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Lecture - 04 Cost Volume Profit Analysis

[FL]. In our first two sessions of Cost and Management Accounting, we had discussed about what is cost accounting; then what are the different classifications of costs and in the last session that is session 3, we started with Cost Volume Profit Analysis.

Now, if you remember this is a very useful technique for decision making, particularly useful for short term decisions. We started with how to about cost volume profit analysis or what are the fundamentals. It fundamentally depends on certain classification of costs. Do you remember that cost classification? How do you classify the costs? You classify the cost based on variability? The whole structure of CVP analysis is based on the possibility of classification as per the variability.

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Now, as the name suggests we get two types of cost we get the first cost which is known as fixed cost and I will directly go to graph now. This is how the fixed cost looks like. The graph is totally flat; that means, from 0 unit to 800 unit. The fixed cost in total is going to remain constant. As per the graph let us assume it is around 80000. So, even if you produce 0 unit the fixed cost is 80000; even if you produce 800 units the cost is 80000. So, naturally the per unit cost is going very sharply. If you just produce one unit the fixed cost will be 80000 upon 1. So, it will be 80000 per unit whereas if you produce 800 units it will be 80000 upon 800, got it? That means, now it is reduced considerably, it is only 100 rupees per unit.

So, it keeps on falling as the number of units increase. That is why actually we say that normally do not look at per unit fixed cost. It does not make much sense because the fixed cost as per definition is constant on a total basis. It will keep on falling as the number of units increase on a per unit basis it will fall, but as a total fixed cost it remains constant ok. Any example would you like to give other than the examples which we discussed last time? We have talked about rent or insurance or depreciation.

Do you think of any other fixed cost which does not change with level of activity? Let us say license fee. We are operating a factory, we pay license fee on annual basis. It does not change if you want to establish factory and keep it running you have to pay license fee every year it remains constant. If you register for a factory you pay license fee, irrespective of production. So, it remains a fixed cost.



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Other type of cost is variable. Again have a look at the graph you can see it starts from 0 and goes up in a straight line format. So, for every extra unit there is a extra fixed cost. From the graph you can just see that around for 100 unit it is 1000, 200 units is 20000 and so on, for 800 units it has touched 80000. So, how much it is on a per unit basis?

10000 upon 100; that means, it is 100 per unit. As the number of units will increase, it will increase in the same ratio that is 100 per unit that is a definition of variable cost.

Any example? Last time we had seen some examples like direct material, direct labor or petrol cost for a vehicle. Any other example? Suppose, you are using a license software and you pay on peruse basis. So, every time you use your to pay some fee. So, per unit as the units increase your cost of license software increase, got it? Suppose, you have got license on lump sum or if your purchased license in becomes, but when you use a software on peruse basis, it becomes a variable cost, getting it?



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Now, the third is semi variable cost. As the name suggest they have an element of variability. So, they change with level of activity, but do not change the same proportion. Neither it is fixed, so, we cannot call it fixed also that is why it is called as a semi variable cost. Any example? Last time we thought of maintenance. Any other example is possible or telephone bill also we have discussed.

Any other cause do you think of? Normally repairs again similar to maintenance; as the usage increase the repairs are likely to increase. Some of the human costs also behave in a semi variable nature because human being gets tired; theoretically it is variable, but there is an element of learning. So, next unit you can use you can produce bit in a lesser time. So, it may have a variability. In real life it can be curves of various types, but as per

that the CVP analysis assumption we assume that cost hour in straight line that is why normally we use this step form of graph.

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Now, CVP analysis takes a look at this like cost desired level of sales, desired level of profit and so on.

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Then, the objectives of CVP we try to look at the interaction between volumes, profits and the costs.

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Now, these are the important assumptions of CVP analysis. Of course, fundamentally it is based on the assumption that all costs can be classified into variable and fixed. You also have assumption that CVP relationship is linear, prices or unit variable cost fixed cost etcetera do not vary within a reasonable range of operation in is true. So, we should we knowing that range.

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And, volume is the only cost driver, inventory levels that do not change. I had told you that though these assumptions are very important conceptually, you will come across

various cases where we dilute an individual assumption. But, in the beginning it is very important that you know these assumptions and using these assumptions come out with a fair decision making. It is very much useful for decision making provided you go ahead with this assumptions in the beginning ok. Sales mix should also be remain unchanged in that period.

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Now, let us go to the next concept that is known as PV ratio or Profit Volume ratio. There is another name for it also that is known as contribution margin ratio. Now, to understand this ratio first of all you have to understand what is contribution. We know that for every extra unit we are able to recover certain sale price from the customer and we have to incur variable cost for it.

Fixed cost do not change. So, fixed cost can be ignored, but what you are a earning from an extra unit is your sale price and what your paying is variable cost. So, we find difference between sale price and variable cost and what extra you what extra over variable cost is known as a contribution margin, getting it?

