparison

Profit as per Accountant = ₹ 25,64,350

Profit as per ABC Computation = ₹ 34,98,600

The profit as per the revised computation is higher by ₹9,34,250.

Explanatory Comments: Revision of computations under the ABC has thrown up the fact of higher profit of ₹26.10 per unit of B in comparison to ₹20.56 per unit of A. As a strategic consequence, quantity of A has been reduced from the level of 1,24,000 to 75,000 and quantity of B has been increased from 23,150 to 75,000 and Thus, pushing up the total volume from 1,47,150 units to 1,50,000 units. The sales realization has gone up from ₹4,39,13,500 to ₹4,53,75,000. The ultimate result is increase in profit by ₹9,34,250.

Illustration 9

State with brief reason whether you would recommend an Activity Based Costing system in each of the following independent situations:

i. A consultancy firm consisting of Lawyers. Accountants and Computer Engineers who provides management consultancy services to clients.

ii. Company X produces one product. The overhead costs mainly consist of Depreciation.

iii. Company Z produces two different labour intensive products. The contribution per unit in both products is very high. The BEP is very low. All the work is carried on efficiently to meet target costs.

iv. Company Y produces 4 different products using different production facilities.

Solution:

i. ABC system uses the cost of activities as the basis for assigning cost of services to jobs which provides more accurate cost information for services. Hence ABC can be used for the consultancy firm.

ii. ABC is needed by organisations for product costing where there is a great diversity in product range. Since company X produces only one product, ABC is not necessary. Moreover, overhead consists of mainly depreciation. ABC is not required.

iii. Company Z is highly labour intensive and does not have a great diversity of products. All work is carried out efficiently, hence ABC is not required. Moreover, Target costs are achieved, Non Value Adding (NVA) activities have already been identified and eliminated.

iv. There is diversity in product range which use different amounts of Overhead (OH) resources as different production facilities are involved. ABC improves product costing by avoiding over or under costing of products. ABC system is recommended.

JIT – Introduction, Benefits, Use of JIT in measuring the Performance

4.2

Just-In-Time (JIT) has, probably, received more attention in a short time than any other new manufacturing technique. The main reason is that JIT gets the credit for much of Japan's manufacturing success.

Just-In-Time is a management technique in which goods are received from suppliers only as and when they are needed. The main objective of this method is to reduce inventory holding costs and increase inventory turnover. Just in time is a demand-pull system of production, wherein actual orders provide a signal for as to when a product should be manufactured. Demand-pull enables a firm to produce only what is required, in the correct quantity and at the correct time. This means that stock levels of raw materials, components, work in progress and finished goods can be kept to a minimum. This requires a carefully planned scheduling and flow of resources through the production process.

Modern manufacturing firms use sophisticated production scheduling software to plan production for each period of time, which includes ordering the correct stock at the correct time. Information is exchanged with suppliers and customers through EDI (Electronic Data Interchange) to help ensure that every detail is correct. Supplies are delivered right to the production line only when they are needed. For example, a car manufacturing plant might receive exactly the right number and type of tyres for one day's production, and the supplier would be expected to deliver them to the correct loading bay on the production line within a very narrow time slot.

The JIT Strategy: By taking a JIT approach to inventory and product handling, companies can often cut costs significantly. Inventory costs contribute heavily to the company expenses, especially in manufacturing organisations. By minimizing the amount of inventory that you hold, you save space, free up cash resources, and reduce the waste that comes from obsolescence.

In addition to the reduction of inventory and greater ROI, there are several improvements in manufacturing that result from operating with low inventories. JIT removes the security blanket of high inventory and Thus, exposes related operating problems. These are problems that need to be faced and solved with prudence. Converting to JIT means a big change—in the culture of a company as well as in its manufacturing operations. Established routines and rules become obsolete. Where backup inventories were once considered to be insurance against unexpected shortages or delays, they are now viewed as evidence of lack-lustre planning or controls, even of laziness. Large production batches can no longer be viewed as beneficial because they help amortize setup costs. JIT forces the elimination of the waste inherent in long setups.

JIT Systems: To facilitate a JIT approach, you need a variety of systems in place. The most notable is a 'kanban'. This is a Japanese approach to ensuring a continuous supply of inventory or product. Kanbans were designed to support the JIT philosophy. A kanban is a visual signal that indicates that it is time to replenish stock and possibly reorder. For instance, as the supply of bolts in a bin on the assembly line falls below a certain number, it may uncover a yellow line painted around the inside of the storage bin. This yellow line indicates to the foreman that he needs to prepare a requisition for more bolts. That requisition is given to the purchasing department, which

processes the order. This prevents the supply of bolts from dropping below a critical amount and allows production continues to flow smoothly.

JIT also exists in concert with continuous improvement systems. Total Quality Management and Six Sigma are overarching programs that help you take a detailed look at every point of the production process and identify ways to make improvements. By applying JIT, you are continuously monitoring the production process. This gives you opportunities for making the production process smoother and more efficient. Because JIT is intended to spread throughout the organisation, it can have an impact on many areas through improvements in processes. When the emphasis is on lean production, systems tend to be made simpler and more predictable. From how a product moves through the building to ways to increase worker involvement in system design, JIT improves efficiency.

Benefits of Just-In-Time System

Following are the advantages of adopting Just-In-Time Manufacturing System:

i. Just-in-time manufacturing keeps stock holding costs to a bare minimum. The release of storage space results in better utilization of space and thereby bears a favorable impact on the rent paid and on any insurance premiums that would otherwise need to be made.

ii. Just-in-time manufacturing eliminates waste, as out-of-date or expired product; do not enter into this equation at all.

iii. As under this technique, only essential stocks are obtained, less working capital is required to finance procurement. Here, a minimum re-order level is set, and only once that mark is reached fresh stocks are ordered, making this a boon to inventory management too.

iv. Due to the afore-mentioned low level of stocks held, the organisation's return on investment (referred to as ROI, in management parlance) would generally be high.

v. As just-in-time production works on a demand-pull basis, all goods made would be sold, and Thus, it incorporates changes in demand with surprising ease. This makes it especially appealing today, where the market demand is volatile and somewhat unpredictable.

vi. Just-in-time manufacturing encourages the 'right first time, concept, so that inspection costs and cost of rework is minimized.

vii. High quality products and greater efficiency can be derived from following a just-in-time production system.

viii. Close relationships are fostered along the production chain under a just-in-time manufacturing system.

ix. Constant communication with the customer results in high customer satisfaction.

x. Over production is eliminated, when just-in-time manufacturing is adopted.

Disadvantages: Following are the disadvantages of adopting Just-In-Time Manufacturing System:

i. Just-in-time manufacturing provides zero tolerance for mistakes, as it makes re-working very difficult in practice, as inventory is kept to a bare minimum.

ii. There is a high reliance on suppliers, whose performance is generally outside the purview of the manufacturer.

iii. As there will be no buffers for delays, production downtime and line idling can occur, which would bear a detrimental effect on finances and on the equilibrium of the production process.

iv. The organisation would not be able to meet an unexpected increase in orders, due to the fact that there are no excess finish goods.

v. Transaction costs would be relatively high, as frequent transactions would be made.

vi. Just-in-time manufacturing may have certain detrimental effects on the environment, due to the frequent deliveries that would result in increased use of transportation which in turn would consume more fossil fuels.

Precautions: Following are the things to Remember When Implementing a Just-In-Time Manufacturing System:

(i) Management buy-in and support at all levels of the organisation are required; if a just-in-time manufacturing system is to be successfully adopted.

(ii) Adequate resources should be allocated, so as to obtain technologically advanced software, that is generally required if a just-in-time system is to be a success.

(iii) Building a close, trusting relationship with reputed and time-tested suppliers will minimize unexpected delays in the receipt of inventory.

(iv) Just-in-time manufacturing cannot be adopted overnight. It requires commitment in terms of time and adjustments to corporate culture would be required, as it is starkly different to traditional production processes.

(v) The design flow process needs to be redesigned and layouts need to be re-formatted, so as to incorporate just-in-time manufacturing.

(vi) Lot sizes need to be minimized.

(vii) Work station capacity should be balanced whenever possible.

(viii) Preventive maintenance should be carried out, so as to minimize machine breakdowns.

(ix) Set up times should be reduced wherever possible.

(x) Quality enhancement programs should be adopted, so that total quality control practices can be adopted.

(xi) Reduction in lead times and frequent deliveries should be incorporated.

(xii) Motion waste should be minimized, so the incorporation of conveyor belts might prove to be a good idea when implementing a just-in-time manufacturing system.

Just-in-time manufacturing is a philosophy that has been successfully implemented in many manufacturing organisations. It is an optimal system that reduces inventory whilst being increasingly responsive to customer needs, this is not to say that it is not without its pitfalls. However, the disadvantages can be overcome, with a little forethought and a lot of commitment at all levels of the organisation.

Use of JIT in measuring the Performance

Toyota first pioneered the concept of just-in-time (JIT) manufacturing in the 1970s. Since then, thousands of companies have successfully taken a page from its playbook. From Dell to Burger King and Harley Davidson, the JIT approach makes sense for a wide range of businesses. The main philosophy behind JIT is to eliminate waste, whether stock, inventory or time. Manufacturers keep a lean supply of materials on hand and produce their products when demanded in rapid-fire fashion. It takes a widespread, end-to-end supply chain approach, which can be tricky, but worth it. Pulling off a winning JIT strategy requires the right building blocks

In a world where JIT is no longer a novelty, margins are thinner than ever, delivering faster than others is still a competitive advantage. As a result, the pressure is on to differentiate with top-notch timing and service. Picking the right key performance indicators (KPIs) to measure is critical to supporting JIT strategy. If a business isn't on top of indicators like the customer's desired timing, delivery windows and communication, it can't pull ahead of the competition.

Timing: First and foremost, among the right KPIs is timing. "What's your lead time?" is the vital KPI question. The manufacturer will have to be on top of the number of hours or days between taking an order and putting a finished product into the hands of customers.

What the Customer Wants: Important to timing is knowing exactly what the customer wants in this regard. There is an instance of one manufacturer working with a client who was spending big money to meet same-day production on any orders received by 4 p.m.; but the manufacturer didn't check to see if its customers really wanted that — they didn't. So they were giving a service that wasn't needed, at a high cost.

Missed Deliveries: Monitoring missed deliveries is also very important. The key observations are: "Examine by how much you failed,"; "If you have a 2% failure rate, is that made up of deliveries that were 15 minutes late? Or days late? There's a significant cost differential in one versus the other." On the other hand, "track your wins and understand why those deliveries worked".

Responding to Failures: Monitoring how well an organisation responds when it doesn't meet JIT and customer expectations is a helpful KPI, as well. It is recommended to establish an EDI relationship with the partner company in order to track all the data. Monitoring the data over time can get a good feel for what is happening. It is suggested baseline requirements be set for in-full and on-time deliveries.; which sets the benchmarks so that one can compare them with those of the contracted levels.

JIT being an extended supply chain, forming the right partnerships is crucial when starting out with JIT. Point to remember is that partnering with the wrong supplier can lead to downtime, slowdowns and materials sitting and waiting. In the end, that can cost a manufacturer more than not implementing JIT.

JIT Success Stories

When pulled off, JIT can work for small and large manufacturers, as myriad examples reveal. Harley Davidson is one such example, shrinking inventory levels by 75% while simultaneously raising productivity. Inventory turnover went from two a year to 17. While controversial from a union perspective, the main factory in York, Pennsylvania, also cut the workforce from about 2,700 to 1,600 during its '80s push to lean out.

