Overhead Allocation at Arvinda Engineering Pvt Ltd

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The management of Arvinda Engineering Pvt Ltd is sceptical about the future after going through its latest financial report. Even while the market is growing, its penetration has been limited and remained static for some years now. The recent meeting between CEO and the Board of Directors brought out many issues concerning the organization that require an urgent response from the management.

Arvinda Engineering's CEO, Mr. Ajay Sahani is highly experienced and carries an impressive corporate stint spanning more than 20 years. Sensing a huge business opportunity arising out of government's massive investment in clean drinking water project, Arvinda Engineering was established with its primary focus on waste water treatment. The company has so far managed to be in an advantageous position, thanks to its virtual monopoly within the industry. In the meeting, however, the CEO pains a grim picture pointing out that the company has failed to get many projects during the last fiscal as the prices quoted by them were far higher than those of its competitors. This concern has been compounded by the fact that while overheads have risen steadily, the product costs do not seem to have absorbed them correctly leading to an adverse impact on the profitability. He further explains the board that hitherto, the overheads have been applied on the product lines using an arbitrary approach where the overheads are apportioned using equal weights. The firm's two significant product lines are the Manufacturing and EPC.

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The board comprises of several independent directors who carry rich corporate credentials. Among them is an independent director, Mr. Ram Prakash, who is an expert in Finance & Costing. With a previous stint as a consultant to a leading IT company, he's quick to point out that akin to several other firms, perhaps, Arvinda Engineering is faced with 'cost-anomalies'. A terminology used to describe a situation where a firm's actual product costs mismatch against the expected owing to inappropriate allocation of overheads. With a stint at Arvinda hardly exceeding a year, but having the costing dynamics in the water-treatment industry, he points out that apportionment of overheads using equal weights appears flawed as, traditionally, EPC is far-less resource consuming in comparison with Manufacturing. Also, given that most of the products being custom designed, the company needs to explore the possibility of alternative approaches to allocation of overheads. The board in agreement with the CEO decides to entrust Mr. Ram Prakash to suggest alternative approaches for allocation of overheads (See 'Glossary of key termnilogies').

The Company

Arvinda Engineering Company Pvt. Ltd is a subsidiary of the trendsetting Arvinda group based at Mysore. Company operates in the industrial area located in the outskirts of Mysore and is having a turnover of around RS 20 million. Arvinda Engineering specialises in turnkey projects in the field of Water Management & Waste Water Purification Systems. Established in 1985 & having an impressive client list based all over India, Arvinda Engineering has been in the forefront of this field which is gaining rapid acceptance amongst the small & medium industries due to wide spread implementation of Water Management Systems in practically all large industrial units.

Providing service to the entire spectrum of Industries, Institutions & Corporates in the field of Water Management, Arvinda can be relied upon for Design, Manufacture, Supply, and Installation & Maintenance of the Effluent Treatment Plants.

Water Management, Waste Water Treatment & Effluent Treatment Plants offered by Arvinda will be of special interest to leaders of industry due to the multi-layered benefits that can be accumulated by their installation.

The Product Line

The company is having to types of product offerings a) EPC and b) manufacturing

1) **Engineering Procurement Contract (EPC):** An EPC work consists of various stages like Design, Manufacture, Procurement, Install and Commission. Figure 1 provides an overview of various stages involved EPC.

a. **Design Stage -** This is the first stage of an EPC contract where the entire process is designed. The process design is followed by the drawing up of specification of individual components. This is followed by the design of the civil unit. The design stage will sometime have other deliverable also.

b. **Manufacturing Stage -** This is the second stage of EPC in which the equipment is designed first. The manufacturing stage requires sub-assemblies and other components to complete the product, this will be procured from outside. The last stage in manufacturing is to fabricate and assemble all the components together.

c. **Procurement -** Sometimes the company requires some finished product like induction motor, gearbox, couplings etc. apart from the regular raw materials that goes into the production process. In this case, the company will ask for price quotes from various vendors. The company will make a comparative statement and will place order.

d. **Installation -** In this stage the finished products are taken to the site and are installed.

e. **Commissioning -** The Company will install all the specified products as mentioned in the contract and will ensure the smooth working of the plant by carrying out the necessary quality check procedures.

2) **Equipment Manufacture –** Arvinda Engineering is known for manufacturing various products like agitators, flash mixers, pressure filter, clari-flocculator etc. In the equipment manufacturing contract there are mainly four stages. These stages are almost similar to EPC but don't have a process design stage. Various stages are as given below.

