

**Financial Management for Managers**  
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**Lecture 43**  
**Risk Analysis in Capital Budgeting - Part IV**

Welcome all, so in the process of learning about the Risk Analysis and Capital Budgeting Projects tell the previous call we have discussed some techniques, 3 techniques that help us to say analyze the risk in the capital budgeting projects or may be in the investment proposals and there we talked about the Sensitivity analysis Scenario analysis and in the breakeven point we talked about the say accounting breakeven point and we talked about the cash breakeven point.

So and now as I told you in the previous class itself that breakeven point can be calculated in the 3 forms, because it is a very important point breakeven point is a very important point because risk of the project remains largely up to the breakeven point because our focus is always upon that at what level of the sales our cost is equal to is going to be equal to the sales or vice versa or sales are going to be equal to cost of production that is our first approach.

Once we are able to means reach out the stage of the no profit, no loss after that means we can say start thinking about the profitability but even if you are able to recover the investment or may be the cost of production then it creates a problem for us, so break a new point when you talk about the counting breakeven point there we simply talk about the level of the no profit no loss or that point where the firm incurs no profit no loss and the cost of production is equal to the value of the sales or the value of the sales is equal to the cost of the production.

In the accounting breakeven point we discussed that it keep in the numerator the your say fix cost which is being incurred in the cash plus the fixed cost which is non-cash which is depreciation. So we have to recover the full, so for recovering that cash and non-cash fixed cost we divided by the contribution margin which is sales value minus the variable cost and in case of the cash breakeven point we simply can say divide or may be keep in the numerator only the cash fixed cost which currently we are paying for paying of the salaries for the administrative expenses for the general expenses, so all that.

We are to divide those cash fixed expenses being incurred in the current period by the contribution margin again, so we have seen that level of sales, as per the accounting breakeven

point is (9 lakh) 9 million rupees and in case of the cash breakeven point it was 3 million rupees, so it means you can understand what does it mean, that up to 9 million rupees of the sales will be earning no profits.

The firm will not be earning rather this flour mill will not be earning any profits and after say the sales which we make total level of the sales is (18) 1.8 crore or the 18 million, so 18 million sales means up to 50 percent of the sales there is no profit but after for the remaining 50 percent of the sales, yes, there will be giving us the profit and in case of the cash breakeven point where you have to only recover the cash fixed cost we could find out the will be attaining the breakeven point or reaching at the breakeven point very early where by simply what we can say that by selling just for 3 million rupees the cash fix cost will be recovered?

So that was all about the accounting breakeven point or the cash breakeven point. Now as I told you in the previous class itself that now we will be learning about the financial breakeven point. I think you have not heard about the financial breakeven point which you will be I think I guess that you will be hearing for the first time and you will learn also how to calculate the financial breakeven point.

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**BREAK-EVEN ANALYSIS**



• ACCOUNTING BREAK-EVEN ANALYSIS

$$\frac{\text{FIXED COSTS + DEPRECIATION}}{\text{CONTRIBUTION MARGIN RATIO}} = \frac{(1+2)\text{Million}}{0.333} = \text{RS. 9 MILLION}$$

**CASH FLOW FORECAST FOR RAJA FLOUR MILL PROJECT**

	('000)	
	YEAR 0	YEAR 1 - 10
1. INVESTMENT	(20,000)	
2. SALES		18,000
3. VARIABLE COSTS (66 2/3% OF SALES)		12,000
4. FIXED COST		1,000
5. DEPRECIATION		2,000
6. PRE-TAX PROFIT		3,000
7. TAXES		1,000
8. PROFIT AFTER TAX		2,000
9. CASH FLOW FROM OPERATIONS		4,000
10. NET CASH FLOW	(20,000)	4000

• CASH BREAK-EVEN ANALYSIS

And financial breakeven point is different from the accounting breakeven point. And on this the focus is on the NPV of the project, NVP of the project and or the accounting profit under the breakeven point we talk about the accounting profit but under the financial breakeven point we

talk about the NPV of the project and for finding out the financial breakeven point we try to find out that at what level of sales will the project have the say 0 NPV, at what level of the sales the project will have a 0 NPV.

