CHAPTER - IV

STRUCTURE OF FIXED COST, VARIABLE COST AND TOTAL COST

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CHAPTER - IV

STRUCTURE OF FIXED COST, VARIABLE COST AND TOTAL COST.

4.1. STRUCTURE OF FIXED COST :

4.1:1. Introduction :

We presented the historical note on biogas plants in India, Maharashtra, Sangli District and Miraj Taluka in Chapter No.1. We have also made an attempt to review the available Literature on biogas plants In chapter No.2., we presented the profile of Arag village and profile of biogas plantsin Arag village. We explained the methodology of the study in detail in chapter No.3. Now in this chapter we wish to present the structure of fixed costs regarding the biogas plants in Arag village. This is possible with the data collected by a survey by the researcher.

The total number of biogas plants in Arag village reported to be during the year 1982 to 1988 is 70. For the calculation of total fixed cost and aveage fixed cost of different type of biogas plants are divided into four groups according to their capacities. We have calculated the fixed cost and average fixed cost of all types of plants i.e. Janata, Shivasadan (K.V.I.C.), Dinbandhu and **KVIC** models according to their capacity seperately. Here first of all let us try to explain the concept of fixed cost and the structure of fixed cost.

4.1:2 Total cost and total fixed cost :

Total cost means the total cost of producing any given level of output. The total cost is conveniently divided into two parts total fixed costs and total variable costs.

Fixed costs are those costs that do not vary with output, they will be the same if output is one unit or one million units. The cost of any fixed factor is a fixed cost. Fixed factors are also often 1refered to as overhead costs or unavoidable costs.

4.1:3. Structure of fixed cost :

Material

For the construction of biogas plants like Janata and Dinbandhu following fixed factors are required. They are bricks, Cement, stone, chips, sand, galvanised Iron pipe and labour etc. The prices of these factors are given below. These price are for the year 1987.

Rate (Rs.)

| 1) | Bricks | 450/- per thousand |
|----|-------------|--------------------|
| 2) | Cement | 65/- per bag. |
| 3) | Stone chips | 4.5 per cubic feet |
| 4) | Sand | 2.5 per cubic feet |

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The value of fixed factors of each biogas plant is calculated at that particular year in which the plant is constructed. In the case of biogas plants like K.V.I.C. model Shivsadan are ready made available in the factory at Madhavnagar (Sangli). Their prices are fixed. The total fixed cost of shivsadan plant is equal to price of plant and Labour charges for pit digging.

For the economic evalution, we have taken into account the biogas plants which are actually in operation. The total numbers of Janata biogas plants of capacity of 2 cubic metre are 6 out of which all the plants are in operation. There are two Shivsadhan biogas plants of same capacity out of which one plant is yet not started due to lack of livestock.

There are 32 Janata biogas plants of capacity 3 cu.m. out of which 6 plants are not in working condition due to leakage of gas, laziness of plant holders and faulty construction. Likewise there are 6 plants of Dinbandhu model of 3 cu.m. out of which only one plant is not yet operated by the plant holder due to lack of water availability.

The total number of Janata biogas plants of capacity 4 cu.m. is 18 out of which 5 plants are not in a working condition due to leakage of gas, faulty contruction and laziness of plant holders. Likewise there are 2 plants of Dinbandhu model and only one plant of K.V.I.C. old model of 4 cu.m. capacity which are working in good condition. Lastly there are 4 plants of Janata model of 6 cu.m. which are also working in good condition. We have calculated the total and average fixed cost of biogas plants of different capacities and different models which are actually in operation.

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Maximum fixed (Rs.) 6600 7510 5700 0006 6000 7400 0006 cost 10000 TOTAL AND AVERAGE FIXED COST OF THE BIOGAS PLANTS OF DIFFERENT CAPACITIES AND MODELS Minimum fixed (Rs.) cost 5045 5000 4700 6740 7400 8000 5700 5700 Average fixed cost (Rs.) 7348.45 8392.50 7783.76 5816 5225 5700 7125 7400 101188.88 191059.9 Total fixed 33570 5700 20900 14250 7400 34896 (Rs.) cost operation are in which Plants 9 26 4 13 \sim 1 Total plants 9 \sim S \sim **,---**1 4 32 18 Shivasadan Dinbandhu N=2 Dinbandhu of K.V.I.C. (KVIC) Type plant Janata N=6 Janata N=26 Janata N=13 Janata N=4 N=1 N=1 Capacity of plant 6 cu.m. 2 cu.m. 3 cu.m. 4 cu.m.