- Equipment Design
- Material Procurement
- Installation
- Commissioning

Competitive Trends

The market is highly fragmented. Cost, high expertise, prior experience and brand equity are critical competitive factors in the Indian market. For huge municipal and industrial projects there is a pre-bidding process and hence high expertise and prior experiences are critical factors. Companies that offer energy-efficient solutions at competitive costs are likely to take a central position in Indian water and wastewater treatment market.

Cost Allocation Conundrum

There is a well-established theory suggesting two ways in which the profitability of a firm can be maximised – one, increase in sales revenue, costs remaining same, and two, sales revenue remaining constant, decrease in costs. Given an industry characterized by cut-throat competition where demand for the product is highly elastic, firms have little elbow-room in raising the price to maximize profitability. However, while there may be obvious constraints placed

on an upward revision of a price of a product, a careful examination of the components of costs making up a product could open up avenues where there could be possibilities of achieving savings, impacting the profitability positively.

In a manufacturing context, costs savings are generally advocated at the stage of procurement of raw materials. This could take place in the form of discounts as a result of bulk-purchases or simply by seeking a cost-competitive substitute in place of the existing material. In addition, manufacturers are also frequently confronted with decision dilemmas like 'make or buy' that are common in an automobile industry, where an automobile manufacturer may want to choose between manufacturing the automobile components or procure the same from a specialized manufacturer. While such decisions lend themselves into a straightforward analysis, it is however, more challenging to manage costs that have seldom any relationship with the manufacturing activity of a product. These costs are typically 'indirect' in nature and are known as overheads. Manufacturing firms characterized by heterogeneity of product, sophistication of manufacturing processes, and higher degree of mechanization; typically, find a higher proportion of overheads of the total costs making up a product. In such a scenario, identifying the cost per unit of a product becomes a challenging task.

Management of Overheads – the Alternative Approaches

Unlike the direct costs like material and labour, apportionment of overheads to individual products becomes difficult as these costs present traceability issues. Consider, for example, manufacturing overheads like supervision and electricity costs. While these must be incurred for completing the manufacturing activity, tracing these costs to individual products on a convenient basis involves considerable subjectivity. For firms, where the overheads make up for half the total costs or more, considerable attention must be paid to the problem of apportionment of overheads.

Volume Based Allocation

This approach is founded on the management's conviction that overheads could ultimately be traced to a single performance of a manufacturing activity. For instance, overheads could be traced based upon the direct labour hours required to produce a product. Alternatively, overheads could be entirely traced based upon the machine hours required to produce a single product. Note that direct labour hours and machine hours represent the single performance of a manufacturing activity.

Consider the following illustration to appreciate the above process.

Table 1.1 :

Cost information of illustrative products

	Product A	Product B
Direct labour hours for 1 unit	3	5
Units produced and sold	500	500

(Source: Illustrative date)

Total manufacturing overheads = INR 10,000

Overhead allocation rate = Total Overheads

_____

Allocation base

Overhead allocation rate (direct labour hours) =

10,000

_____ = Rs. 2.50 per hour

(3 X 500) + (5 X 500)

Overhead costs – direct labour hours

Overhead cost per unit (Product A) = 2.50 x 3 = INR 7.50 per unit

Overhead cost per unit (Product B) = 2.50 x 5 = INR 12.50 per unit

It may be observed from the above computations that the overhead cost assigned to each product is directly proportional to the cost-base. For example, observe that while the machine cost of A is twice that of B, the overhead cost also follows similar pattern when the allocation base is machine hours. The above observed pattern, which is very common in volume based allocation, frequently leads to a problem known as 'cost-anomaly'.

Activity Base Costing (ABC) Approach

Unlike the volume based approach, an ABC system does not make any subjective assumption liking overheads with a single performance of manufacturing activity. Here, the focus hinges upon identifying the activities that give rise to overheads. By tracing the overhead cost components to the specific activities (cost drivers), the system seeks to address the problem of allocation more systematically. This is achieved by studying the activity consumption pattern of every product. An application of ABC system entails the following steps.

1. Identification of cost drivers
2. Ascertaining the cost per driver
3. Application of overhead cost to individual product

Consider the illustration reflected above. The following data relating to ABC is given below.