Because in financial terms the breakeven point is seems to have been achieved when the NVP of the firm is 0, so normally also in the NVP analysis our decision making process remains that NPV of the project minimum should be 0, it should not be negative, if it is positive very good but if it is 0 even then we can think about going ahead with the project. So here in case of the financial breakeven point we try to find out the level of sales.

In the other cases we were trying to find out when we discuss NPV and IRR situation or those techniques for the evaluation of the capital budgeting proposals there we discuss so many things, cash flow was the one important criteria, cash out flow and cash inflow and then we had to have the discount rate and other things but here we only try to find out the level of sales. The level of sales which we have to say means finally you can say make in the market which takes a firm to the level of the say NPV, where the NPV becomes 0.



So it means financial breakeven points says that at what level of the sales will the project have a 0 NPV because at present cash outflow how much is going out currently? How much is the cash outflow that is in both the cases the current cash outflow means the cash outflow in cash as well as the in terms of the non-cash that is the depreciation cost, so both we have to try to find out that the total outflow has to be compared with the present value of the inflows.

And we want to find out that level of sales where the NPV of the firm will be 0, so how we can find out that level of sales? Where the NPV of the firm will be 0? That can be easily understood or can be say realized by means taking this example forward, for example I am again taking the figures of this Raja cash flows particularly, cash flow figures of Raja Flour mill and this flour mill project will help us to understand that how to calculate the say financial breakeven point and then means will be calculating here by taking these particulars these information given to us will be calculating that how the financial breakeven point can be calculated.

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Financial B.E.P

1. V. costs = 66.67% of Sales
2. Contribution = 33.33% of Sales
3. Fixed cost = Rs. 1 Million
4. Dep. = Rs. 2 M
5. Pre-tax Profit =  $(0.333 \times \text{Sales}) - \text{Rs. 3M}$
6. Tax rate @ (33.33%) =  $\frac{0.333(0.333 \text{ Sales} - \text{Rs. 3M})}{0.333(0.333 \text{ Sales} - \text{Rs. 3M})}$
7. PAT =  $0.667(0.333 \text{ Sales} - \text{Rs. 3M})$
8. Cash flow (CF) =  $\text{Rs. 2M} + 0.667(0.333 \text{ Sales} - \text{Rs. 3M})$   
 $= 0.222 \text{ Sales}$
9. PV(CF) =  $0.222 \text{ Sales} \times \text{PVIFA}(10 \text{ years}, 12\%)$   
 $= 1.9543 \text{ Sales}$

### BREAK-EVEN ANALYSIS



• ACCOUNTING BREAK-EVEN ANALYSIS

$$\frac{\text{FIXED COSTS} + \text{DEPRECIATION}}{\text{CONTRIBUTION MARGIN RATIO}} = \frac{(1 + 2) \text{ Million}}{0.333} = \text{RS. 9 MILLION}$$

CASH FLOW FORECAST FOR RAJA FLOUR MILL PROJECT

	YEAR 0	YEAR 1 - 10
1. INVESTMENT	(20,000)	
2. SALES		18,000
3. VARIABLE COSTS (66.7% OF SALES)		12,000
4. FIXED COST		1,000
5. DEPRECIATION		2,000
6. PRE-TAX PROFIT		3,000
7. TAXES		1,000
8. PROFIT AFTER TAX		2,000
9. CASH FLOW FROM OPERATIONS		4,000
10. NET CASH FLOW	(20,000)	4000

• CASH BREAK-EVEN ANALYSIS

So financial breakeven point, so we have to calculate the financial breakeven points, so we are taking the example of this previous one which we used for calculating the accounting breakeven point and the cash breakeven point. With the help of same example will be calculating the financial breakeven point. So first of all what we have to see here is, what is the variable cost? If you talk about the variable cost it is how much?

