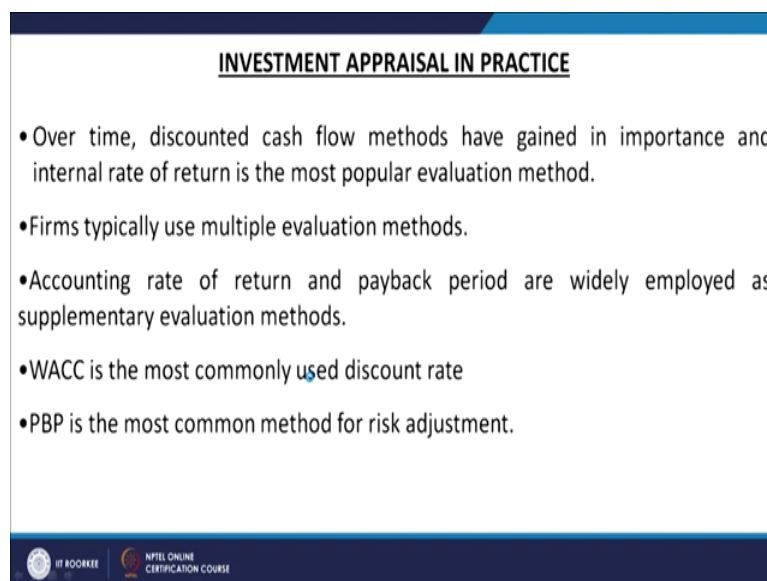**Financial Management for Managers**
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Lecture 26
Capital Budgeting Part 10

Welcome all. So, now, we are say in the process of completing the discussion on the capital budgeting techniques or the evaluation of the say capital budgeting proposals or the capital expenditure proposals. So, in the last part of the discussion, I completed the discussion on all the say methods that is three discounted criteria and the two non-discounted criteria. And now, as I told you that in the next two, three classes we will discuss some practical problems.

But before that I would like to conclude it the discussion on that with some observations about say investment appraisal in the practice or the which criteria, which method and how the investment appraisal in practice takes place that I am going to discuss with you this criteria which is in the practices is reported in the book by a say "Prasanna Chandra", "Financial Management by Prasanna Chandra", I have taken these points from that book only.

And that is because that book is say regularly updated book means Prasanna Chandra regularly updates that book. So, it provides us very interesting and updated information I would advise you all of you to means purchase that book and make use of that. So, in that book, some practical surveys, the results of the practical surveys are given here.

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So, one say some important observations which are here with regard to the investment appraisal criteria in practice, they are here and say the first important point if you look at overtime, discounted cash flow methods have gained in importance and the internal rate of return is the most popular evaluation method and the internal rate of return is the most popular and popular method. So, one observation is that discounted rate of return are more popular because of the say important consideration there the time value of money.

So, they are the most important things and the internal rate of return is the most important criteria there. So, this is the one important observation. That is why I told you many times that internal rate of return being in percentage terms, it say facilitates a comparison, means more easily and more you can call it as logically as compared to the net present value, which gives us the NPV in the absolute terms.

So, because IRR though it has number of limitations, so we have to find out or we have to calculate the modified IRR. If the simple IRR is not possible to be worked out, because of the cash outflows or the investment to be made in the multiple durations or at the multiple points even after the launching of the project.

So, there we can use a modified internal rate of return, but IRR is the more popular as against NPV, but in overall you can say discounted criterias are more acceptable and popular to the people as compared to the non-discounted criteria. Firms typically use multiple evaluation methods. This also I have discussed with you that is only, not only the discounted criteria, but for the reference we use the non-discounted criteria also and they are the PBP method is largely used. So, we can normally, what we do?

We can use either of the say methods of the discounted criteria either NPV or the IRR and some of the methods of the non-discounted criteria like payback period method. So, it means in that way we can evaluate the investment proposals by using more than one methods, not only one method and then we can try to find out that how the project is responding or expected to respond and how it will be means the financially looking like. So, we have to use the multiple criteria.