Table 1.2 :

Cost data for ABC allocation

Cost pool	Cost driver	Cost (RS)	Driver – Qty.	Product A	Product B
Setup	No of setups	4000	5	3	2
Engineering	No of engg. Hours	6000	5000	3000	2000
Units produced and sold				500	500

(Source: Illustrative data)

a) Identification of cost drivers - Here, an examination of overheads led the management to identify the overheads arising primarily from setup and engineering activity.

b) Ascertaining the cost per driver - Similar, to the process of computation of overhead allocation rate under volume-based approach, the following parameter is used.

$$\text{Overhead allocation rate} = \frac{\text{Total Overheads}}{\text{Allocation base}}$$

$$\text{Cost per driver - setup} = \frac{4{,}000}{5} = \text{Rs. 800 per setup (allocation base-setups)}$$

$$\text{Cost per driver - Engineering} = \frac{6{,}000}{5{,}000} = \text{Rs. 1.20 per engineering hour (allocation base engineering hours)}$$

c) Application of overhead costs to individual products

Overhead cost = Cost per driver x Driver consumption per product

Setup costs

Product A 800 x 3 = Rs. 2,400

Product B 800 x 2 = Rs. 1,600

Engineering costs

Product A 1.20 x 3000 = Rs. 3,600

Product B 1.20 x 2000 = Rs. 2,400

Overhead cost per unit

$$\text{Product A} = \frac{(2{,}400 + 3{,}600)}{500} = \text{Rs.12 per unit}$$

ProductB = $\frac{(1,600 + 2,400)}{500}$ = Rs.8 per unit

Compare the results obtained under ABC with those under the volume based allocation. The figures are summarized in the table given below.

Table 1.3 :
Comparison of product cost under alternative approaches

Method of allocation	Product A	Product B
Volume based – Direct labour hours	7.50	12.50
ABC system	12	8

(Source: Computed data)

Observe the magnification of this anomaly by reflecting the chart depicted below.

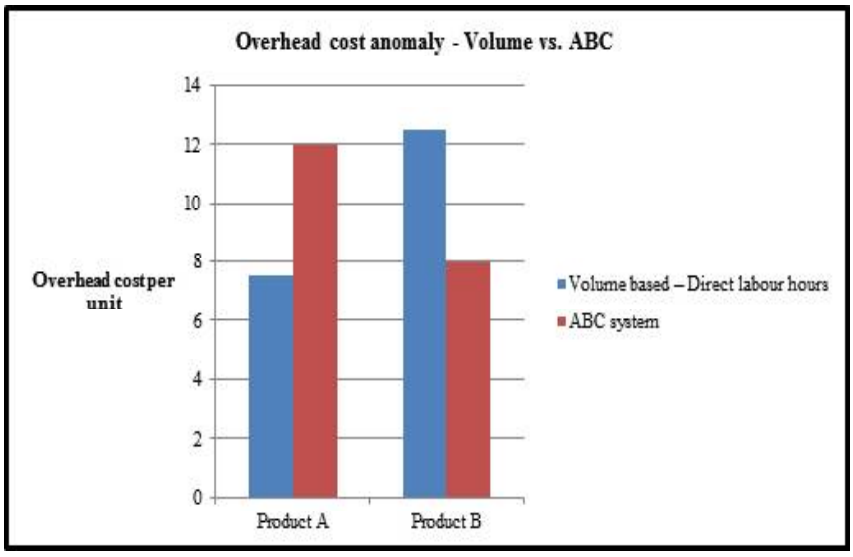

Figure 1.1 : Graphical depiction of product costs under alternative approaches

The anomaly arising out of allocation of overheads based upon two different methods is clearly visible. This is likely to lead the management to arrive at a totally dichotomous total product cost figures, where overheads make up for substantial part of the product. Consequently, even the pricing, is likely to be misleading driving the management to take incorrect decisions.

Suggested Alternatives for Overhead Allocation at Arvinda Engineering

As Arvinda Engineering is a small scale manufacturing firm and almost all of its products are customized according to the customers need. Since it is a small scale and there is no proper standard to measure the direct labour hours, it will be difficult to go for job costing method. The shop-floor workers normally work on multiple machines and the same worker is skilled enough to carry out multiple tasks like cutting, bending, welding etc. This makes it difficult to trace how a shop-floor worker divides his time among various activities.

The costing model can be done using ABC model with slight modifications. The method followed will be a two stage allocation model. In this method all the overheads that are incurred in the organization is found out. These overheads will be then allocated to the various activities that help in the production of various products. And from there it is allocated to the product lines.