Variable cost is in terms of percentage it is 66.67 percent, variable cost is 66.67 percent it is already given to us. So we have to take this cost and we start with this variable cost because it is important, this cost is important to calculate something which is called as contribution. And for

calculating the breakeven point because breakeven point is basically a concept of marginal costing right and in the marginal costing we do not end up directly to say a jump to calculate the profits by subtracting the total cost from the sales or we move step by step.

So from the total sales we subtract the variable cost, we arrive at something which is called as contribution and that contribution is called as contribution or why it is called as contribution? Because that contribution is a contribution towards meeting the fixed cost, so we would like absorption costing, in the absorption costing we subtract the total cost, variable plus fixed from the selling price or the sales value.

So we end up directly to the profit but in this case for calculating the breakeven point we follow the contribution approach and in the contribution approach we take the sales first which is already given to us or calculated and then from that at the first go we subtract the contribution and that is called as a contribution because that is a contribution towards meeting the fixed cost and from the contribution when you subtract the fixed cost you are at the level of the or you are able to find out the profit, operating profit. So same processing will follow here that is variable cost 66.67 percent.

Number 2 is now we have to find out the contribution, contribution we have to find out the contribution and in the contribution how we can find out the contribution! Because if this is the level of the variable cost so it means the level of the contribution is already means you can find out that is sales minus variable cost. So sales are 100, so means in terms of percentage and variable cost is 66.67 percent of the variable cost, it means contribution is 33.33 percent of sales, this is the 67 percent you can say of sales.

And it is the 33 percent of again sales and then we have to now take into account the third thing that is the fixed cost. Fixed cost is how much? Fixed cost is rupees how much? 1 million, fixed cost is rupees 1 million, it is given to us, if you go back to the problem this is the fixed cost which is given to us this is 1 million and this is a depreciation 2 million we are taking this, so fixed is rupees 1 million and number 4 is the depreciation.

And depreciation if you take is how much? That is rupees 2 million, this is rupees 2 million. So number 5 pre-tax profit, pre-tax profit or profit before tax. If you calculate the pre-tax profit here you can easily calculate like 0.333 into sales 0.333 into sales the information is given is the, into

sales minus something we have to write here is rupees 3 millions, 0.33 percent of sales is the contribution, this is the contribution and this is the fixed cost.

This is contribution and this is the fixed cost, so finally what will be the net result when you from the contribution when you subtract the fixed cost you will be arrived at something which is called as the pre-tax profit and now we go for the tax rate, let us go for the tax rate, what is the tax rate here? Tax rate we are assuming here is it is only given I think tax rate yes it is given here taxes we have calculated is the 1000.

So against the pre-tax profit of 3000, if the tax is 1000 it means the tax rate is 33.33 percent, so tax at the rate of 33.33 percent, at the rate of 33.33 percent this is the tax at this rate we have to calculate the tax of this rate of the percentage and if you calculate this tax rate percentage you can calculate that what is going to be the tax value, so this is the in the percentage terms? So if you take the tax here at the rate of 33.33 percent so it will be how much?

You can say that is 0.333 again into now you take this amount, this-this right, so we take these 3 values here and 0.333 because again we have to write the same figure so it is a tax part and 0.33 of sales because we are multiplying this our equation same and minus how much? Rupees 3 million which is the fixed cost minus 3 millions is the fixed cost, so this is the tax rate, this is the contribution margin and this is the fixed cost, so it means this component becomes, component inside the bracket becomes the profit before tax, pre-tax profit and then the tax rate when we are multiplying with 0.333.

So you are finally coming up with the something which is called as profit after tax PAT, we are calculating the PAT profit after tax which will be 0.667 and other things remaining is the same 0.333 that is the profit after tax 0.667 into 0.333 sales minus (3 rupees) 3 millions minus rupees 3 millions that becomes the profit after tax because it is the 0.33 is the tax rate, so profit after tax is the to 1 minus 0.333 is equal to say (67) 66.67 percent of the profit is means pre-tax profit is going to be the post-tax profit.