Third important point here is, accounting rate of return and payback period are widely employed as supplementary evaluation methods. I told you already that accounting rate of return and payback period are widely employed as the supplementary evaluation methods.

So, in these two also, payback period is more important as compared to accounting rate of return.

Because in the accounting rate of return this analysis is based upon the say the accounting profit and the difference between the accounting profit and the real profit I have discussed with you that that is not the cash profit. Because when you talk about the payback period method, we take into account the cash flows which includes the profit also.

But in the accounting rate of return, we take into account the profit after tax, average profit after tax which is only nominal profit accounting profit, not the real profit and sometime because of that limitation we do not use that. So, you can say some of the internal rate of return and then along with that payback period method we normally use.

Weighted average cost of capital is most commonly used as a discount rate. I have already discussed with you that how to discount your cash flows. We have to find out some discount rate and discount rate is basically the weighted average cost of capital and we discount the cash flows with the help of WACC.

We will have a long discussion on the weighted average cost of capital that while say there is a separate part, I have put assigned some hours. For discussing the cost of capital that is the independent topic called as the cost of capital and how to calculate the cost of capital, what are the important considerations to be borne in mind while calculating the cost of capital.

So, there, say weighted average cost of capital concept we will also discuss and entirely it will be a full-fledged discussion on the cost of capital because it is a independent topic and financial management and in our course plan also. So, there I will discuss, I will throw light on the WACC. But here for the reference, that discount rate that when we say that cash flow in the first year is 1 lakh rupees divided by 1 plus R. So, what is R? R is basically the discount rate and that discount rate is basically the weighted average cost of capital.

PBP is the most common method for risk adjustment. PBP is the most common method for the risk adjustment because we talk in terms of the time duration. I discussed with you that longer the time of the recovery of the investment from any project higher is the risk involved, higher is the risk involved.

Because if you are going to recover the investment from any project in the next 6 years, and in any project in the next 3 years, So, which one is less riskier, where the lesser time period is

involved? So, we check with the help of payback period method. We try to find out in how many years our investment is going to get back and shorter the period better it is for the evolution of the project and say preferring the project.

Because first of all, every investor is concerned about the recovery of his investment. Later on, we talk about the growth, first is the recovery that how much I am investing that should come back to me, after that if there is any surplus say inflow is available then fine, very good, that will be called as my NPV.

But first I would like to know that when the NPV is going to be 0. So, and 0 NPV, I am more concerned about it. And here when you are talking about the risk and the returns. So, it is directly linked to the duration of the project, longer the duration of the project. It means longer the duration of the project, it means you can say more risker the project is and shorter the duration of the project, lesser risk of the project.

And it means in this whole case, when we talk about the duration of the project, you can directly find out with the help of payback period method. That which project is helping us to recover the investment in the shorter period of time. That project is less riskier.

So, that is why we are more focused and concerned about by using the payback period method about the recovery of the investment, where you can say in a say that project is attaining the breakeven point, project is at the say having the NPV 0. So, it means we are concerned about the positive NPV, but first we are concerned about the 0 NPV where my outflows are equal to the present value of inflows or vice versa and my investment stands recovered. So, this, these are some important points about the investment appraisal in practice.

So, you can understand that how out of the 5 methods, 3 the discounted criteria methods and 2 are the non-discounted criteria methods, how they are being used in the practice, or they are in the say practice or they are in the walk. And if we want to really evaluate any capital investment proposal tomorrow in our life, which method to use, how to use it, and how to take the decisions. So, with this, I complete the conceptual discussion.

And now, as I have already told you, in the next two, three classes, we will do some practical problems with regard to the capital budgeting proposals. And after that, we will close the discussion on this particular topic. And I will move to the next topic that is the assessment or evaluation of the cash flows of the capital investment proposals.

Capital Budgeting Problems

Problem 1.

The expected cash flow of a project are as follows:

Years	Cash flow
0	-100000
1	20,000
2	30,000
3	40,000
4	50,000
5	30,000

The cost of capital is 12 percent.