So, suppose 10 rupees is a selling price, for earning 10 rupees on one from one unit I have to pay variable cost of 8 rupees. So, 10 minus 8, 2 rupees is a gross profit I have earned. Those of you know accounting we will called it gross profit loosely; here we can almost called it as a contribution. So, 10 minus 8, 2 rupees per unit basis is your contribution. If you convert it as a ratio 2 by 10, 10 is a selling price. So, contribution

margin per unit upon selling price per unit we get percentage. So, 20 percent is known as contribution margin for this example. It is also popularly it is known as PV ratio or profit volume ratio.

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Now, how do you calculate this is a very important calculation for solving any case problem or any problem. So, profit is in total up I am looking at a total line right now. Overall you know that profit is sales minus total cost. Now, we divide total cost into two components variable and fixed.

So, profit is sales minus total variable cost minus total fixed cost. Now, we can calculate you know that contribution margin is total revenue minus total fixed cost. So, what we do is here the sales minus variable cost is nothing, but a contribution margin. So, profit is going to be contribution margin minus fixed cost.

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Sales -Variable Cost Contribution -Fixed Cost Profit	XX (XX) XX (XX) XX (XX) XX	
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Now, it is depicted in this fashion. In a P and L account we compare sales and costs to get profits, but here we consider variability. So, sales minus variable cost give me contribution from contribution deduct fixed cost to get the profit, getting it?

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Now, you can get further equations from this because we know that the upper portion that is comparison of sales and variable cost changes on per unit basis. So, we can incorporate the quantity or number of units there. So, you get this formula: profit is equal

to S minus V into Q minus FC. Remember, FC has nothing to do with quantity it is going to remain irrespective of quantity.

But S minus V that is sale and variable cost is constant on per unit basis. So, S is now defined as a selling price per unit VC or V is a variable cost per unit. So, what we are doing is bracket in bracket we take is S minus V that is on per unit basis and multiply it by Q. Q is a number of units required to be sold for that level of profit, getting it? So, profit is equal to S minus V into bracket into cube minus FC. Now, if you want to know Q, you can use the same equation for calculating desired level of units which is FC plus profit because was FC will go on this side. So, FC plus profit divided by S minus VC; S minus VC is on per unit basis.

So, selling price per unit the example which I was discussing selling price was assumed to be 10, variable cost were assumed to be 8. So, 10 minus 2 on every unit sold we are earning 2 rupees. So, to earn certain level of profit how many units you have to sell, this is how we calculate the desired level of sales. That is also known as profit planning, getting it? So, this is a very important calculation for us known as PV ratio. Now, let us go to the next calculation that is breakeven point.

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Now, breakeven analysis is used to know the minimum level of production required. Every company or every unit or every factory wants to avoid losses. It does not want to go in red. So, it has to produce certain minimum units. Those minimum units are known as breakeven point. Minimum for what? Minimum to avoid being in loss.

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Now, this is useful for finding suitable sales mix. Sales mix in such a way that we avoid losses. It is also useful for calculating the desired level of sales and we can further also tweak it to know the profits at certain levels of sales and prices. Now, from CVP analysis we come to BEP or that level of activity at which revenues recover all variable and fixed costs, but there is no profit.

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So, starting from zero units, we will be in losses. As our units increase a point comes where there is neither profit nor loss that is known as breakeven point. Beyond breakeven point a company or a plant starts making profit.

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Now, breakeven point is also useful just like CVP analysis for various decisions particularly for pricing decisions, make or buy decision, temporary shutdown decision and so on.

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Some more decisions are modernizations or automation decision. So, whether we should go for new machine or no; whether we should go for expansion or no; whether a new product can be launched or no; many of such decisions can be well taken based on CVP or BEP analysis.

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Now, some of the formulas because when you want to solve problems the formulas will come handy. For calculation of BEP our main goal is recovery of fixed costs. So, we take fixed cost in the numerator and divide it by contribution per unit. So, in our example, I had told you that selling price is 10 rupees; variable cost is 8 rupees. So, per unit basis you make a profit of or contribution of 2 rupees. Let us say fixed costs are 1000. So, 1000 upon 2; that means, 500 units becomes your BEP ok.

So, minimum 500 units must be to produced to avoid losses. If you want to calculate BEP as a sales value we are assume fixed cost of 1000. So, 1000 divided by PV ratio? What was the PV ratio? 2 by 10; that means, 20 percent. So, if you divide 1000 by 20 percent 1000 is a fixed cost, 20 percent is a margin you are earning; that means, you must make sales of at least 5000 to avoid losses. When your sales go above 5000 you will start making profit.

Now, BEP in sales value is also very important because many times you may not have an identifiable unit. You may be selling different types of products or different types of

services, but if you know the margin or if you the PV ratio you can calculate the BEP as a sale value ok. So, both the formulas are useful.