Dell is another JIT success story. It stands as unique from many others in that it requires its suppliers to carry inventory. Dell demands they deliver components on short lead times, and Dell then quickly assembles the computers and ships them off to the customer.

Even fast-food king McDonald's famously improved its customer service by implementing a version of JIT. High holding costs can lead to slow delivery and wastage in this business. McDonald's changed its approach by adding sophisticated burger-making technology and waiting to make burgers until they are ordered, delivering a higher quality product and cutting down on waste.

The evident learning is that successful JIT implementation can lead to improved cash flow and as a result also happier customers.

Illustration 10

B Ltd. has decided to adopt JIT policy for materials. The following effects of JIT policy are identified-

1. To implement JIT, the company has to modify its production and material receipt facilities at a capital cost of ₹10,00,000. The new machine will require a cash operating cost ₹1,08,000 p.a. The capital cost will be depreciated over 5 years.
2. Raw material stockholding will be reduced from ₹40,00,000 to ₹10,00,000.
3. The company can earn 15% on its long-term investments.
4. The company can avoid rental expenditure on storage facilities amounting to ₹33,000 per annum. Property. Taxes and insurance amounting to ₹22,000 will be saved due to JIT programme.

5. Presently there are 7 workers in the store department at a salary of ₹5,000 each per month. After implementing JIT scheme, only 5 workers will be required in this department. Balance 2 workers' employment will be terminated.
6. Due to receipt of smaller lots of Raw Materials, there will be some disruption of production. The costs of stock-outs are estimated at ₹77,000 per annum.

Determine the financial impact of the JIT policy. Is it advisable for the company to implement JIT system?

Solution:

Cost-Benefit Analysis of JIT policy

A. Costs (Per annum)

Serial	Particulars	(₹)
1	Interest on capital for modifying production facilities (₹10,00,000 × 15%) / Interest Income Fore gone	1,50,000
2	Operating Costs of new production facilities (given)	1,08,000
3	Stock-Outs Costs (given)	77,000
4	**Total Costs**	**3,35,000**

B. Benefits (per Annum)

Serial	Particulars	(₹)
1	Interest on investment on funds released due to reduction in raw material stocking (₹40,00,000 - ₹10,00,000) ×15%	4,50,000
2	Saving in salary of 2 workers terminated (₹5,000×12 months×2)	1,20,000
3	Saving in Rental Expenditure	33,000
4	Saving in Property Tax & Insurance	22,000
6	**Total Benefits**	**6,25,000**

C. Net Benefits = (6,25,000 – 3,35,000) = ₹2,90,000

Advise: The JIT policy may be implemented, as there is a Net Benefit of ₹2,90,000 per annum.

Note: Depreciation, being apportionment of capital cost, is ignored in decision-making, Tax Saving on Depreciation is not considered in the above analysis.

Illustration 11

Altra Video Company sells package of blank video tapes to its customers. It purchases video tapes from Yash Tape Company at ₹150 per packet. Yash Tape Company pays all freight to Altra Video Company. No incoming inspection is necessary because Yash Tape Company has a superb reputation for delivery of quality merchandise. Annual demand of Altra Video Company is 15,600 packages. Altra Video Company requires 10% annual return on its investment. The purchase order Lead time is 2 weeks. The purchase order is passed through internet and it costs ₹20 per order. The relevant insurance, material handling etc. is ₹10 per package per year.

Altra Video has to decide whether or not to shift to JIT purchasing. Yash Tape Company agrees to deliver 100 packages of Video tapes 156 times per year (6 times every 2 weeks) instead of existing delivery system of 1,200 packages 13 times a year, with additional amount of ₹0.05 per package. Altra Video Company incurs no stock out under its current purchasing policy. It is estimated that Altra Video Company will incur stock out cost on 50 video tape packages under a JIT purchasing policy. In the event of stock out, Altra video company has to rush order tape packages, which costs ₹8 per package. Comment whether Altra Video Company should implement JIT purchasing system.

Ram Company also supplies video tapes. It agrees to supply at ₹145 per package under JIT delivery system. If video tape is purchased from Ram Co. relevant carrying cost would be ₹9 per package against ₹10 in case of purchasing from Yash Tape Company. However, Ram Company does not enjoy a sterling reputation for quality. Altra Video Company anticipates the following negative aspects of purchasing tapes from Ram Company.

1. Incurring additional inspection cost of ₹0.05 per package.
2. Average stock out of 360 tape packages per year would occur, largely resulting from late deliveries. Ram Company. cannot rush order at short notice. Altra Video Company anticipates lost contribution margin per package of ₹10 from stock out.
3. Customers would likely return 2% of all packages due to poor quality of the tape and to handle this return, an additional cost of ₹25 per package would be incurred.

Comment on whether Altra Video Company can place an order with Ram Company.

Solution:

(i) Computation of Carrying Costs

SL	Particulars	Current Policy	JIT with Yash Tape Co.	JIT with Ram Co.
1	Interest (₹)			
	a. Cost per Package	150.00	150.05	145.00
	b. Interest @ 10% on (a)	15.00	15.005	14.50
2	Insurance, Material Handling, etc.	10.00	10.00	9.00
3	Carrying Cost p.u. p.a. (1 + 2)	**25.00**	**25.005**	**23.50**
4	Average Inventory			
	a. Quantity per Order	1200	100	100
	b. Average Inventory @ 50% of the order	600	50	50
5	Annual Carrying Costs (₹) = [3 × 4 (b)]	**15,000**	**1250.25**	**1175**

(ii) Comparative Statement of Total Relevant Costs

SL	Particulars	Current Policy	JIT with Yash Tape Co.	JIT with Ram Co.
1	Cost of Tapes			

SL	Particulars	Current Policy	JIT with Yash Tape Co.	JIT with Ram Co.
	a. Cost per Tape (₹)	150.00	150.05	145.00
	b. Cost per 15,600 (a × 15,600)	23,40,000	23,40,780	22,62,000
2	Ordering Costs			
	a. Ordering Cost per Order (₹)	20.00	20.00	20.00
	b. Number order per annum	13	156	156
	c. Ordering Costs per annum (₹) (a × b)	260	3,120	3,120
3	Annual Carrying Costs (₹)	15,000	1250	1175
4	Stockout Costs			
	a. Number of Packages	Nil	50	360
	b. Loss per package	-	8	10
	c. Stockout Costs (₹) = (a × b)	Nil	400	3600
5	Inspection Costs			
	a. Number of Packages	Nil	Nil	15600
	b. Cost per package	-	-	0.05
	c. Inspection Costs (₹) = (a × b)	Nil	Nil	780
6	Customer Return Costs			
	a. Number of Packages	Nil	Nil	15600
	b. Number of Returns	-	-	15600 x 2% = 312
	c. Cost per Return (₹)	Nil	Nil	25
	d. Customer Return Costs (₹) = (b × c)			7,800
7	**Total Costs (₹)**	**23,55,260**	**23,45,550**	**22,78,475**

Observations & Comments

a. Cost Saving of implementing JIT purchasing system with Yash Tape Co = (₹23,55,260 - ₹23,45,550) = ₹9,710

Hence, implementation of JIT system is recommended.

b. Amongst the three alternatives JIT with Ram Company results in the least total cost. Hence order may be placed with Ram Company.

Throughput Accounting

4.3

Concept

Throughput Accounting (TA) is variable-cost-accounting presentation based on the definition of throughput (sales minus material and component costs). Sometimes, it is referred to as super variable costing because only material costs are treated as variable. It is a management accounting technique used as a performance measure in 'the theory of constraints'.

Throughput accounting is a process used in management accounting that focuses on a company's production efficiency. It looks at the rate at which a company converts its raw materials into finished goods and makes money from them. The purpose of throughput accounting is to identify any bottlenecks in a production process. This process allows companies to either eliminate those bottlenecks or use them as efficiently as possible.

"Throughput Accounting is a technique where the primary goal is to maximize throughput while simultaneously maintaining or decreasing inventory and operating costs" CIMA Official

Throughput Accounting is an alternative accounting methodology that attempts to eliminate harmful distortions introduced from traditional accounting practices – distortions that promote behaviours contrary to the goal of increasing profit in the long term.

In traditional accounting, inventory is an asset (in theory, it can be converted to cash by selling it). This often drives undesirable behaviour at companies – manufacturing items that are not truly needed. Accumulating inventory inflates assets and generates a "paper profit" based on inventory that may or may not ever be sold (e.g., due to obsolescence) and that incurs cost as it sits in storage. The Theory of Constraints, on the other hand, considers inventory to be a liability – inventory ties up cash that could be used more productively elsewhere.

In traditional accounting, there is also a very strong emphasis on cutting expenses. The Theory of Constraints, on the other hand, considers cutting expenses to be of much less importance than increasing throughput. Cutting expenses is limited by reaching zero expenses, whereas increasing throughput has no such limitations.

Throughput accounting aims to maximize a company's profitability while also reducing its operating costs and inventory. It does so by evaluating which factors contribute to a stoppage or act as a bottleneck in the production process. Through this, throughput accounting identifies any factors that prevent a company's throughput from being higher.

Throughput accounting is a method commonly used in Just-In-Time (JIT) systems. In these systems, any stoppage or bottlenecks can significantly increase costs or cause losses. For companies, it may not be possible to eliminate those bottlenecks every time. Therefore, throughput accounting focuses on the efficient use of limited resources to maximize throughput.

Throughput accounting works by identifying any bottlenecks that may exist in a system. By doing so, it allows a

company to understand its restraints and how they limit production. After identifying these, companies can decide on how to exploit those limited resources. This process requires companies to consider which products or processes can maximize profits.

Once companies identify the best use of their resources to maximize profitability, they can structure the process around the decision. In this process, companies can allocate the maximum use of any limited resources to the process with the highest profit contribution. Similarly, it requires them to provide the bare minimum resources for other processes to function.

However, throughput accounting may not end there. This process is continuous for most companies. By efficiently allocating one resource, companies may come across other bottlenecks. Similarly, two or more resources may contribute to stoppages to a process at the same time. Companies need to identify these and repeat the same steps as above continuously.

Core Measures and Terms

These and other conflicts result in the Theory of Constraints (TOC) emphasizing Throughput Accounting, which uses as its core measures: Throughput, Investment, and Operating Expense which are defined as below:

Core Measures	Definition
Throughput	The rate at which customer sales are generated less totally variable costs (typically raw materials, sales commissions, and freight). Labour is not considered a totally variable cost unless pay is 100% tied to pieces produced.
Investment	Money that is tied up in physical Assets: product inventory, machinery and equipment, real estate, etc. Formerly referred to in TOC as Inventory.
Operating Expense	Money spent to create throughput, other than totally variable costs (e.g., payroll, utilities, taxes, etc.). The cost of maintaining a given level of capacity.

In addition, Throughput Accounting has four key derived measures, viz. Net Profit, Return on Investment, Productivity, and Investment Turns.

Net Profit = (Throughput − Operating Expenses)

Return on Investment = (Net Profit ÷ Investment)

Productivity = (Throughput ÷ Operating Expenses)

Investment Turns = (Throughput ÷ Investment)

The other terms used in TA are as follows:

Totally Variable Cost: Totally Variable Cost is considered as the cost which is incurred only if a product is produced. In many cases only direct materials are considered as totally variable cost. Direct labour is not totally variable, unless piece rate wages are paid.

Capacity Constraint: Capacity Constraint refers to any resource within a company, that limits its total output. For example, it can be a machine that can produce only a specified amount of a key component in a given time period, thereby keeping overall sales from expanding beyond the maximum capacity of that machine. There may be more than one capacity constraint in a company, but rarely more than one for a specified product or product line.