Because one third of the profit is paid as the tax, as we have paid in the previous this thing, we have also paid out of the pre-tax profit we have paid the 1000 which is the 33.33 percent of tax, so pre-tax profit we have calculated. Now we are going to calculate the cash flow they are going

to calculate the cash flow, so what is the cash flow now available with us? This would be you can say column number 4 plus column number 7.

Column number 4 is what? Depreciation, column number 7 is PAT, so what is PAT, so what is the depreciation here? This is rupees 2 million plus we are taking this same amount 0.667 into 0.33 of sales this is of the sales 0.33 of the sales minus 3 millions, minus 3 million so if you take this total amount here will be able to find out the final cash flow amount and if you take the final cash flow amount you have to means in this what is the profit after tax?

In this profit after tax you have to add up the depreciation amount which is a non-cash expense so this becomes the cash flow which is some total of it if you solve this, this will become as 0.22 of sales, this is the cash flow we have already calculated, so it means this cash flow is we have calculated from this entire analysis and this cash flow is only for 1 year. But what is the life of the project here? We are assuming here the life of the project is 1 to 10 years means 10 years.

So it means for all the 10 years this much of the cash flow will be coming what the firm will be earning, so what we have to do now is, you have to calculate the present value of cash flow, present value of the cash flow, so if you calculate the present value of the cash flow, so what you have to do is because it is going to be NOT, so you have to do is 0.22 of sales right, so what we have take here as the present value, interest factor for NOT and that is for how much?

For 10 years period of time and at the rate of how much, 12 percent? That is given to us the discount rate is given to us is the 12 percent or we have already assumed it as 12 percent, so it means if you say discount it as NOT because we have taken here as that is the present value interest factor for NOT for a period of 10 years and the discount rate is 12 percent, so if you discount this by applying this discount rate of the 12 percent for a period of 10 years, so you will be coming up here with the value of something which is called as 1.254 sales of the sales.

1.254 of the sales, so it means we have got this amount 1.254 of the sales and this amount is called as the present value of the cash flows arising out of the say project. So now what we have to do is, our objective is to find out the cash sorry financial breakeven point and as I told you the financial breakeven point is objective of finding out the financial breakeven point is 2, find out that level of sales where the present value of the project is 0.

So it means in this case you can say now we have to find out the present value of the sales where the NPV of the project is you can call it as NPV of the say we have to find out the amount of the sales where the NPV of the project is 0, so in this case what we have to do is, what is your total investment we are making in the project? The investment we are making here is of the 20 millions.

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Handwritten calculations on a whiteboard:

$$PV(C/F) = \text{Investment} -$$

$$1.254 \text{ Sales} = \text{Rs } 20 \text{ million}$$

$$\text{Sales} = \text{Rs } 15.95 \text{ Millions} \quad \text{f B.E.P.}$$

$$\checkmark \text{ A.D.E.P.} = 9 \text{ M}$$

$$\checkmark \text{ C.A.B.E.I} = 3 \text{ M}$$

$$\text{f.c + Dep.} = 1 \text{ M}$$

$$\frac{\text{f.c + Dep.}}{\text{C.M.R.}} = \frac{1+2}{0.333}$$

$$\text{Approx } 7 \text{ M}$$

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Handwritten calculations for Financial BEP:

Financial B E P

- V. costs = 66.67% of sales
- Contribution = 33.33% of sales
- fixed cost = Rs. 1 million
- dep. = Rs 2 M
- Pre-tax Profit =  $\frac{(0.333 \times \text{sales}) - \text{Rs } 2 \text{ million}}{\text{C}}$
- Tax rate @ 33.33% =  $0.333(1.333 \text{ sales} - \text{Rs } 3 \text{ M})$
- PAT =  $0.667(0.333 \text{ sales} - \text{Rs } 3 \text{ M})$
- Cash flow (4+7) =  $\text{Rs } 2 \text{ M} + 0.667(0.333 \text{ sales} - 3 \text{ M})$   
=  $0.222 \text{ sales}$
- PV(C.F) =  $0.222 \text{ sales} \times \text{PVIFA}(10 \text{ year}, 12\%)$   
=  $1.254 \text{ sales}$

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So it means the formula can be for the financial breakeven point present value of cash flows should be equal to some total of, means present value of all the cash flow should be equal to the investment. So it means if you take this as the investment it should be equal to the investments,



so if you take the investment here, so this is the investment. What is the present value of cash flow? We have already got the present value of cash flow is here and this is the present value of cash flows which is 1.254 of the sales, we can again means if you write it we will say that this is the present value of the sales, that is 1.254 sales this is the present value of the cash flows.