Required:

(a) Calculate Net present value (b) Benefit-cost ratio (c) Internal rate of return (d) Modified IRR (e) Pay back period and (f) Discounted PBP.

Problem 2.

Raja international wishes to evaluate a capital project whose expected cash flows are as follows:

Years	Cash flow
0	-10,00,000
1	1,00,000
2	2,00,000
3	3,00,000
4	6,00,000
5	3,00,000

Required:

a) What is the NPV of the project if, the discount rate is 14 percent for the entire period?
b) What is the NPV of the project if, the discount rate is 12 percent for the year 1 and rises every year by 1 percent?

So, now, when you talk about say some practical problems with regard to the capital budgeting, I have got this one problem here. And this problem says that it is a very simple problem, but you have to calculate all the five things, you have to calculate all the five things. So, these are, this is a very simple a proposal and capital investment proposals are otherwise very simple.

But only complexity comes here for calculating these values, for calculating these cash inflows, you have to do a thorough analysis. And then this also is not easy job, because capital investment, for calculating that you have to do the market and demand analysis, technical analysis, then profitability analysis, means this financial analysis.

So, all this analysis require, required to be done and this this all is means what we are involved here, showing here is the part of the DPFR - Detailed Project Feasibility Report. So, calculating these cash flows is not very easy job, once these cash flows are available and this is we are going to learn in the next say topic. Next topic is a, say assessment of the cash flows and the capital investment proposals.

So, we learned there that how we identify or how we calculate the cash outflows, the investments to be made in any capital investment proposal and how to work out the cash inflows available from those capital say investment proposals.

So, this, if it is available with us if the cash outflow and cash inflow information is available with us, then we can say easily apply the discounted or non-discounted criteria of the capital budgeting or out of the capital budgeting techniques and we can take the decision that whether to go for the project or whether to no, not to go for this particular investment. So, in this case, we are given here that the expected cash flow of a project are as follows.

Cash outflow is in the 0 period is 1 lakh rupees and then other cash inflows over the next five years in the first year it is 20,000, second year it is 30,000, third year it is 40,000 and fourth year it is 50,000, fifth year it is 30,000 rupees. These cash flows are available. So, it means, when you are saying that this sorry this is not 1 million, but this is a 1 lakh rupees. So, out of this inflow, outflow of the 1 lakh rupees we are talking about here is that how much is inflow available over a period of time, we have the inflow of the 20000, 30000, 40000, 50000 and 30000 rupees inflow is available.

So, against this outflow of or the investment of 1 lakh rupees, we are getting this much back. So, we have to evaluate this project, if the cost of capital is 12 percent. If the cost of capital is 12 percent, then we have to calculate the net present value, benefit cost ratio, internal rate of return, modified internal rate of return, payback period and the discounted payback period, we have to find out all the one, two, three, four, five and six things here. So, information about the cash outflow and inflow is given to us and we have to evaluate this.

So, for, means applying this concept here, what we have to do here is, we have to solve this and we have to say find out the answer to all these problems. So, here when you go ahead with this particular part, we have the next problem here also, but first we will solve this and then we will move to the second problem.

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So, in this case, let us solve this and try to find out. So, first of all, what is the first requirement? What is the NPV? The NPV of the project or the net present value out of this project, how much investment we are making? 1 lakh rupees, and how much is the inflow available that is different figures over a period of next 5 years and the cost of capital is how much? Cost of capital is 12 percent.

So, we have to, the discount rate which we have to use is that is 12 percent. So, it means in this case how can you do it? You can apply the formula simply that for calculating the NPV, how you have to do is? NPV of the project is equal to minus 100,000 which is the investment initial investment we have made here. Plus what is a cash flow available from the first year? It is 20, 30. So it is 20,000 available cash inflow, 20,000 in the first year. Discount rate by

1.12 that is 1 plus R and since it is first year so no power, only 1 and which we do not write here, plus we have got here is 30,000 and you have to discount it also and it is 1 plus 0.12 power 2.