Throughput (or Cycle) Time: Throughput (or cycle) time is the average time required to convert raw materials

into finished goods ready to be shipped to customer. It includes the time required for activities such as material handling, production processing, inspecting and packaging.

Throughput Efficiency: Throughput efficiency is the relation of throughput achieved to resources used. Expressed as a formula:

Throughput efficiency = Throughput Cost ÷Actual Factory Cost

Throughput Time Ratio: Throughput Time Ratio is the ratio of time spent adding customer value to products and services divided by total cycle time. It is also known as the 'ratio of work content to lead time'.

Total Factory Cost: With the exception of material costs, in the short run, most factory costs (including direct labour) are fixed. These fixed costs can be grouped together and called total factory costs (TFC).

Manufacturing Response Time: With JIT, products should not be made, unless there is a customer waiting for them, because the ideal inventory level is zero. The effect of this will be that there will be idle capacity in some operations except the operation, which is bottleneck of the moment. Working on output just to increase WIP or Finished Goods stocks creates no profit and so would not be encouraged. This means that profit is inversely proportional to the level of inventory in the system.

The throughput formula for a specific product is as follows.

Throughput = Sale revenue from the product – Direct material costs

The throughput accounting ratio is a metric often used in throughput accounting. This ratio looks at the return a company generates for each hour of work compared to its costs for the same time. Through the throughput accounting ratio, companies can determine the rate at which they are making income from selling their products. The formula given below is used to calculate the throughput accounting ratio.

Throughput Accounting Ratio (TAR/TPAR) = Return per factory hour ÷ Cost per factory hour

The throughput accounting ratio requires calculating two figures. As mentioned, these are the return per factory hour and the cost per factory hour. The formulae to calculate the return per factory hour and the cost per factory hour are as follows.

Return per Factory Hour = (Throughput per Unit ÷ Product's time taken for the Limited Resource)

Cost per Factory Hour = (Total Factory Cost ÷ Total Limited Resource Time Available)

When a company's throughput accounting ratio is 1, it means that the company generates the same return as it incurs costs. However, companies prefer for the ratio to be greater than 1. The higher the ratio is for a company, the better. It signifies that the company is generating more income than its costs for a unit of factory hour.

When a company's throughput accounting ratio is greater than 1, meaning that its throughput is profitable. In that case, it is beneficial for the company to continue with the process as it will help cover the fixed costs while also making profits. A TPAR ratio of below 1, on the other hand, means that the company cannot recover its fixed costs from the throughput.

Example 1

A company, ABC Co.., produces a product that has a selling price of ₹50. The direct material cost for each product manufactured is ₹20. Each unit of product manufactured takes two factory hours to produce. ABC Co. has

a limited amount of factory hours for production, which is only 10,000 hours. ABC Co.'s operating expenses for each month is ₹1,00,000. Relevant throughput workings would be as follows:

Throughput = Sale revenue from the product – Direct material costs

= ₹50 – ₹20 = ₹30

Return per factory hour

= Throughput per unit ÷ Product's time taken for the limited resource

= ₹30 ÷2 = ₹15/hour

Cost per factory hour = Total factory cost ÷ Total limited resource time available

= ₹100,000 ÷ 10,000 hours = ₹10/hour

Throughput Accounting Ratio (TPAR)

= Return per factory hour ÷ Cost per factory hour

= ₹15 per hour ÷ ₹10 per hour = 1.5

Therefore, producing the product will be overall profitable.

Throughput accounting is a process by which companies use to maximize profitability and reduce costs when there are bottlenecks involved. The throughput accounting ratio looks at the returns from a product in comparison to its costs. Companies prefer products that have a throughput accounting of above 1.

Theory of Constraints– by Eliyahu M. Goldratt

The Theory of Constraints is a methodology for identifying the most important limiting factor (i.e., constraint) that stands in the way of achieving a goal and then systematically improving that constraint until it is no longer the limiting factor. In manufacturing, the constraint is often referred to as a bottleneck.

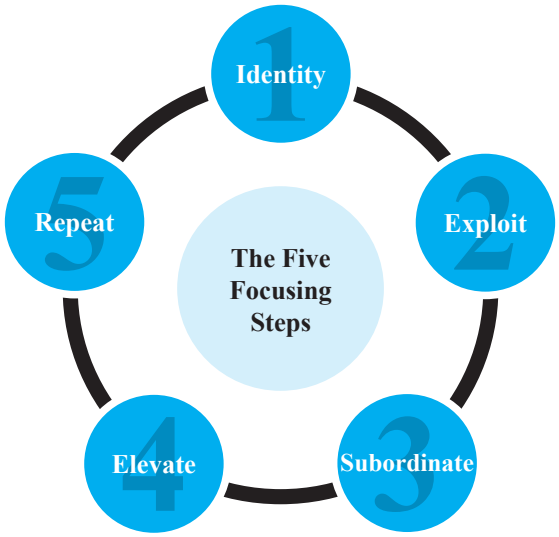

Figure 4.4: 5 Steps of TOC

The core concept of the Theory of Constraints is that every process has a single constraint and that total process

throughput can only be improved when the constraint is improved. A very important corollary to this is that spending time optimizing non-constraints will not provide significant benefits; only improvements to the constraint will further the goal (achieving more profit).

Thus, TOC seeks to provide precise and sustained focus on improving the current constraint until it no longer limits throughput, at which point the focus moves to the next constraint. The underlying power of TOC flows from its ability to generate a tremendously strong focus towards a single goal (profit) and to removing the principal impediment (the constraint) to achieving more of that goal. In fact, Goldratt considers focus to be the essence of TOC.

The Theory of Constraints provides a specific methodology for identifying and eliminating constraints, referred to as the Five Focusing Steps.

The Five Focusing Steps

STEP	OBJECTIVE
1. Identify	Identify the current constraint (the single part of the process that limits the rate at which the goal is achieved).
2. Exploit	Make quick improvements to the throughput of the constraint using existing resources (i.e., make the most of what you have).
3. Subordinate	Review all other activities in the process to ensure that they are aligned with and truly support the needs of the constraint.
4. Elevate	If the constraint still exists (i.e., it has not moved), consider what further actions can be taken to eliminate it from being the constraint. Normally, actions are continued at this step until the constraint has been "broken" (until it has moved somewhere else). In some cases, capital investment may be required.
5. Repeat	The Five Focusing Steps are a continuous improvement cycle. Therefore, once a constraint is resolved the next constraint should immediately be addressed. This step is a reminder to never become complacent – aggressively improve the current constraint…and then immediately move on to the next constraint.

Basic logic of throughput costing

Throughput costing assigns only unit level spending for direct costs as the cost of products or services. Advocates of throughput costing argue that adding any other indirect cost, past or committed cost, to product cost creates improper incentives to drive down the average cost per unit by making more products than can be used or sold. Since these are committed costs, making more units with the same level of spending arithmetically reduces the average cost per unit and makes the production process appear to be more efficient. Throughput accounting (costing) avoids this incentive because the cost per unit depends only on the unit level spending (i.e., cost of materials) and not on how many units are made.

Using throughput accounting (costing) means that cost management analyst must distinguish between:

a. Spending for resources caused by the decision to produce different levels of products and services, and
b. The use of resources that organisation has committed to supply regardless of level of products and services provided.

Problems with throughput accounting

1. When throughput accounting is the driving force behind all production scheduling, a customer that has

already placed an order for a product, which will result in a sub-optimal profit level for the manufacturing, may find that his order is never filled.

2. The company's ability to create the highest level of profitability is now dependent on the production scheduling staff, who decide, what products are to be manufactured and in what order.
3. Another issue is that all costs are totally variable in the long-run, since the management has the time to adjust them to long-range production volumes.

Reporting under throughput accounting

When the throughput model is used for financial reporting purposes, the format appears slightly different. The income statement includes only direct materials in the cost of goods sold, which results in a 'throughput contribution' instead of gross margin. All other costs are bounded into an 'Operating Expenses' category below the throughput contribution margin, yielding a net income figure at the bottom. All other financial reports stay the same. Though this single change appears relatively minor, it has significant impact. The primary change is that throughput accounting does not charge any operating expenses to inventory so that they can be expressed in future period. Instead, all operating expenses are realized during the current period. As a result, any incentive for managers to overproduce is completely eliminated because they cannot use the excess amount to shift expenses out of current period, thereby making their financial results look better than they would otherwise. Though this is a desirable result, such a report can be used only for internal reporting because of the requirement of generally accepted accounting principles that some overheads should be charged to excess production.

Systematic changes required for acceptance of the Throughput Accounting

Throughput accounting does not have a logical linkage with the more traditional form of cost accounting. This makes it difficult for it to gain acceptance. The main problem is that this method does not use cost as the basis for the most optimal production decisions. This is entirely contrary to the teachings of any other type of accounting, which holds that the highest margin products should always be produced first. Now question is whether the enterprise should either use throughput or traditional costing exclusively or is there any way to merge the two. Following discussion relates to this issue:

1. **Inventory Valuation:** Generally accepted accounting principles clearly state that cost of overhead must be apportioned to inventory. Throughput accounting states that none of the overhead costs should be so assigned. In this case, since the rules are so clear, it is apparent that throughput accounting loses. The existing system must continue to assign costs irrespective of how throughput principles are used for other decision making (short-range) activities.
2. **Inventory Investment Analysis:** There are fundamental differences between the two methodologies. Both hold that the objective is always to keep one's investment at a minimum. In the case of traditional cost accounting, this is because the return on investment is higher when the total amount of investment is forced to the lowest possible level. Throughput accounting, however, wants to shrink the amount of investment because it includes work-in-progress inventory in this category. It tries to keep WIP levels down so that waste is reduced in the production system. In short, first system advocates a small investment for financial reasons, while the alternative system favours it because it makes more operational sense. Despite the differences in reasoning, the same conclusion is reached by both methodologies. However, throughput approach is still better, for it forces one to analyse all inventory reduction projects in the light of how they together will impact the capacity constraint rather than individually.
3. **Capital Investment Analysis:** Traditional cost accounting only analyses each investment proposal on its own rather than considering its impact on the production processes as a whole. It tends to recommend investments that will result in an incremental investment but no overall change in the level of corporate

capacity, which is driven by capacity constraint. Throughput accounting, however, has a tight focus on investment only in areas that impact capacity constraint – to other investment proposals are rejected. In this instance, it is best to reject the traditional system and conduct analysis based on throughput principles.