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Now, using the knowledge of CVP we can calculate cost-volume-profit graph. Sometimes this is also known as break even chart because we are showing break even here. We have already seen a similar graph. So, wherein a fixed cost line was drawn. So, this is a line of fixed cost. Now, from here onwards a line which goes up is a total cost line. You know that fixed cost line is totally horizontal and total cost line goes up. A revenue line is also drawn that is a red line which starts with 0 and goes up beyond the price crosses the total cost line. So, the point of interaction between the two is a breakeven point.

Actually in the graph slightly that arrow is wrong it shows it somewhere here, but actual breakeven point is this, getting it? Breakeven point is a point where PC and PR that is total cost line and total revenue line intersect or meet each other. This is known as a loss area because when sales are below the breakeven point, then it is a loss, getting me? Why there is a loss because your revenue is still below the total cost only when revenue crosses the total cost that is above breakeven point you reach your profit area. So, the revenue is more than the cost.

Profit area is unlimited as you can increase your units your profits will go on increasing, but loss area is relatively limited because maximum loss which you can make here is equal to your fixed cost. Of course, subject to our assumptions that fixed cost and variable cost do not change; maximum loss is this. Now, this particular breakeven point you can track it on unit basis and on number and on sales basis maybe this line is slightly wrong, but from breakeven point if you take it to units you will know how many units is at what level of units you break even. And, if you take it to sales in rupees, so, we had seen these two formulae; break even in units, break even in sales.

So, from the BE chart that is break even chart you can calculate the breakeven in rupees also and breakeven in units also, getting it?

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Now, let us look at a very simple illustration. So, Krishna Game wants to produce a new toy bike. They have collected some data based on market research; like the likely price per bike is 800, variable cost is 300, fixed cost related to production are 55 lakhs, target profit is 2 lakhs, total estimated sales are 12000 bikes. Now, based on this data try to calculate the breakeven point. For calculating breakeven point of course, you have to calculate the PV ratio also.

So, compute the PV ratio; compute the breakeven point; compute the level of sales required to earn the target profit because at breakeven they will make no profit. Actually they want to make a profit of 2 lakhs; so, what will be the target sales for that profit and what will be profit if with they really achieve estimated sales of 12000. Try to calculate all this things. I think it is just a common sense.

So, if you start from contribution, how much is the contribution? Sale price minus VC per unit that is 800 minus 300, 500 per unit is a contribution. So, every bike they sell, they make a margin of 500. When they sell just 1 bike, they will make a margin of 500. But, keep in mind that they would huge fixed cost; fixed costs are 55 lakhs. So, if they just make 1 bike they will only earn 500. They want to make enough margin to cover 55 lakhs that will be their breakeven point.

So, how will you calculate BEP? Fixed cost divided by contribution per unit so, 55 lakhs upon 500. What is their breakeven point now? You are getting? Is it 10000? So, let us have a look at the calculation. You are asked to calculate all this things.

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Quantity for break even, target profit, PV ratio, BEP and the estimated profit.

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So, we have seen that variable cost to be deducted from Sp you will get contribution per unit of 500. Now, you want to recover 55 lakhs based on a contribution of 500. So, 55 lakhs by 500, you get 11000, that is the breakeven point in terms of quantity. So, if the company is able to sell 11000 bikes they would just be able to breakeven or they would just have enough contribution to match the fixed cost of 55 lakhs, got it?

But, in reality they want to make a profit of 2 lakhs. So, they have to recover 55 lakhs plus make profit of 2 lakhs; that means, they want to recover 57 lakhs. So, 57 lakhs divided by 500, you get 11400. This is called as a target quantity. So, they would like to enter the business only if they can at least reach 11400. Now, you know that estimated sales are 12000.

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So, so, let us calculate first PV ratio. If you take contribution per unit as a percentage of SP that is 500 upon 800 you get PV ratio of 0.625. You can also express it as a percentage that 62.5 percent. Now, breakeven point you may want to calculate it in terms of rupees that is total fixed cost which is 55 lakhs divided by 0.625 you will get 88 lakhs; that means, 88 lakh rupees is a sale to breakeven.

You can cross check it also because 11000 bikes is a BEP quantity multiplied by 800 that is nothing, but rupees 88 lakhs right.

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Now, the last point is what is the estimated profit? They have estimated a sale of 12000, from each unit sold they make 500. So, 12000 into 500; that means, they are likely to earn a contribution of 60 lakhs. From 60 lakhs they have to pay fixed cost of 55 lakhs. So, estimated profit is 5 lakhs. Are you getting me? So, this was a very simple illustration to understand the basic concepts of CVP and BEP analysis.

In our next session, we will continue our discussion on the same topic [FL].