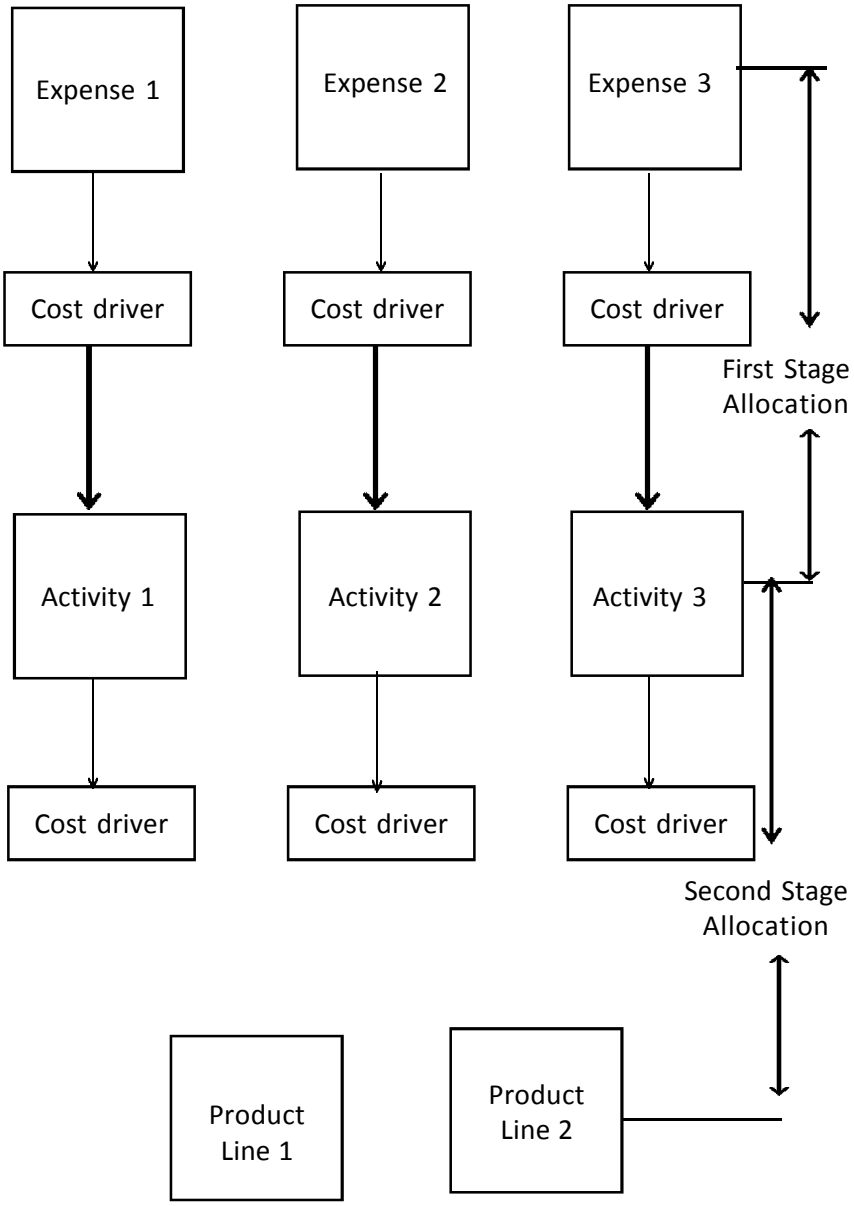

Figure 1.2 : Relationship between expense, activities and product line

Stages of Overhead Allocation at Arvinda Engineering

Stage 1: Finding the Overhead Expenses Incurred by the Company

The overall expenses incurred by the company can be traced with the help of the cost sheet developed from the trial balance of the company. Expenses refer to how the company divides its overhead among the various manufacturing activities.

Stage 2: Finding the Activities or Cost Pools

For the proper implementation of ABC, the production process of the company should be classified into various activities. A flow chart of the various processes is a commonly used tool in finding out the various activities of the firm. In order to find the various activities, homogenous processes are often grouped together.

Stage 3: Finding the Cost Drivers for Various Activities

One expense may contribute to multiple activities. For tracing the expense to these activities, cost drivers, often called as first stage cost drivers should be properly calculated.

Stage 4: Preparing the Expense Activity Dependence Matrix (EAD matrix)

The relationship various expenses and the relationship between various activities are estimated with the help of various information gathering processes like 1) Educated Guess 2) Analytical Hierarchical Process 3) Actual data collection.

In the EAD matrix the expense categories represents the column and the activities involved represents the rows. If an activity 'i' contributes to a particular expense 'j', then a check mark is placed in the corresponding cell "i, j". The proportion or level expense incurred will be found out by the various information gathering process and the check mark will replaced by the corresponding proportion.