So now what you have to do is, present value of the cash flows is who much? 1.254 sales is equal to, how much is the investment? Initial investment is how much? Rupees 20 millions, this investment is the rupees 20 millions, so it means if you solve this entire process you will be able to find out level of sales will be here is how much? Rupees 15.95 millions, if you solve this it will come up as rupees 15.95 million, so what this is the figure of the 15.95 millions?

This figure of 15.95 millions, we have got some figure which is called as the sales and this is a value of the 15.95, so it means this is the financial breakeven point that a point of means the amount of sales which will take the NPV of the project to the 0 level or the level of sales where the NPV of the project will be 0 is 15.95 millions is 15.95 millions and if you compare it with the accounting breakeven point, if you compare with the accounting BEP how much was it?

If you recall it accounting BEP was how much? Accounting BEP was if you recall that figure that was 9 millions, it was 9 millions and if you call about the cash breakeven point it was 3 millions. So these are the 3 figures, this is called as the financial breakeven point F BEP, this is the financial breakeven point, this is the accounting breakeven point and this is the cash breakeven point, so this is the lowest one which is the 3 million rupees and why it is a lowest one?

Because we followed the formula that is the fixed cost divide by the contribution margin ratio CMR and in this case we talked about the fixed cost which was only 1 million which was the cash fixed cost, so we have to recover only the smallest amount only 1 million from the contribution margin ratio, so because of this reason we were able to reach at the cash breakeven point by just selling the total amount of or the total product of or by attaining the level of sales that is equal to 3 millions.

Further we add it, in this one more thing which is called as depreciation, so if we came something like this fixed cost plus depreciation this became the accounting breakeven point and contribution margin ratio remained the same, so what happened our say here in this case 1 plus 2

plus the contribution margin we have to say means this ratio was the contribution margin ratio was this, so then we have to recover this it means your fixed cost level bent y 2 more times so it became to 3 times of the of this level when we have to recover this.

So it means in this case we have to means sell more and according to this level or to attain this level of the say contribution to recover the fixed cost which is the cash plus non-cash fixed cost, so we have to increase the level of sales that this level of the fixed cost will be possible to recover if we are selling worth rupees 9 million rupees. But you see the main point of comparison is between this figure and the, this figure.

Here accounting breakeven point says that we are reaching at the breakeven point by just selling for 9 million rupees but in case of the financial breakeven point we say that we have to sell for about approximately 16 million rupees. So there is a difference of how much? Approximately 7 million rupees, approximately 7 million rupees of the sales, why this difference of the 7 million rupees of the sales is there?

The reason for the difference is that in the accounting breakeven point we have not calculated the present value of the cash flows, we have not discounted the cash flows accounting breakeven point you can say it is a non-discounted criteria, it is the non-discounted criteria and the financial breakeven point is the discounted criteria. So when you are calculating the present value of the cash flows, so it means the total amount which we are showing the cash flows whatever that amount of the cash flows is coming to us that is with the value of that is decreasing because we are discounting against the cost of capital and that is 12 percent.

So when you are discounting, so it means the value to be added into the cash flows means as per the present value of the cash flows that values is coming down, so that is the only reason that to attain the financial breakeven point in terms of NPV, so that means that level of sales where the NPV of the firm becomes 0, we have to sell more and this is the real analysis here that actually the cash flows have to be means considered as the discounted cash flows not as the non-discounted cash flows.