4. **Product Costing:** Under throughput accounting, a product has only a totally variable cost, which may be far lower than the fully absorbed cost, that would be assigned to it under more traditional costing system. This totally variable cost is almost always direct materials, which is an easily calculated figure. Full absorption costing, however, requires a large amount of calculation effort, before a detailed cost can be compiled for a product. For companies selling to Government under cost-plus contracts, there are lengthy detailed requirements as to what variable and overhead costs should be assigned to each product manufactured. These rules virtually require the use of absorption costing – throughput costing is not a viable solution. For companies, that do not require detailed costing justifications while selling their products, it may be possible to use the much simpler throughput accounting approach.
5. **Production Scheduling:** Traditional systems do not include any kind of throughput accounting, that tells production planners which orders should be produced first. These days with throughput accounting, it is possible to customize existing systems or to upgrade packaged software so that this option is available to planners. This would allow them to produce the items that result in the highest throughput per minute of the capacity constraint. Here it is difficult to fully support the throughput approach. Any company that has already received an order from customer has an obligation to fill it, even if the resulting sale will reduce its overall level of profit from the theoretical maximum that can be calculated with throughput accounting. Maximising short-term profit by ignoring orders tantamounts to long-term suicide since customers will leave in droves. Consequently, production planners should be left alone to schedule production in the traditional manner rather than basing their decisions on short-term profit maximisation.
6. **Long-term planning:** This is the main application area of throughput accounting. The enterprise should estimate the approximate sales levels for each product for a long-time frame, enter into a throughput model and determine what mix of prospective sales will result in the highest level of profitability. This method is much superior to using throughput costing for short-term production decisions, since long-term planning sidesteps problems by avoiding existing customer orders that will result in low profits. Long-term planning does not involve existing customer orders so that decisions to produce various types of products at different price points can be made before the sales force goes out to obtain orders.
7. **Price Setting:** Throughput accounting is favoured by the sales and marketing staff because the margin on products is simple to obtain-just subtract totally variable costs from the price. This beats the incomprehensible image of allocations accompanying activity-based costing. Price setting in throughput environment focuses more on what products can be inserted into the existing production mix at a price that will incrementally increase overall profitability, rather than the painful accumulation and allocation of costs to specific products. Throughput accounting is the clear choice here based on case of understandability and the speed with which information can be accumulated.

Illustrative 12

A factory has a key resource (bottleneck) of Facility A which is available for 62,600 minutes per week. The time taken per unit of Product X and Y in Facility A are 5 minutes and 10 minutes respectively. Last week's actual output was 9500 units of product X and 1300 units of Product Y. Actual factory cost was ₹1,56,500. What is the throughput cost for the week?

Solution:

Cost per Factory Minute = Total Factory Cost / Minutes Available

= ₹1,56,500 ÷ 62,600 = ₹2.50

Standard Minutes of throughput for the week = (9500 units of X × 5 hours) + (1300 units of Y × 10 hours)
= (47500 + 13000) = 60,500 minutes

Therefore, throughput Cost for the week = 60,500 × ₹ 2.50 = ₹1,51,250

Illustration 13

Modern Co produces 3 products, A, B and C, details of which are shown below:

Particulars	A	B	C
Selling price per unit (₹)	120	110	130
Direct material cost per unit (₹)	60	70	85
Variable overhead (₹)	30	20	15
Maximum demand (units)	30,000	25,000	40,000
Time required on the bottleneck resource (hours per unit)	5	4	3

There are 3,20,000 bottleneck hours available each month.

Required:

Calculate the optimum product mix based on the throughput concept.

Solution:

Step1: Computation of Rate per Factory Hour

Serial	Particulars	A	B	C
1	Selling price per unit (₹)	120	110	130
2	Direct material cost per unit (₹)	60	70	85
3	Throughput per unit (₹) (1 – 2)	60	40	45
4	Time required on the bottleneck resource (hours per unit)	5	4	3
5	Return per Factory Hour (₹) (3 ÷ 4)	12	10	15
6	Ranking (on the basis of 5)	II	III	I

Step 2: Allocation of Hours according to Ranking

Description	Hours Allocated	Balance
Total of Bottleneck Hours Available		3,20,000
Hours allocated for C (40,000 units × 3 hours per unit) [Rank I]	1,20,000	2,00,000
Hours allocated for A (30,000 units × 5 hours per unit) [Rank II]	1,50,000	50,000
Hours allocated for B (Being the balance) [Rank III]	50,000	-

Step 3: Optimum Product MIX

No. of units of B that can be made in balance hours = (50,000 hours ÷ 4 hours per unit) = 12,500 units

Therefore, Optimum Product MIX:

A = 30,000 units

B = 12,500 units

C= 40,000 units

Illustration 14

Cat Co makes a product using three machines – X, Y and Z. The product has to pass through all the three machines.

The capacity of each machine is as follows:

	X	Y	Z
Machine capacity per week (in units)	800	600	500

The demand for the product is 1,000 units per week. For every additional unit sold per week, profit increases by ₹50,000. Cat Co is considering the following possible purchases (they are not mutually exclusive hence combination of multiple Proposals are to be evaluated):

Proposal 1: Replace machine X with a newer model. This will increase capacity to 1,100 units per week and costs ₹60 Lakhs.

Proposal 2: Invest in a second machine Y, increasing capacity by 550 units per week. The cost of this machine would be ₹68 Lakhs.

Proposal 3: Upgrade machine Z at a cost of ₹75 Lakhs, thereby increasing capacity to 1,050 units.

Required: Which is Cat Co's best course of action under throughput accounting?

Solution:

Since the product has to pass through all the machines, machine capacity is the bottleneck.

Bottleneck resource in order of preference is firstly machine 'Z', secondly machine 'Y' and lastly machine 'X' because the no. of units is in that order in the existing capacity.

Particulars	Proposal	X	Y	Z	Demand
Current capacity per week	-	800	600	500*	1,000
Buy X	1	1,100	600	500*	1,000
Buy Y	2	800	1,150	500*	1,000
Buy Z	3	800	600*	1,050	1,000
Buy X & Z	1, 3	1,100	600*	1,050	1,000
Buy X & Y	1, 2	1,100	1,150	500*	1000
Buy Z & Y	2, 3	800*	1,150	1,050	1,000
Buy Z, Y & X	1, 2, 3	1,100	1,150	1,050	1,000*

* = bottleneck resource

Therefore, all the three machines are to be purchased in the above order to meet the existing demand.

[Note: It can be seen that under Throughput Costing, decision is taken on the basis of capacity and not on the basis of Capital Cost and Profit Amount]

Illustration 15

A factory has a key resource (bottleneck) of Facility A which is available for 31,300 minutes per week. Budgeted factory costs and data on two products, X and Y, are shown below:

Product	Selling Price/Unit	Material Cost/Unit	Time in Facility A
X	₹ 35	₹ 20	5 minutes
Y	₹ 35	₹ 17.50	10 minutes

Budgeted factory costs per week:

	₹
Direct labour	25,000
Indirect labour	12,500
Power	1,750
Depreciation	22,500
Space cost	8,000
Engineering	3,500
Administration	5,000

Actual production during the last week is 4,750 units of product X and 650 units of product Y. Actual factory cost was ₹ 78,250.

Calculate:

(i) Total factory costs (TFC)

(ii) Cost per factory minute

(iii) Return per Factory Minute for both products

(iv) TA ratios for both products

(v) Throughput cost per week

(vi) Efficiency ratio

Solution:

(i) Total Factory Costs = (Total of all costs except materials

= (₹ 25,000 + ₹ 12,500 + ₹ 1,750 + ₹ 22,500 + ₹ 8,000 + ₹ 3,500 + ₹ 5,000) = ₹ 78,250

(ii) Cost per factory minute = Total factory cost ÷ Minutes available

= ₹ 78,250 ÷ 31,300 = ₹ 2.50

(iii)

(a) Return per bottleneck minute for Product X $= \frac{\text{(Selling Price-Material Cost)}}{\text{(Minutes in bottleneck)}}$

$= \frac{35 - 20}{5} = ₹\ 3$

(b) Return per bottleneck minute for Product Y $= \frac{\text{(Selling Price-Material Cost)}}{\text{(Minutes in bottleneck)}}$

$= \frac{35 - 17.5}{10} = ₹\ 1.75$

(iv) Throughput Accounting (TA) Ratio for Product X $= \frac{\text{Return per minute}}{\text{Cost per Minute}}$

$= \frac{₹\ 3 \text{ per minute}}{₹\ 2.50 \text{ per minute}} = 1.20$

Throughput Accounting (TA) Ratio for Product Y $= \frac{\text{Return per minute}}{\text{Cost per Minute}}$

$= \frac{₹\ 1.75 \text{ per minute}}{₹\ 2.50 \text{ per minute}} = 0.70$

Explanatory Observations:

a. TA ratio of Product X is greater than 1 (1.20) and hence increasing the production of X will be more profitable

b. TA ratio of Product Y is less than 1 (0.75) and hence decreasing the production of Y will reduce the losses and be more profitable)

(v) Standard minutes of throughput for the week:

$= [4,750 \times 5] + [650 \times 10] = 23,750 + 6,500 = 30,250$ minutes

Throughput cost per week = 30,250 × ₹ 2.5 per minute = ₹ 75,625

(vi) Efficiency % = (Throughput cost ÷ Actual TFC) %

= (₹ 75,625 ÷ ₹ 78,250) × 100 = 96.6%

Explanatory Observations:

The bottleneck resource of Facility A is available for 31,300 minutes per week but produced only 30,250 standard minutes. This could be due to:

a. The process of a 'wandering' bottleneck causing facility A to be underutilized.

b. Inefficiency in facility A)

Note:

Wandering Bottleneck is a bottleneck emerging due to change in product mix

Illustration 16

Given below is the basic data relating to New India Company for three years

	Year 1	Year 2	Year 3
Production and Inventory data:			
Planned production (in units)	2,500	2,500	2,500
Finished goods inventory (in units), Jan 1	0	0	750
Actual production (in units)	2,500	2,500	2,500
Sales (in units)	2,500	1,750	3,250
Finished goods inventory (in units), Dec. 31	0	750	0

Revenue and Cost data, all three years

	₹
Sales price per unit	48
Manufacturing costs per unit	
Direct material	12
Direct labour	8
Variable manufacturing overheads	4
Total variable cost per unit	**24**
Used only under absorption costing:	
Fixed manufacturing overhead = Annual fixed OH / Annual Production = ₹ 30,000 / 2,500	12
Total absorption cost per unit	**36**
Variable selling and administration cost per unit	4
Fixed selling and administrative cost per year	5,000

You are required to Prepare:

(a) Absorption Costing Income Statement

(b) Marginal Costing Income Statement

(c) Reconciliation of Income under Absorption and Marginal Costing.

(d) Throughput Costing Income Statement.

(e) Draw your observations.

Solution:

Actual production is 2500 units in each year.

(a) Absorption Costing Income Statement

New India Company: Income Statement as per Absorption Costing

Particulars	Year 1 (₹)	Year 2 (₹)	Year 3 (₹)
Number of Units Sold	2500	1750	3250
Sales Revenue (at ₹ 48 per unit)	1,20,000	84,000	1,56,000
Less: Cost of goods sold (at absorption cost of ₹ 36 per unit)	90,000	63,000	1,17,000
Gross margin	**30,000**	**21,000**	**39,000**
Less: Selling and administration expenses:			
Variable (at ₹ 4 per unit)	10,000	7,000	13,000
Fixed	5,000	5,000	5,000
Operating Income	**15,000**	**9,000**	**21,000**

(b) Marginal Costing Income Statement

New India Company: Income Statement as per Variable Costing / Marginal Costing

Particulars	Year 1 (₹)	Year 2 (₹)	Year 3 (₹)
Number of Units Sold	2500	1750	3250
Sales Revenue (at ₹ 48 per unit)	1,20,000	84,000	1,56,000
Less: Variable Expenses			
Variable manufacturing costs (at ₹ 24 per unit)	60,000	42,000	78,000
Variable selling & admin. costs (at ₹ 4 per unit)	10,000	7,000	13,000
Contribution margin	**50,000**	**35,000**	**65,000**
Less: Fixed Expenses:			
Fixed manufacturing overhead	30,000	30,000	30,000
Fixed selling & admin. Expenses	5,000	5,000	5,000
Operating Income	**15,000**	**0**	**30,000**

(c) Reconciliation of Income under Absorption and Marginal Costing.