= Number of plants which are in operation)

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Table No. 4.1: 1

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1) The total fixed cost of 6 biogas plants of Janata model of 2 cu.m. capacity is Rs. 34,896 and average fixed cost is Rs. 5816/-. The minumum and maximum fixed cost of these plants is Rs. 5045/- and Rs. 6600.00 respectively. There is one Shivasadan (KVIC) plant of capacity 2 cu.m. Total fixed cost of this plant is Rs. 5700/-.

2) There are 26 Janata model biogas plants of capacity 3 cu.m. whose total and average fixed cost is Rs. 191059.9 and Rs. 7348.45 respectively. The minimum and maximum fixed cost of these plants is Rs. 5000 and Rs. 9000 respectively. As well as there we find 4 Dinbandhu biogas plants of 3 cu.m. capacity, whose total fixed cost and average fixed cost is Rs. 20900 and Rs. 5225 respectively. The minimum and maximum fixed cost of these plants is 4700 and Rs. 6000 respectively.

3) The total fixed cost and average fixed cost of 13 Janata model biogas plants of 4 cu.m. capacity is Rs. 101188.88 and 7783.76 respectively. The minimum and maximum fixed cost of these plants is Rs. 5700 and Rs. 10000/- respectively. There we find 2 Dinbandhu model biogas plants of same capacity whose total fixed cost and average cost is Rs. 14250/- and Rs. 7125/- respectively. The minimum and maximum fixed cost of these plants is Rs. 7510 and Rs. 7500 respectively. There is only one KVIC biogas plant whose total and average fixed cost is Rs. 7400/-.

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4) The total fixed cost and average fixed cost of 4 Janata model biogas plants of 6 cu.m. capacity is Rs. 33570 and Rs. 8392.5 respectively. The minimum and maximum fixed cost is Rs. 8000 and Rs. 9000 respectively.

5) There is a big gap between minimum and maximum fixed cost mainly because of following reasons.

- Out of total biogas plants in Arag village only 48.57 %
 plants are operating without lavatories.
- ii) In some area some plant holders have spend more money for pit digging due to hard rocks and some plant holders have spent less for that purpose due to soft rocks and soil.
- iii) 48 % of biogas plants particulary Janata biogas plants are constructed in mason's training camp for construction of biogas plants so as to give training to the masons of Arag village. In this training camp all plants were constructed free of charge.

6) The size or capacity of biogas plants seems to be largely influenced by the factors like size of livestock, size of family and size of farm. It is preseted in table No. 4.1:2.

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Table No. 4.1:2

SIZE OF LIVESTOCK, SIZE OF FAMILY AND SIZE OF FARM OF BIOGAS PLANT HOLDERS OF DIFFERENT CAPACITIES.

| | ================ ==================== | | |
|------------------------------|--|---------------------------|--|
| Size or capacity of plant | Average size of livestock | Average size of family | Average size of farm. (in hecters) |
| | | | |
| 2 cu.m. N=7 | 5 | 5.12 | 1.91 |
| 3 cu.m. N=30 | 5.86 | 8.16 | 3.70 |
| 4 cu.m. N=16 | 6.76 | 10.52 | 2.69 |
| 6 cu.m. N=4 | 10.25 | 15. 5 | 2.64 |
| | | | |

(N = number of biogas plants which are in operation)

It is clear from above table that the size or capacity of biogas plants depends upon the size of livestock, size of family and size of farm. Th size or capacity of biogas plants vary with these factors. The fixed cost of the plant depends upon capacity of plants. There is direct releationship between capacity of plant and the fixed cost of a plant. : 62 :

4.2 STRUCTURE OF VARIABLE COST :

4.2:1 Introduction :

Here we have tried to explain the meaning and definition of variable cost as well as the operational definition of variable cost of biogas plants and calculated the variable cost of variable factors of biogas plants.

4.2:2 Meaning and definition of variable cost :

Variable costs are those costs that vary directly with output, $\frac{2}{2}$ rising as more is produced and falling as less is produced.

Variable cost represents all the items of total cost except for fixed cost as, for example, raw materials, wages fuel etc. Total cost = fixed cost + variable cost. Variable costs are often referred 3 as direct costs.

4.2:3 Operational definition of variable costs :

The variable or working cost or operational cost of biogas plant consists of the value of dung, painting expenses, labour charges, 4maintenance cost and others like water charges. 63 **:**

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4.2:4 Structure of variable cost of biogas plants :

Dung, paints, labour charges and water charges are the main components of variabl costs of biogas plants. The dung is fed to biogas plants every day through the inlet of biogas plant. Plant holders spend some of their time for mixing the dung with water and feed it to plant every day. Painting is needed for steel gas holder of KVIC model and Shivasadan model plants every year.

The value of dung is estimated in terms of value of dung cakes obtainable from dung. In village Arag people sell their dung cakes at the rate of Rs. 10/- per hundred dung cakes. So the value of one basket of dung is Re.1/- because with help of one basket of dung 9 to 10 dung cakes are prepared. We have calculated the value of dung in terms of money for one year.