Stage 5: Obtain the Total Cost of Each Activity

$$TCA(i) = \sum_{j=1}^{M} Expense\,(j) \times EAD(i, j)$$

where

TCA (i) = Total cost of activity i

M = number of expense categories

Expense (j) = Value of expense category j, in RS

EAD (i, j) = Entry i, j of Expense-Activity-Dependence matrix

Stage 6: Preparing Activity Product Dependence Matrix (APD matrix)

Activities consumed by each product are identified by various information gathering processes. The activities are mentioned as columns while the products are mentioned in rows. The activity contribution is studied in a similar method as followed in EAD matrix. The EAD matrix is given check mark, which is later replaced with the contribution margin of each activity to particular products.

Stage 7: Calculate the Total Overhead Cost of the Product

The overhead cost of the product is calculated using the equation mentioned below :

$$OCP\,(i) = \sum_{j=1}^{N} TCA\,(j) \times APD\,(i, j)$$

where

OCP (i) = Overhead cost of product i

N = Number of activities

TCA (j) = Dollar value of activity j

APD (i, j) = Entry i, j of Activity-Product-Dependence matrix

Information Gathering Process

Since ABC is carried out in two allocation stages, it is very important to have accurate information in each stage for the smooth implementation of ABC. The information gathered contains lot of proportions which are the main input of EAD matrix and APD matrix. The values of the proportions can be gathered in three different methods.

a) Educated Guess

When the actual data is not available, and the collection methods are not financially justified; then educated guess can be used to get the proportion.

The educated guess is performed with a collective effort from managers, accountants, supervisors and other operational employees. The quality of the guess will be directly related with the experience and diversity within the group involved in the process.

b) Analytical Hierarchical Process (AHP)

It is used to convert the subjective data into more representative information. It makes use of Eigen values to represent the qualitative functions into quantitative function. AHP makes use of mathematics and psychology to derive the needed contribution value. FiRStly the problem is broken down into various hierarchical situations. Then they will compare various elements with each other. AHP make use of human judgement as well as the underlying information to derive the values.

a) Actual Data Collection

Most accurate procedure for computing proportions is the collection of actual data. In most of the cases the collection of data requires skilled persons and some data collection equipment. The actual data collection is time oriented and the results are often statistically tested for accuracy.

Questions for Discussion

1) Would Arvinda Engineering Pvt Ltd benefit from a sophisticated method of allocation of overheads?

2) With reference to calculated total cost of each product line (referring Exhibits 1 and 2), is there any evidence of cost-anomalies?
3) Is an ABC system necessarily flawless? Could you think of scenarios where ABC might become a bane for an organization?

Exhibits

Key overhead allocation data for Arvinda Engineering Pvt Ltd

Exhibit 1

Budget Allocation Using ABC Model

Budget Allocation Using ABC Model for SME					
	% Allocation of Budget				
	Budget `	PL1 : Manu facturing	PL2 : EPC	PL1 :Manu facturing	PL2 : EPC
Direct Material	11336335.74	60%	40%	6801801	4534534
Direct Labour	1921264.667	80%	20%	1537012	384253
Overhead	5643585.567	60%	40%	3386151	2257434
Overall Expense	18901185.97			11724965	7176221

(Source : Primary Source)

Exhibit 1

Budget Allocation using Traditional Model

Budget Allocation Using Traditional costing Model for SME					
	% Allocation of Budget				
	Budget `	PL1 : Manu facturing	PL2 : EPC	PL1 :Manu facturing	PL2 : EPC
Direct Material	11336335.74	60%	40%	6801801	4534534
Direct Labour	1921264.667	80%	20%	1537012	384253
Overhead	5643585.567	50%	50%	2821793	2821793
Overall Expense	18901185.97			11160606	7740580

(Source : Primary Source)

Glossary of Key Terminologies

ABC Allocation –Also called as activity based costing it is a modern system of allocation of overheads that lays emphasis on identification of overheads in relation to their activities. This is achieved by allocation overhead cost pools using appropriate cost drivers.

Cost Driver – These represent the key activities that give rise to overhead costs. For example, no of machine hours has a direct bearing on machining costs.

Cost Pool – All overhead costs that are similar in nature are clubbed together for the purpose of allocation, which helps in saving time, costs, and efforts. A cost pool has a cost driver that is used for allocation. For example, repairs & maintenance, and depreciation form part of the machining cost pool.

Overheads – These are also called as indirect expenses whose traceability to final product is not direct. Examples of manufacturing overheads include supervisory salaries, and machinery depreciation.

Volume-Based Allocation – It is a traditional method of allocation of overheads, where overheads are allocated on some arbitrary basis, like direct labour hours or machine hours. Here, the overheads allocated to products are directly proportional to consumption of volume based measures that often results in over or under allocation of overheads.