New India Company: Reconciliation of Income

Serial	Particulars	Year 1 (₹)	Year 2 (₹)	Year 3 (₹)
A	Operating Income under absorption costing	15,000	9,000	21,000
B	Operating Income under marginal costing	15,000	0	30,000
C	Difference (A-B)	**0**	**9,000**	**(9,000)**

Analysis of Difference

Year 1: There is no difference

Year 2: Operating Income under absorption costing is higher by ₹9,000.

Production in Year 2= 2500 units

Sales in Year 2= 1750 units

Change in FG Inventory = (2500-1750) =750 units i.e., increase

The absorption of overheads being on the basis of units sold, under-absorbed Fixed Overheads on 750 units @ ₹12 per unit aggregating to ₹9,000 have resulted in the higher Operating Income under absorption costing.

Year 3: Operating Income under absorption costing is lower by ₹9,000.

Production in Year 3= 2500 units

Sales in Year 3= 3250 units

Change in FG Inventory = (2500- 3250) = (750) units i.e., decrease

The absorption of overheads being on the basis of units sold, over-absorbed Fixed Overheads on 750 units @ ₹12 per unit aggregating to ₹9,000 have resulted in the lower Operating Income under absorption costing.

(d) Throughput Costing Income Statement

New India Company: Income Statement as per Throughput Costing

Particulars	Year 1 (₹)	Year 2 (₹)	Year 3 (₹)
Number of Units Produced	2500	2500	2500
Number of Units Sold	2500	1750	3250
Sales Revenue (at ₹48 per unit) (No. of Units sold × ₹48)	1,20,000	84,000	1,56,000
Less: Cost of goods sold (at throughput cost: Direct material cost of ₹12 per unit) (No. of Units sold × ₹12)	30,000	21,000	39,000
Throughput	**90,000**	**63,000**	**1,17,000**
Less: Operating costs:			
Direct labour @ ₹8 Per unit on units produced (No. of Units sold × ₹8)	20,000	20,000	20,000
Variable manufacturing overhead @ ₹4 Per unit on units produced (No. of Units sold × ₹4)	10,000	10,000	10,000
Fixed manufacturing overhead	30,000	30,000	30,000
Variable selling & admin. Expenses @ ₹4 per unit on units sold	10,000	7,000	13,000

Particulars	Year 1 (₹)	Year 2 (₹)	Year 3 (₹)
Fixed selling & admin. Expenses	5,000	5,000	5,000
Total Operating Costs	**75,000**	**72,000**	**78,000**
Operating Income (Throughput – Total Operating Costs	**15,000**	**(9,000)**	**39,000**

(e) Observations

Comparative Statement of Operating Income (Rupees) (₹)

Year	Production	Sales	Operating Income (Rupees) (₹)		
	Units	Units	Absorption Costing	Marginal Costing	Throughput Costing
1	2,500	2,500	15,000	15,000	15,000
2	2,500	1,750	9,000	0	(9,000)
3	2,500	3,250	21,000	30,000	39,000
Total	**7,500**	**7,500**	**45,000**	**45,000**	**45,000**

Observations:

i. In year 1, number of units produced (2,500) are equal to units (2,500) sold; Operating Income remains the same (i.e., ₹15,000) under all the three systems.

ii. In year 2, number of units produced (2,500) are greater than units sold (1750); Operating Income is the highest (i.e., ₹9,000) under Absorption Costing, and the lowest (i.e., ₹9,000) under Throughput System.

iii. In year 3, number of units (2,500) produced are less than units sold (3,250); Operating Income is the highest (i.e., ₹39,000) under Throughput System followed by Marginal Costing (i.e., ₹30,000); Operating Income is the lowest (i.e., ₹21,000) under Absorption Costing.

iv. When all the three years are totalled, number of units produced (7,500) are equal to units (7,500) sold; and Operating Income remains the same (i.e., ₹45,000) under all the three systems.

v. Operating Income being sales driven, Throughput and marginal systems facilitate better control.

Illustration 17

T Ltd, produces a product which passes through two processes - cutting and finishing.

The following information is provided:

	Cutting	Finishing
Hours available per annum	50,000	60,000
Hours needed per unit of product	5	12
Fixed operating costs per annum excluding direct material (₹)	10,00,000	10,00,000

The selling price of the product is ₹1,000 per unit and the only variable cost per unit is direct material, which costs ₹ 400 per unit. There is demand for all units produced.

Evaluate each of the following proposals independent of each other:

(i) An outside agency is willing to do the finishing operation of any number of units between 5,000 and 7,000 at ₹ 400 per unit.

(ii) Another outside agency is willing to do the cutting operation of 2,000 units at ₹ 200 per unit

(iii) Additional equipment for cutting can be bought for ₹10,00,000 to increase the cutting facility by 50,000 hours, with annual fixed costs increased by ₹ 2 lakhs.

Solution:

Cutting process capacity = 50,000hours ÷ 5 = 10,000 units

Finishing process capacity = 60,000hours ÷ 12 = 5,000 units

Throughput contribution per unit = (Selling Price – Material Cost)

= (₹ 1,000 – ₹ 400) = ₹ 600 per unit

Observation: Finishing capacity (5,000 units) is less than the cutting capacity (10,000 units). Therefore, Finishing Capacity is the bottleneck resource.

Alternative-I: If an outside agency is willing to do the finishing operation of any number of units between 5,000 and 7,000

Increase in throughput contribution per unit = (Throughput contribution - Subcontracting charges)

= (₹ 600 – ₹ 400) = ₹200

Throughput Contribution for 5,000 units = (5000 × 200) = ₹10,00,000

Throughput Contribution for 7,000 units = (7000 × 200) = ₹14,00,000

Observation: Increase in throughput contribution is higher than the fixed operating costs of ₹10,00,000- per annum beyond 5,000 level of subcontracting. Therefore, subcontracting above the 5,000 level is beneficial.

Alternative-II: If an outside agency is willing to do the cutting operation

The capacity of cutting process is 10,000 unis as against the finishing capacity of 5,000 units. Cutting is not the bottleneck and hence outsourcing is not beneficial.

Alternative-III: Installation of additional equipment for cutting process.

The cutting process has surplus capacity. It is, therefore, suggested not to increase non-bottleneck capacity.

Illustration 18

H Ltd. manufactures three products. The material cost, selling price and bottleneck resource details per unit are as follows:

Particulars	Product X	Product Y	Product Z
Selling Price (₹)	66	75	90
Material and other variable cost (₹)	24	30	40
Bottleneck resource timeline (minutes)	15	15	20

Budgeted factory costs for the period are ₹ 2,21,600. The bottleneck resources time available is 75,120 minutes per period.

Required:

(i) Company adopted throughput accounting and products are ranked according to 'product return per minute'. Select the highest rank product.

(ii) Calculate throughput accounting ratio (TA Ratio) and comment on it.

Solution:

(i) Calculation of Rank according to product return per minute

Particulars	X	Y	Z
Selling Price	66	75	90
Less: Variable cost	24	30	40
Throughput contribution (a)	42	45	50
Minutes per unit (b)	15	15	20
Contribution per minute [(a) ÷ (b)]	2.8	3	2.5
Ranking	II	I	III

Comment: Product Y with a contribution of ₹3 per minute ranks the highest.

(ii) Calculation of throughput accounting ratio

Particulars	X	Y	Z
Factory cost per minute (₹) (₹ 2,21,600 ÷ 75,120 minutes)	2.95	2.95	2.95
TA ratio (Contribution per minute ÷ Cost per minute)	0.95	1.02	0.85
Ranking based on TA ratio	II	I	III

Comments: TA Ratio of Product Y is greater than 1 whereas TA Ratios of Product X and Product Z are less than 1. It is beneficial to maximise the production of Y and minimise the production of Z and X.

Back-Flush Accounting

4.4

Concept

Backflush Costing or Backflush Accounting is a product cost accounting approach that, as the name suggests, flushes back the cost from the end of the production process. It is different from the traditional costing system in that this system records costs after the production process ends. As such, the costing process is deferred until the final production of goods and services. This system does away with the requirement of keeping work-in-process accounts and the manual assignment of costs at separate production stages. Companies that use just-in-time (JIT) inventory systems generally use backflush approach.

Backflush costing system does not create any journal entry to record the transactions of raw materials and work in process unless and until the production is completed. Only after the production process ends, backflush costing uses one main journal entry to record the entire inventory, which was used in the production process.

For example, a producer estimates the standard cost of ₹10 per unit. Assuming that the total number of units that the producer produces is 500 units; after the end of the production cycle, a single journal entry of ₹5,000 will be made. The journal entry would be – Dr. Parts Expense ₹5,000 and Cr. Cash ₹5,000. In any other costing system, several journal entries would have to be made, such as – Dr. Part A Expense and Cr. Cash; Dr. Part B Expense and Cr. Cash; Dr. Part C Expense and Cr. Cash; and so more. As no journal entries are made initially or intermittently, the manager uses standard or normal costing later and works backward to assign a cost to the goods or services. In this way, the costs are "flushed back" to the already completed production cycle.

Backflushing is usually employed in parallel with JIT, where there is no work-in-progress to consider nor, does work –in-progress materially fluctuates. What is essential, however, is an accurate bill of materials, good measures of yield, generally effective production control and accurate engineering change notice when yields do change. The principle of a just-in-time system is that production is pulled by customer demand and this in turn pulls the purchasing procedures. Thus, theoretically there are zero stocks of raw materials, work-in-progress and finished goods. For such a situation to exist there needs to be an excellent system of production planning and communication with materials suppliers.

The backflushing formula used to assign the cost is:

Number of Raw Material units used from Inventory = Total Production × Listed Unit Count in the Bill of Materials for Each Component or Raw material per unit of producxtion as per Bill of Material.

The Process

- Once a company gets an order, it records only the essential information into the system, such as quantity, delivery date, and the item code. Based on this, the list of materials needed to complete the order is made.
- When the production is about to start, the company takes the delivery of the raw material and shifts it to the production floor.

- Now software does the routing of all the components for that production order. The cost manager still has a say on what parts and how much quantity to push in.
- After the end of the production process, the operator enters all information about the product into the computer. The software then prepares the production report.
- Based on that report, the operator in a single transaction assign materials cost to the production order.

Benefits

Backflush costing method is more useful for companies with complex products or where the production process involves several stages. With such companies, each stage of production would require several journal entries to track the cost accurately. It could result in hundreds of entries for one product, making accountants' job very cumbersome. If such a company uses backflush costing, the accounts department will not have to post journal entries throughout the production process. The system, thus, simplifies the costing operation and accounting tasks without compromising too much on the information.

Other benefits of this system are:

- It makes it relatively easier to verify the materials used for production.
- Makes post-production issuance simpler.
- It makes it easier to track the inventory.
- When handling bulk materials, it keeps a check on the reverse issuance of materials.

Backflush system works best for products with short production times and the ones that use JIT (just-in-time) inventory systems. Usually, the companies that use this costing are those:

- That wants a simple accounting system.
- That is okay with assigning standard costs to every product.
- The inventory of the raw materials is either low or constant.

Limitations

Though the backflush costing system seems simple to implement, it is not suitable for all products and production processes. For instance, one should not use this system that has a long manufacturing process, or the products that take too much time to produce. It is because, the more time it takes, the more difficult it becomes to assign costs correctly. Suppose a product takes a day to produce. One can easily assign costs to it. But what if it takes about a year to manufacture a product. It would get complicated to map and keep track of the cost correctly.