The labour charges are estimated for one year at the rate of Rs.6/- per day. This wage rate is for women workers. Such type of work is generally done by the women. So we have estimated the labour charges at the rate of Rs.6/- which is prevailing in village Arag.

The painting expenses and the other maintenance costs are calculated for one year.

The variable cost of biogas plant = The value of dung + labour charges + painting expenses + other maintenance cost. : 64 :

In table No. 4.2:1, we have shown the variable cost of biogas plant of one year.

Table No. 4.2:1

VARIABLE COST OF BIOGAS PLANTS OF DIFFERENT MODELS ACCORDING TO THEIR CAPACITYES :

| Capacity of plant | y Model | Average value of dung | Average labour cost per plant per year. | Average painting charges & other mainten- ance cost. | Total of (A+B+C) |
|----------------------|--|-----------------------------|---|--|---------------------|
| | | (Rs.) A | (Rs.) B | (Rs.) C | (Rs.) |
| 2 cu.m. | Janata N = 6 | 726.95 | 136.87 | _ | 863.82 |
| | Shivasada (KVIC) N = 1 | n 365.00 | 136.87 | 40 | 541.87 |
| 3 cu.m. | Janata N = 26 | 1059.90 | 136.87 | - | 1196.77 |
| | Dinbandhu N = 4 | 912.50 | 136.87 | - | 1049.37 |
| 4 cu.m. | Janata N = 13 | 1151.14 | 136.87 | - | 1288.01 |
| | Dinbandhu N = 2 | 547.50 | 136.87 | - | 684.37 |
| | $\begin{array}{l} \text{KVIC} \\ \text{N} = 1 \end{array}$ | 1460. 0 | 136.87 | 40 | 1636.87 |
| 6 cu.m. | Janata | 1733.75 | 410.62 | - | 2144.37 |

(N = number of biogas plants which are actually in operation.)

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The average variable cost of 2 cu.m. capacity of Janata and
 Shivasadan plants is Rs. 863.82 and Rs. 541.87 respectively.

2) The average variable cost of 3 cu.m. capacity plants of Janata and Dinbandhu is Rs. 1196.77 and 1049.37 respectively.

3) The average variable cost of 4 cu.m. capacity plants of Janata, Dinbandhu and KVIC is Rs. 1288.01, Rs. 684.37 and Rs. 1636.87 respectively.

4) The average variable cost of 6 cu.m. capacity plants is Rs. 2144.37.

5) It is clear from above table No. 4.2.1 that the quantity of dung vary with the capacity of plants. There is a direct relationship between quantity of dung and the capacity of plant.

6) The average labour charges are near about the same but in case of biogas plants of capacity 6 cu.m. it is high as compare to other..

7) The average maintenance cost of plant is very neigligible. The biogas plants like Janata and Dinbandhu has no maintenance cost because such types plants has no steel gas holder. But in case of KVIC and Shivasadan plants it is essential due to steel gas holder. The maintenance cost of Shivasadan plant of capacity 2 cu.m. is Rs. 40 and the maintenance cost of KVIC plant of capacity 4 cu.m. is Rs. 40.

4.3 STRUCTURE OF TOTAL COST AND AVERAGE COST :

4.3:1 Introduction :

Here we have tried to explain the term total cost and average total cost. In this chapter previously in two sections we have explained and calculated the fixed costs and variable costs of biogas plants of different models and different capacities. In this section we have defined the total cost adaverage total cost and then presented the structure of total cost of all types of plants according to their capacities.

4.3:2 Meaning and definition of total and average cost.:

Total cost means the total cost of producing any given level of output. Total cost means cost of production. The total cost is conveniently divided into two parts.

- i) Fixed costs
- ii) Total variable costs.

Average cost is the total cost of producing any given output divided by the number of units produced so as to give the cost per unit.

Average cost may be divided into average fixed cost and average variable cost.

The average variable costs may rise or fall as production is increased. It is clear that average fixed costs decline continuously as output increases. A doubling of output always leads to a halving of fixed costs per unit of output. This is a process popularly known as " Spreading one's overhead."

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4.3:3 Structure of total costs and average costs :

Total cost = Total fixed costs + Total variable cost. Here we have explained the structure of fixed costs and variable costs.

Average cost = Average fixed costs of plants + Average variable costs of plants.

So as to calculate the benefit cost ratio of biogas plants of different capacities, we have to make comparison between annual cost and annual revenue of biogas plant. So we have calculated the annual cost of biogas plants.