That is why always when we talk about even the capital budgeting proposals evaluation of the capital budgeting proposals there also we more believe into the discounted criteria rather than the non-discounted criteria and that is the main difference means explain here also that accounting

breakeven point is a non-discounted criteria and the financial breakeven point is a discounted criteria and that is why level of sales is different.

In one case you have to sell for 16 million then you are reaching at the breakeven point and that is the real means comparison, in the other case you have to means only sell for 9 million at 50 percent of sales you are reaching at the breakeven point in case of the accounting breakeven point which is a non-discounted criteria but to arrive at the say financial breakeven point or as per the financial breakeven point we have to sell as high as 16 million worth of the sales to arrive at the financial breakeven point.

So the point of difference here is that the level of sales has increased tremendously almost touching double or 90 percent of the say accounting breakeven sales because the cash flows considered here are the discounted cash flows that is why the your financial breakeven level has gone up from the 9 million of the sales to the say almost 16 million of the sales to attain the accounting to attain the financial breakeven point.

But I think you have to clearly understood it because financial overall breakeven energy is a very-very important analysis and in the risk analysis also breakeven helps us to understand that at what level of sales we are able to recover the our investment or the cost. So in case of the accounting breakeven point we talk about the recurring cost, the current cost. We forget the investment cost that is you call it as reconsider it as sum-cost.

But whatever the say current cost is there that is the fixed cost in terms of the, your say cash fixed cost and the depreciation that we are more concerned about. So we take into account the variable expenses, we take into account the fixed expenses and then we try to calculate the accounting breakeven point and you can say that accounting breakeven point is basically the or any breakeven point is basically the any breakeven point is basically the replica with the of the payback period.

In the payback period also we arrive at the level of sales where we are going to recover our investment our cost. In one way you call it as investment and in one way you call it as the cost, so in the breakeven point also we are talking about at what level of sales we are going to recover the cost? Or when we are going to reach at the breakeven point where the cost of production is equal to the level of sales or sales are equal to the level of the cost of production.

Because that is the most important point, once our whole investment is recovered after that now we have to only think about the profitability and if the project is going on production is going on and we have the capacity to produce and sell more in the market so remaining amount of the sales will give us the profit. So it means if our own investment is recovered it means level of the risk has almost becomes 0 at least we are not going to lose our own investment and if the profitability is concern it can be more or it can be less.

But it is going to be a profit but risk is going to be or if the situation which is going to create means a situation or the situation which comes up as that if you are able to recover our own investment also then that is a grave situation and is a very serious situation, so in the breakeven point we are more concern then why it is a risk analysis tool because we are more concern first about the recovery of our own investment.

Once it stands the recover after that we have to think about the profits whether the profits are a high or profits are low or they are not right we are means concern but not that much as we are concerned about the recovery of our own investment. So focus has to be first we have to try to find out that level of sales, we are going to recover our own investment. Once the investment stands is recovered after that how much profit is available from the project?

There you talk about means the profitability but risk stands fully means taken care of and now the investment is not going to be a risky investment. So these are the 3 techniques we talked about is the sensitivity analysis, scenario analysis and the breakeven analysis where we learned about the 3 breakeven points. After this we will talk about some complex risk analysis tools.

I will touch upon those risk analysis tools not in detailed manner but yes means to the extent possible I will try to explain them but because we are studying the risk analysis and the capital budgeting so they are equally important or at least being a student of finance or financial management we should have an idea that how many different techniques are there to say look for the risk analysis of the capital budgeting projects.

So most importantly used are 3 only sensitivity analysis, scenario analysis and breakeven analysis but these other techniques are also there and it should have an idea that other techniques are also there, so after this I will talk to you is the fourth technique, technique of a risk analysis

that is the Hillers model then we will learn about the stimulation and then we will learn about the decision tree analysis.

These 3 more techniques I will talk to you and after that will close the discussion on the this particular topic that is the risk analysis of the capital budgeting projects, so these remaining 3 techniques Hillers model and then the stimulation and the decision tree analysis I will discuss with you in the subsequent classes, till then thank you very much.