Since this costing system works backward to assign costs after the end of the production, it often assigns standard costs to the product. It could result in variance with the actual costs. Thus, in the real world, companies need to recognize these variances. For example, one can identify the variation by comparing the labour cost assigned to the production with the actual cash outflow for the labour expenses.

Similarly, such a costing method is not suitable for custom orders. It is because such orders would require separate invoices for each material that is used in the production of custom orders. Also, backflush costing system is not suitable for companies with slow inventory turnover.

One big drawback of this costing system is that it is not in-line with the GAAP (generally accepted accounting principles), and thus, makes it difficult to audit.

Also, statutory Reports and Tax calculations cannot be done on figures obtained by Back Flush costing / Accounting.

Other drawbacks of backflush costing system are:

- It is relatively difficult to implement.
- For the results to be accurate, this system needs an accurate production count. In the formula above, the finished goods count is one of the two inputs. So, if this number is wrong, then the resultant figure will not be accurate as well.
- Its success also depends on the accuracy of the bill of materials. A bill of material contains the list of all components and raw materials that a product will require. Thus, if there is a discrepancy in the bill of materials, the backflush costing will assign an incorrect amount of raw materials and components.
- Scrap reporting also needs to be accurate. Usually, in a production process, there is a large amount of scrap. The bill of material does not account for this scrap. It is essential to remove these scraps from the inventory to get the right picture.
- Since this system does not record the work-in-process inventory, it needs a fast production cycle time. This costing system does not record inventory until the end of the production. So, during this timeframe, the records will remain incomplete. The only way to ensure records get updated quickly is to shorten or quicken the production cycle.

The Variants of Backflush Accounting

There are a number of variants of the Backflush system, each differing as to the 'trigger points' at which costs are recognized within the cost accounts and Thus, associated with products. All variants, however, have the following common features:

- The focus is on output – costs are first associated with output (measured as either sales or completed production) and then allocated between stocks and costs of goods sold by working back.
- Conversion costs (labour and overheads) are never attached to products until they are complete (or even sold) – Thus, the traditional WIP account doesn't exist. Materials are recognized at different points according to the variant used, but only to the extent of being either stock of raw materials or part of the cost of stock of finished goods. Again, materials are not attached to WIP.

Two variants of the Backflush system are summarized below. Note that in each as conversion costs (labour and overheads) are incurred they will be recorded in a conversion cost (CC) account.

Variant 1

This has two Trigger Points (TP), viz.

- **TP 1:** Purchase of raw materials / components. A 'Raw Material in Process (RIP)' account will be debited with the actual cost of materials purchased, and creditors credited.
- **TP 2:** Completion of good units. The finished goods (FG) account will be debited with the standard cost of units produced and the RIP and CC account will be credited with the standard cost.

Under this variant, then, there will be two stock accounts i.e., (i) raw materials (which may, in fact, be incorporated into WIP) and (ii) finished goods

Variant 2

This has only one trigger point – the completion of good units. The FG account is debited with the standard cost of units produced, with corresponding credits to the CC account and the creditors account. Thus, the cost records exclude:

- Raw materials purchased but not yet used for complete production
- The creditors for these materials (and any price variance)

And there is only stock account, carrying the standard cost of finished goods stock.

Other variants include those using the sale of completed good units as a trigger point for the attachment of conversion cost to unit -- Thus, there is no finished goods account, just a raw materials stock account, carrying the materials cost of raw materials, WIP and finished goods. It should be seen that as stock of raw materials, WIP and finished goods are decreased to minimal levels, as in a 'pure' JIT system, these variants will give the same basic results.

Assimilation

Backflush costing is an easy solution to the difficulties in assigning costs to the products, but its implementation is not that simple. Many companies, however, still use it because of its ease and other benefits.

Illustration 19

The manufacturing cost information for March for a division of XYZ Co. is as follows:

Cost incurred in March	₹ '000
Purchase of Raw Materials	4,250
Labour	2,800
Overheads	1,640
Activity in March	**Units ('000)**
Finished goods manufactured during the period	180
Sales	145
Standard cost per unit	₹
Materials	20
Labour	15
Overheads	9
Total	**44**

There were no opening stocks of raw materials, WIP or finished goods. It should be assumed that there are no direct materials variance for the period. Show the relevant Journal entries and ledger accounts in Variant 1 and Variant 2 of backflush system.

Solution:

Variant 1 (Entries when there are two trigger points):

The double entry would be as follows

Serial	Particulars	Dr. ₹ '000	Cr. ₹ '000
1	RIP account	4,250	
	To, Creditor		4,250
2	Conversion Cost account	4,440	
	To, Cash		2,800
	To, Cash/creditor		1,640

Serial	Particulars	Dr. ₹ '000	Cr. ₹ '000
3	FG account (180 × 44)	7,920	
	To, RIP account (180 × 20)		3,600
	To, Conversion Cost account (180 × 24)		4,320
4	COGS (145 × 44)	6,380	
	To, FG account		6,380

The ledger would appear as follows

Dr. **Raw and in process materials A/c** **Cr.**

Particulars	₹ '000	Particulars	₹ '000
To, Creditor	4,250	By, FG	3,600
		By, Bal c/d	650
	4,250		**4,250**
Bal c/d	650		

Dr. **Conversion costs A/c** **Cr.**

Particulars	₹ '000	Particulars	₹ '000
To, Cash/Creditor	4,440	By, FG	4,320
		Bal c/d	120
	4,440		**4,440**
To, Bal c/d	120		

Dr. **Finished goods A/c** **Cr.**

Particulars	₹ '000	Particulars	₹ '000
To, RIP	3,600	By, COGS	6,380
To, Conversion Cost	4,320	By, Bal c/d	1,540
	7,920		**7,920**
To, Bal c/d	1,540		

Dr. **Cost of goods sold A/c** **Cr.**

Particulars	₹ '000	Particulars	₹ '000
To, FG	6,380	By, Sales	6,380
	6,380		**6,380**

The stock balances at the end of March would be

	₹ '000
Raw and in process material	650
Finished goods	1,540
	2,190

The balance on the Conversion Cost (CC) Account will be carried forward and written off at the end of the year.

Variant 2: Accounting entries where there is only one trigger point (i.e.,on completion of units):

			Dr. ₹ '000	Cr. ₹ '000
1	Conversion Cost account	Dr.	4,440	
	To, Cash			2,800
	To, Cash/creditor			1,640
2	FG account (180 × 44)	Dr.	7,920	
	To, RIP account (180 × 20)			3,600
	To, Conversion Cost account (180 × 24)			4,320
3	COGS	Dr.	6,380	
	To, FG account			6,380

Variant 2 is, thus, suitable for JIT system with minimal raw materials stocks.

Illustration 20

Dandia Ltd. follows JIT system. It had following transactions in May, 2024:

i. Raw materials were purchased for ₹ 2,00,000.

ii. Direct labour cost incurred ₹ 36,000

iii. Actual overhead costs ₹ 3,00,000

iv. Conversion costs applied ₹ 3,16,000

All materials, that were purchased, were placed into production and the production was also completed and sold during the month. The difference between actual and applied costs is computed.

You are required to pass both Traditional journal entries and back flush journal entries.

Solution:

In the books of Dandia Ltd.

Journal Entries (Traditional)

Particulars	Debit (₹)	Credit (₹)
Material A/c .....Dr.	2,00,000	

Particulars	Debit (₹)	Credit (₹)
To, Accounts Payable		2,00,000
(Being purchase of raw materials)		
WIP A/c.....Dr.	2,00,000	
To, Materials A/c		2,00,000
(Being materials issued to production)		
WIP A/c.....Dr.	36,000	
To, Direct wages A/c		36,000
(Being direct labour cost incurred)		
Overhead Control A/c .....Dr.	3,00,000	
To, Accounts Payable		3,00,000
(Being overhead cost incurred)		
WIP A/c.....Dr.	2,80,000	
To, Overhead Control A/c		2,80,000
(Being application of overhead)		
Finished Goods A/c.....Dr.	5,16,000	
To, WIP A/c		5,16,000
(Being completion of goods)		
Cost of Goods Sold A/c.....Dr.	5,16,000	
To, Finished Goods		5,16,000
(Being cost of finished goods sold transferred)		
Cost of Goods Sold A/c.....Dr.	20,000	
To, Overhead Control A/c		20,000
(Being variance recognized)		

In the books of Dandia Ltd.

Journal Entries (Backflush)

Particulars	Debit (₹)	Credit (₹)
Raw Material in Process A/c.....Dr.	2,00,000	
To, Accounts Payable		2,00,000
(Being purchase of raw materials)		
Conversion Cost Control A/c .....Dr.	3,36,000	

Particulars	Debit (₹)	Credit (₹)
To, Direct wages A/c		36,000
To, Accounts Payable		3,00,000
(Being overhead cost incurred)		
Finished Goods A/c.....Dr.	5,16,000	
To, Raw Material in Process A/c		2,00,000
To, WIP A/c		3,16,000
(Being completion of goods)		
Cost of Goods Sold A/c.....Dr.	5,16,000	
To, Finished Goods		5,16,000
(Being cost of finished goods sold transferred)		
Cost of Goods Sold A/c.....Dr.	20,000	
To, Overhead Control A/c		20,000
(Being variance recognized)		

Benchmarking

4.5

Concept

It is believed that the term benchmark, originates from the history of guns and ammunition, and with the same aim as for the business term; comparison and improved performance. Benchmarking is the continuous process of measuring products, services or activities against the best levels of performance that may be found either inside or outside the organisation. It is a process of comparing a firm's activities with best practices. The process involves establishment of benchmarks (targets or comparators), through the use of which the levels of performance of the organisation is sought to be improved.

The idea behind benchmarking is to measure internal processes against a chosen standard. Benchmarking is used to measure the internal performance using a specific indicator encompassing cost, time or quality resulting in a metric of performance that can be compared to others. The examples of indicators include cost per unit of measure, productivity per unit of measure, cycle time of x per unit of measure or defects per unit of measure, and so on.

Benchmarking can focus on roles, processes, or strategic issues. It can be used to establish a function or mission of an organisation. It can also be used to examine existing practices while looking at the organisation as a whole to identify practices that support major processes or critical objectives. Benchmarking is, also, a potentially powerful tool to promote continuous improvement in an enterprise.

Benchmarking is a powerful management tool because it overcomes "paradigm blindness" and overcomes the thinking, "the way we do it is the best because this is the way we've always done it". Bench Marking opens organisations to new methods, ideas and tools to improve their effectiveness. It helps crack through resistance to change by demonstrating other methods of solving problems than the one currently employed and demonstrating that they work, because they are being used by others. The benefits of benchmarking include several avenues of cost reduction and cost control such as reducing labour cost, streamlining the work flow, and optimising productivity, etc.

Types of Benchmarking

Noteworthy types of Benchmarking are:

1. Product Benchmarking (Reverse Engineering)
2. Competitive Benchmarking
3. Process Benchmarking
4. Internal Benchmarking
5. Strategic Benchmarking
6. Global Benchmarking

1. **Product Benchmarking (Reverse Engineering):**

   Product Benchmarking is an age-old practice of product oriented reverse engineering. Every organisation buys its rival's products and tears down to find out how the features and performances etc., compare with its products. This could be the starting point for improvement.

2. **Competitive Benchmarking:**

   Competitive Benchmarking looks at a company's direct competitors and evaluates how the company is doing in comparison. Competitive Benchmarking moves beyond product-oriented comparisons to include comparisons of process with those of competitors. In this type, the process studied may include marketing, finance, HR, R&D etc. Knowing the strengths and weaknesses of the competition is not only important in plotting a successful strategy, but it can also help prioritize areas of improvement as specific customer expectations are identified.