Annual cost of a biogas plant consists of interest on fixed cost of a plant of one year, depreciation and variable cost of a plant.

i) Interest :

The sum of interest on average fixed cost of biogas plant of different capacities is calculated at the rate of 12 % per annum. Government of India and Government of Maharashtra have made provision of finance at concessional rate of interest to accelerate the biogas programme in the country. All nationalised and co-operative banks provide the loans to the plant holders.

ii) Depreciation cost :

For the economic evaluation we have taken into

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consideration the depreciation cost of a biogas plant. It is supposed the economic life of biogas plant is 40 years. After 40 years the plant become outdated or useless. So as to replace the plant after 40 years, plant holders have to make provision by accumulating definite amount of money every year this definite amount of money means depreciation cost.

Depreciation cost = Total fixed cost of plant.

Economic life of plant.

The economic life of biogas plant is determined on the basis of the life of digester.

iii) <u>Variable costs</u> :

The variable cost of biogas plant consists of the value of dung, labour charges for feeding the plant and maintenance cost. We have calculated the variable cost of all types of plants according to their capacities. It is shown in table No. 4.3.1

| | | | Table N | Vo. 4.3:1 | | | | |
|--|--|---------------|----------|------------------|-------------------|---|-------------------------------------|----------|
| | | TOTAL | COST OF | BIOGAS | PLANTS. | | | |
| | | Cap | acity of | Biogas | plants | | | |
| Farticulars of cost | 2 | cu. m. | 3 cu | • B• | 4 0 | u. m. | 6 cu | · . |
| | Janata | Shivasadan | Janata | Dinbandhu | Janata | Dinbandhu | KVIC | Janata |
| | N = 6 | $\dot{N} = 1$ | N = 26 | N = 4 | N = 13 | N = 2 | N = 1 | N = 4 |
| A. Fixed cost | ····· ···· ···· ······················ | | | | 900 MAR | 360 Str — The And And And Str — The And And And And | ara ana ana ana ara ara ana ana ana | |
| i) Interest on fixed cost (in Rs.) | 697.92 | 684.00 | 881.81 | 627.00 | 934.05 | 855.00 | 888.00 | 1007.10 |
| <pre>ii) Depreciation (in Rs.)</pre> | 145.40 | 142.5 | 183.71 | 130.62 | 194.59 | 178.12 | 185.00 | 209.81 |
| Sub Totl (A) | 843.32 | 826. 5 | 1065.52 | 752.62 | 1128.64 | 1033.12 | 1073.00 | 1216.91 |
| B. Variable cost or working cost | | | | | | | | |
| i) Labour cost | 136.87 | 136.87 | 136.87 | 912.00 136.87 | 1101.14 136.87 | 136.87 | 1400.00 136.87 | 205.26 |
| iii) Miscellaneous (repars & | ł | 40.00 | ł | ł | I | I | 40.00 | Í I I |
| Sub Total (B) | 836.82 | 541.87 | 1196.77 | 1049.37 | 1288.01 | 684.37 | 1636.87 | 1939.01 |
| Grand Total (A + B) | 1707.14 | 1368.37 | 2262.29 | 1806.99 | 2416.65 | 1717.49 | 2709.87 | 3155.92 |
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(N = Number of plants which are in operation)

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In table No. 4.3:1 we have shown the structure of total cost which we call by the name annual cost of biogas plant of different models according to their capacities. Total cost or annual cost consists sum of interest on fixed cost depreciation cost and variable cost (cost of dung) labour cost and miscellaneous i.e. repairs and painting.

1) The total cost or annual cost of Janata and model biogas plants is Rs. 1707.14 and Rs. 1368.37 (per plant) respectively.

2) The total cost or annual cost of Janata and Dinbandhu model biogas plants of 3 cu.m. capacity is Rs. 2262.29 and Rs. 1806.99 per plant respectively.

3) The total cost or annual cost of Janata, Dinbandhu and KVIC model plats of capacity 4 cu.m. is Rs. 2416.65, Rs. 1717.49 and Rs. 2709.87 per plant respectively.

4) Lastly the total cost or annual cost of Janata model biogas plants of capacity 6 cu.m. is Rs. 3155.92 per plant which is the highest among all the plants.

5) The variable cost depends up on the size of plant, average livestock and the quantity of dung. Annul fixed cost also varies from plant to plant. It is directly related to the capacity of plants. It is clear from the table that the total cost or annual cost of Dinbandhu

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model plant is comparatively less than other plants because such type plant requires less bricks, cement and sand as compare to Janata model plants and KVIC moe plants. Generally the total cost or annual cost directly related to the size of plant.

In the chapter we have explained the structure of fixed costs, structure of varibl costs and lastly the structure of total costs or annual cost of different models of biogas plant according to their capacities. To make easy the calculation of the benefit cost ratio and identification of optimum unit, we have calculated the annual cost per plant according to their capacities and models.



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