3. **Process Benchmarking:**

   Process benchmarking consists of a mechanism for identifying specific work procedures that could be improved by imitating external examples of excellence that can be set as the best standard in the industry. In that sense, Process Benchmarking involves the comparison of one's own utility with other similar utilities, with the purpose of self-improvement through adopting structures or methods that happen to be successful elsewhere. It allows a firm to find out how others do business, whether they are more efficient or not and, if so, whether the firm can understand and use those methods to its own advantage. The goal of process benchmarking is to improve different stages of the production process and to increase efficiency by "learning from others". Sharing experiences is crucial for the success of the technique. For example, by comparing specific core indicators (and the procedures currently used that affect those indicators) for a set of utilities, best practice can be hopefully identified and transferred to weak performers, who should adopt in order to increase efficiency.

4. **Internal Benchmarking:**

   Internal Benchmarking is an application of process benchmarking, within an organisation by comparing the performance of similar business units or business process. Internal Benchmarking is the analysis of existing practice within various departments or divisions of the organisation, looking for best performance as well as identifying baseline activities and drivers. Organisations collect data on their own performance at different points in time and under different circumstances and identify gaps or areas for strengthening.

5. **Strategic Benchmarking:**

   Strategic Benchmarking is used to describe the situation when a firm is interested in comparing its performance versus the best-in-class or what is deemed as world-class performance. This process often involves looking beyond the firm's core industry to firms that are known for their success with a particular function or process. The best-in-class form of benchmarking examines multiple industries in search of new, innovative practices. It not only provides a broad scope, but also the best opportunities over that range. Looking beyond your own industry for best-in-class performance for particular processes or functions is an excellent way to challenge your firm to rethink long-standing assumptions and practices. A unique example is that of Southwest Airlines which had analysed the processes, approaches, and speed of automobile racing pit crews to gain ideas for improving their airplane turn-around time at the gate. The outcome of this benchmarking study is reported to have helped Southwest reconfigure their gate maintenance, cleaning, and customer loading operations, and to have saved the firm millions of dollars per year.

6. **Global Benchmarking:**

   Global Benchmarking is an extension of Strategic Benchmarking to include benchmarking partners on a global scale. E.g. Ford Co. of USA benchmarked its account payable functions with that of Mazada in Japan and found to its astonishment that the entire function was managed by 5 persons as against 500 in Ford.

Process of Benchmarking

The benchmarking process is relatively uncomplicated. Some knowledge and a practical dent are all that is needed to make such a process a success. The key stages in the benchmarking process may be summarized as:

(i) Planning

(ii) Collection of Data

(iii) Analysis of Data

(iv) Implementation

(v) Monitoring

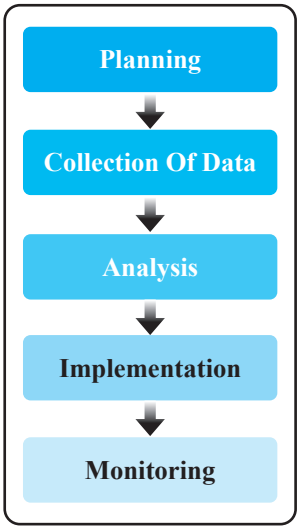

Figure 4.5: Process of Benchmarking

Planning (Stage 1): Planning starts with determination of benchmarking goal statement. It is imperative that the organisation identifies the activities that need to be benchmarked prior to engaging in benchmarking. Since benchmarking can be applied to any business process or function, a range of research techniques may be required. These include informal conversations with customers, employees or suppliers. These also include exploratory research techniques, re-engineering analysis, process mapping, quality control variance reports, financial ratio analysis, or simply reviewing cycle times or other performance indicators.

Second step in planning is Identification of best performance, i.e., seeking the "best". To arrive at the best is both expensive and time consuming, so it is better to identify a Company which has recorded performance success in a similar area. Before embarking on comparison with other organisations it is essential to know the organisation's functions and processes. Base lining performance provides a point against which improvement effort can be measured. The benchmark organisation can be a single entity or a collective group of organisations, which operate at optimal efficiency. If such these organisations operate in a similar environment or if they adopt a comparable strategic approach to reach their goals, its relevance would be greater.

The third step is establishment of the benchmarking or process improvement team. This should include persons who are most knowledgeable about the internal operations and will be directly affected by changes due to benchmarking.

The last step in planning is defining the relevant benchmarking measures. Relevant measures will not be restricted to include the measures used by the firm today, but they will be refined into measures that comprehend the true performance differences. Developing good measurement is key and critical to successful benchmarking.

Collection of Data and Information (Stage 2): This stage involves the following steps: –

a. Compiling information and data on performance. They may include mapping processes.

b. Selecting and contacting partners.

c. Developing a mutual understanding about the procedures to be followed and, if necessary, to prepare a Benchmarking Protocol with partners.

d. Preparing questions and conceiving terminology and performance measures to be used.

e. Distributing a schedule of questions to each partner.

f. Undertaking information and data collection by chosen method for example, interviews, site-visits, telephone fax and e-mail.

g. Collecting the findings to enable analysis.

Data can be in the form of primary data and secondary data. Primary data refers to collection of data directly from the benchmarked organisation/organisations itself, while secondary data refers to information generated from the media, publications or internet. Exploratory research, market research, quantitative research, informal conversations, interviews and questionnaires are some of the most popular methods of collecting information. When engaging in primary research, the organisation needs to redefine its data collection methodology. Drafting a questionnaire or a standardized interview format, carrying out primary research via the telephone, e-mail or in face-to-face interviews, making on-site observations; and documenting such data in a systematic manner is vital, if the benchmarking process is to be a success.

Analysis of Data (Stage 3): Once sufficient data is collected, the proper analysis of such information is of foremost importance. The process may consist of the following steps.

(a) Reviewing the findings and producing tables, charts and graphs to support the analysis

(b) Identifying gaps in performance between our firm and better performers.

(c) Seeking explanations for the gaps in performance. The performance gaps can be positive, negative or zero.

(d) Ensuring that comparisons are meaningful and credible

(e) Communicating the findings to those who are affected.

(f) Identifying realistic opportunities for improvements. The negative performance gap indicates an undesirable competitive position and provides a basis for performance improvement. If there is no gap it may indicate a neutral position relative to the performance being benchmarked. The zero position should be analysed for identifying means to transform its performance to a level of superiority or positive gap.

Recommendation & Implementation (Stage 4): This is the stage in the benchmarking process, where it becomes mandatory to walk the talk for success. This usually means that far reaching changes need to be made so that the performance gap between the target and the actual is narrowed and eliminated. It starts with deciding the feasibility of making the improvements in the light of conditions that apply within own firm. A formal action plan, that promotes change, is to be formulated keeping the culture of the organisation in mind so that the resistance that normally accompanies change is minimized. The commitment of management and staff is to be fully ensured for the process and sufficient resources are to be there to meet the cost of facilitating the necessary improvements.

Monitoring & Review (Stage 5): Benchmarking process need to be properly monitored in order to reap the maximum benefit out of the benchmarking process. This could involve:

a. Evaluating the benchmarking process undertaken and the results of the improvements against objectives and success criteria plus overall efficiency and effectiveness.

b. Documenting the lessons learnt and make them available to others.

c. Periodically re-considering the benchmarks for continuous improvement.

A systematic evaluation is required to be carried out on a regular basis. Assimilating the needed information, evaluating the progress made, reiterating the impact of the changes and making any necessary adjustments, are all part of the monitoring process.

Pre-requisites of Benchmarking

1. **Commitment:** Senior Managers should support benchmarking fully and must be committed to continuous improvements.
2. **Clarity of Objectives:** The objectives should be clearly defined at the preliminary stage. Benchmarking teams must have a clear picture of their firm's performance before approaching others for comparisons.

3. **Appropriate Scope:** The scope of the work should be appropriate in the light of the objectives, resources, time available and the experience level of those involved.
4. **Resources:** Sufficient resources must be made available to complete projects within the required time scale.
5. **Skills:** Benchmarking teams should have appropriate skills and competencies.
6. **Communication:** Stakeholders, and also staff and their representatives, are to be kept informed of the reasons for benchmarking.

Difficulties in implementation of Benchmarking

1. **Time consuming:** Benchmarking is time consuming and at times difficult. It has significant requirement of staff time and Company resources. Companies may waste time in benchmarking non-critical functions.
2. **Lack of management Support:** Benchmarking implementation requires the direct involvement of all managers. The drive to be best in the industry or world cannot be delegated.
3. **Resistance from employees:** It is likely that there maybe resistance from employees.
4. **Paper Goals:** Companies can become pre-occupied with the measures. The goal becomes not to improve process, but to match the best practices at any cost.
5. **Copy-paste attitude:** The key element in benchmarking is the adaptation of a best practice to tailor it to a company's needs and culture. Without that step, a company merely adopts another company's process. This approach condemns benchmarking to fail leading to a failure of benchmarking goals.

Case Study: Drive thru Practice

A quick service (fast food) restaurant chain dependent upon speedy, accurate service in the drive-thru to maximize efficiency, cut costs and increase profits may study the drive-thru practices of key competitors. Every second gained without sacrificing customer quality allows the firm to increase profits. Over the years, competitors have consistently innovated in their drive-thru operations with configuration, number of windows, menu and speaker boards and ordering approaches in an attempt to improve in this area. They are constantly watching and benchmarking against each other.

Pal's Sudden Service, a small hamburger and hot dog chain and a Baldrige Quality Award winner, is very successful at achieving best-in-class performance for drive-thru and overall restaurant operations. Pal's does not offer sit-down service inside its restaurants. Instead, customers pull up to a window, place their orders face-to-face with an employee (no scratchy loudspeakers), pull around to the other side of the facility, take their bag, and drive on. All this happens at a lightning pace – an average of eighteen seconds at the handout window to place an order, an average of twelve seconds at the drive-up window to receive the order. That's four times faster than the second-fastest quick serve restaurant, which requires more than a minute on average to take an order.

Many companies in the fast-food market use Pal's as a best-in-class benchmark for their own firms. It is no wonder that Pal's opened an educational institute to train other organisations.

Terms to Master

- **Activity Based Costing System:** Activity Based Costing may be defined as 'cost attribution to cost units on the basis of benefit received from indirect activities e.g. ordering, setting up, and assuring quality.' The system assumes that products consume activities and activities consume costs. It leads to more precise allocation of manufacturing overheads amongst the products. Activity-based costing provides a means to collect indirect costs in multiple categories and then applies the results individually to the products and services.

- **Activity:** An activity means an aggregate of closely related tasks having some specific functions which are used for completion of a goal or objective.
- **Resource:** Resources are elements that are used for performing the activities or factors helping in the activities.
- **Cost:** Cost is the amount paid for the resources consumed by an activity.
- **Cost Object:** Cost Object refers to an item for which cost measurement is required. e.g., a product, a service, or a customer.
- **Cost Pool:** A cost pool is a term used to indicate grouping of costs incurred on a particular activity which drives them.
- **Cost Driver:** Any element that would cause a change in the cost of activity is cost driver. Cost drivers are the basis of charging cost of activity to cost object.
- **Activity Based Management:** Activity Based Management is a set of actions that management can take, based on information from an Activity Based Costing system, to improve profitability.
- **Activity Based Budgeting:** Activity-based budgeting is a budgeting method where activities are thoroughly analysed to predict costs.
- **Activity Based Responsibility Accounting:** Activity Based Responsibility Accounting is an accounting system that assigns responsibility to processes and uses both financial and nonfinancial measures of performance. Activity-based accounting redefines accountability from costs to team-based activities.
- **Just-In-Time:** Just-In-Time is a management technique in which goods are received from suppliers only as and when they are needed. The main objective of this method is to reduce inventory holding costs and increase inventory turnover.
- **Throughput Accounting:** Throughput Accounting (TA) is variable-cost-accounting presentation based on the definition of throughput (sales minus material and component costs). Sometimes, it is referred to as super variable costing because only material costs are treated as variable. It is a management accounting technique used as a performance measure in the theory of constraints.
- **Theory of Constraints:** The Theory of Constraints is a methodology for identifying the most important limiting factor (i.e., constraint) that stands in the way of achieving a goal and then systematically improving that constraint until it is no longer the limiting factor. In manufacturing, the constraint is often referred to as a bottleneck.
- **Backflush Costing:** Backflush Costing or Backflush Accounting is a product cost accounting approach that, as the name suggests, flushes back the cost from the end of the production process.
- **Bench-marking:** Benchmarking is the continuous process of measuring products, services or activities against the best levels of performance that may be found either inside or outside the organisation.

Exercise

A. Theoretical Questions:

⊙ **Multiple Choice Questions**

1. P operates an activity-based costing (ABC) system to attribute its overhead costs to cost objects. In its budget for the year ending 31st March 2024, the company expected to place a total of 2,895 purchase orders at a total cost of ₹ 1,10,010. This activity and its related costs were budgeted to occur at a constant rate throughout the budget year, which is divided into 13 four-week periods. During the four-week period ended 30 June 2023, a total of 210 purchase orders were placed at a cost of ₹ 7,650. The over-recovery of these costs for the four-week period was:

   A. ₹ 330

   B. ₹ 350

   C. ₹ 370

   D. ₹ 390

   Workings

   Cost driver rate = Budgeted cost of orders ÷ Budgeted number of orders

   = ₹1,10,010 ÷2895 = ₹38 for each order

   Cost recovered for 210 orders = 210 × ₹38 = ₹7,980

   Actual costs incurred = ₹7,650

   Over-recovery of costs for four-week period = 7980 - 7650 = ₹330

2. A company manufactures and sells packaging machines. It recently introduced activity-based costing to refine its existing system. Each packaging machine requires direct materials costs of ₹ 50,000; 50 equipment parts; 12 machine hours; 15 assembly line hours and 4 inspection hours. The details about the cost pools, allocation bases and allocation rates are given below:

Indirect cost pool	Cost allocation base	Budgeted allocation rate
Material handling	No. of component parts	₹8 per part
Machining	Machine hours	₹68 per machine hour
Assembly	Assembly line hours	₹75 per assembly hour
Inspection	Inspection hours	₹104 per inspection hour

   The company has received an order for 40 can-packaging machines from a customer. Using activity-based costing, indirect costs allocated to the order of the customer would be:

   A. ₹1,30,850

   B. ₹1,25,280

   C. ₹1,15,050

   D. ₹1,10,280

Workings

Indirect Costs per Packaging Machine

Indirect cost pool	Cost allocation base	Allocation rate	Workings
Material handling	50 comp. parts	₹8 per part	50 × 8 = 400
Machining	12 Machine hours	₹68 per mach.hr.	12 × 68 = 816
Assembly	15 Asly. line hours	₹75 per asly. hr.	15 × 75 = 1125
Inspection	4 Inspection hours	₹104 per ins.hr.	4 × 104 = 416
Total			**₹2,757**

Therefore, for 40 machines the indirect cost = 40 × ₹2757= ₹1,10,280

3. Process of Cost allocation under Activity Based Costing is

   A. Cost of Activities → Activities → Cost Driver → Cost allocated to cost objects

   B. Cost Driver → Cost of Activities → Cost allocated to cost objects → Activities

   C. Activities → Cost of Activities → Cost Driver → Cost allocated to cost objects

   D. Activities → Cost Driver → Cost allocated to cost objects → Cost of Activities

4. At KL Company, cost of personnel department has always been charged to production department based upon number of employees. Recently, opinion gathered from the department managers indicate that number of new hires might be better predictor of personnel cost,

   Total personnel department cost are ₹ 2,00,000.

Department	A	B	C
Number of employees	30	270	100
The number of new hires	8	12	5

   If number of new hires is considered the cost driver, what amount of cost will be allocated to Department A?

   A. ₹15,000

   B. ₹64,000

   C. ₹72,000

   D. ₹40,000

   Workings

   Total Cost of Personnel Department = ₹2,00,000

   Total No. of New Hires – 8 + 12+ 5 = 25

   Personnel Cost per New Hire = 2,00,000 ÷ 25 = ₹8000

   Total Cost allocated to Department A = ₹8000 × 8 = ₹64,000

5. Cost Driver is

   A. Grouping of costs on a particular activity which drives them

   B. Item for which cost measurement is required.

   C. Elements that would cause a change in the cost activity.

   D. All of the above

6. ABC Management
   A. Accurately identifies sources of profit and loss
   B. Assigns costs using measure of service consumed
   C. Recognizes the casual relationship of cost drivers to activities
   D. All of the above

7. Which of the following is not suitable for a JIT production system?
   A. Batch production
   B. Jobbing production
   C. Process production
   D. Service production

   Explanantion:

   Batch production uses stocks to supply customers whilst other products are being produced. Stocks are avoided in a JIT system. Jobbing production makes products to customer order and is ideal for JIT.

8. Kanban Japanese System under JIT approach ensures that
   A. Continuous supply of inventory or product
   B. Minimum & maximum level of stock to be maintained
   C. Inventory valuation
   D. All of the above

9. JIT relates to
   A. Time Management
   B. Inventory and product handling
   C. Delivery systems
   D. None of the above

10. Glasso, a manufacturer of large windows, is experiencing a bottleneck in its plant. Setup time at one of its workstations has been identified as the culprit. A manager has proposed a plan to reduce setup time at a cost of ₹7,20,000. The change will result in 800 additional windows. The selling price per window is ₹18,000, direct labour costs are ₹3000 per window, and the cost of direct materials is ₹7,000 per window. Assume all units produced can be sold. The change will result in an increase in the throughput contribution of ……
    A. ₹64,00,000
    B. ₹88,00,000
    C. ₹56,80,000
    D. ₹1,44,00,000

    Workings

Selling Price per Window	= ₹18000
Material Cost per window	= ₹7000
Throughput contribution per window	= ₹11000 (SP – Material Cost)
Total through put Contribution	= ₹11000 × 800 = ₹88,00,000

11. Cost per unit under throughput accounting and marginal costing are mainly different because
    A. Labour is not considered in throughput accounting
    B. Direct labour is considered fixed in throughput accounting
    C. Total cost is considered in throughput accounting
    D. Variable cost is considered in marginal costing

12. Ankit Ltd., operates throughput accounting system. The details of product A per unit are as under:
    Selling Price: ₹75
    Material Cost: ₹30
    Conversion Cost: ₹20
    Time to bottleneck resources: 10 minutes
    What is the throughput contribution per bottleneck resource per hour?
    A. ₹270
    B. ₹150
    C. ₹120
    D. ₹90

    Workings
    Throughput Contribution
    = (Selling Price – Material Cost) ÷ Time on bottleneck resources.
    = [(₹75 – ₹30) ÷10 minutes] × 60 = ₹270

13. Producing more non-bottleneck output
    A. Creates more inventory, but does not increase throughput contribution
    B. Creates more inventory and increases throughput contribution
    C. Creates less pressure for the bottleneck workstations
    D. Allows for the maximization of overall contribution

14. Twin Ltd. uses JIT and back flush accounting. It does not use a raw material stock control account. During September 2023, 10000 units were produced and sold. The standard cost per unit is ₹ 150 which includes materials of ₹ 60. During September 2023, ₹ 9,90,000 of conversion costs were incurred. The debit balance in cost of goods sold account for September 2023 is:
    A. ₹14,00,000
    B. ₹14,80,000
    C. ₹15,90,000
    D. ₹16,20,000

    Workings

Standard Material Cost	= (10,000 × ₹60) = ₹6,00,000
Actual Conversion Cost	= ₹9,90,000
Debit Balance of COGS	= (Material Cost + Conversion Cost)
	= 6,00,000 + 9,90,000
	= 15,90,000

15. The companies that would benefit from back-flush costing include companies
    A. Which have fast manufacturing lead time
    B. Whose inventory vary from period to period
    C. Companies that require audit trails
    D. None of these

16. Bench marking is
    A. A continuous process
    B. The practice of setting targets using external information
    C. Method to provide performance assessment
    D. All of the above

17. S Ltd. recently sold an order of 50 units having the following costs:

	(₹)
Direct materials	1,500
Direct labour (1000 hours @ ₹8.50):	8,500
Variable overhead (1000 hours @ ₹4.00)1:	4,000
Fixed overhead2:	1,400
Total:	15,400

1. Allocated on the basis of direct labour-hours.
2. Allocated at the rate of 10% of variable cost.

The company has now been requested to prepare a bid for 150 units of the same product. If an 80% learning curve is applicable, S Ltd.'s total cost on this order would be:

A. ₹ 38,500
B. ₹ 37,950
C. ₹ 26,400
D. ₹ 31,790

Workings:

Production (Units)	Labour Hours for 50 units	Total Hours
50	1000	1000 × 1 = 1000
100	80% of 1000 = 800	800 × 2 = 1600
200	80% of 800 = 640	640 × 4 = 2560

Therefore, Direct Labour Hours for 150 units

= (Total Hours for 200 units – Total Hours for 50 units)

= (2560 – 1000) = 1,560

Estimate for 150 units

1. Variable Cost (₹)

(i) Direct materials @ ₹30/- per unit: 4,500
(ii) Direct labour (1560 hours @ ₹8.50): 13,260
(iii) Variable overhead (1560 hours @ ₹4.00):6,240
(iv) Total Variable Cost: 24,000
2. Fixed overhead (10% of 24,000): 2,400
3. Total: 26,400

Explanatory Comment

The problem addresses the application of the concepts of learning curve for cost estimation as also the marginal costing.

Answer:

1	A	2	D	3	C	4	B	5	C	6	D
7	A	8	A	9	B	10	B	11	B	12	A
13	A	14	C	15	A	16	D	17	C		

Essay Type Questions

1. Elaborate the concept and purpose of Activity Cost Management.
2. What are the vital stages of implementation of Activity Based Costing?
3. Write a note on Activity Based Budgeting.
4. Differentiate between Traditional Cost systems and ABC systems.
5. What are the benefits of just-in-time manufacturing systems?
6. What are the precautions that should be taken while implementing a just-in-time manufacturing system?
7. What is the need for throughput accounting?
8. What are the core measures and terms which are used in throughput accounting?
9. Write a note on theory of constraints.
10. Discuss the process of back-flush costing.
11. What are the limitations of back-flush costing?
12. What are the noteworthy types of benchmarking?

Abbreviations

ABB	Activity Based Budgeting
ABC	Activity Based Costing
ABCM	Activity Based Cost management
BPR	Business Process Reengineering
CC	Conversion Cost
COGS	Cost of Goods Sold
ERP	Enterprise Resource Planning
FG	Finished Goods
JIT	Just-In-Time
KPI	Key Performance Indicators
RIP	Raw & In Process Material
TQM	Total Quality Management
TA	Throughput Accounting
TFC	Total Factory Costs
TOC	Theory of Constraints
TPAR	Throughput Accounting Ratio
WIP	Work in Process