And then we have to take the next outflow, sorry inflow and this is 40,000 it is 1.12. And it is power 3, then it is the next one is the 50,000, next cash flow is 50,000 divided by 1.12 power 4 and then continuing with this 5 the next part and this is, so, what is the cash flow? 20, 30, 40, 50; 20, 30, 40, 50 and then it is 30, then it is 30,000 and it is 1.12 and power it is 5, power it is 5.

So, if you want to take here is now, this is minus 1 lakh then it is plus, now we have to find out the values of this. When you find out the discounted value of it, 20,000 has come down to 17,860, this is the one value 17,860, then it is 23,910, if you do this, this value is this is because of this and second value is because of this.

If you discount 40,000, 40,000 after discounting for a means for a period of 3 years, by 1.12, so it means this amount comes up as 31,800 this amount will become 31,800 and next and the last one is, we have got is how much? First one is we have got is 17,860, this is because of this, second one is we have what is the 23,910 and yes third year, one we have say forgotten one part and 1 is the this cash inflow is going to be the third year and third year is the cash inflow is how much?

Third year cash inflow is going to be this inflow is 40,000. So, when you are discounting the 40,000 you are left with something called as 28,480. And then you have the next one and next one is 50,000, when you are discounting at 1.15 this is called as remaining or coming down to 31.800.

And then is the next figure if you talk about the next figure 30,000. So 30,000 when you are discounting you are getting back is how much, the time value of money is 17010, 17010 is the value. So, you can find out what is now the NPV of the project. So, let us again check it up, when your (inves) making the investment of 1 lakh rupees, 1 lakh is the, 1 lakh in the 0 period, then when you are getting the first inflow of 20,000 rupees and discounting it at the rate of 1., means at the rate of 12 percent with 1.12 dividing it by 1.12, it is coming down to 17,860.

Next is 30,000 discounted at 12 percent, 23,910 and then we have got 40,000 discounted by 1.12, so it means the next figure is coming up at 28,480 and the next figure, inflow is 50,000

discounted at 12 percent. This is 31 point, 31,800. And then the last is 50,000, sorry 30,000 when discounted at 12 percent, this comes down to this amount comes down to 17,010.

So, if you total it up, if you calculate the total NPV these are the 5 positive figures and this is the 1 negative figure, if you sum these up and minus 1 lakh rupees, so NPV of the project comes up here is somewhere 19,060 rupees, 19,060 rupees is the net present value of this project. Very simple means you have you should have the information about the cash outflows and cash inflows and calculating the say applying the discounting criteria after that or evaluating their proposal is not a difficult job.

Next thing is the benefit cost ratio, BCR, next requirement is calculating the benefit cost ratio what is required here? Calculate the benefit cost ratio. So, if you calculate the benefit cost ratio here, so how much you are getting here? It means, if the NPV is 19,060 it means in this case benefit cost ratio, we are not talking about the net benefit cost ratio, we are talking about the benefit cost ratio. So, we have to apply the formula is present value of benefits divided by initial investment. So, what is the present value of benefits? 19,060 is NPV and the total investment is 1 lakh rupees.

So, it means this has come up means it is clear to us that the present value of benefits must be 119060 and divided by the initial investment, what is the initial investment that is 1 lakh rupees. So, this ratio comes up as roughly you can call it as 1.19 this ratio is called as the 1.19. So, it means if the benefit cost ratio is 1.19, so if you calculating the net benefit cost ratio, what you have to do is the benefit cost ratio BCR minus 1.

So, if you do this, so, it means benefit cost ratio is 1.19 minus 1 is equal to 0.19 this ratio is 0.19. So, it means this ratio is more than 1. So, you can say the ratio is positive and the benefit cost ratio is 1.19 which can be easily calculated with the help of the say present value of the benefits whatever the discounted cash flows you have calculated.

For example, if you forget this 1 lakh rupees for a moment, then this plus this plus this plus this plus this becomes 119060 and from say when you divide this 119060 which is called as the present value of benefits, if you are dividing it 1 lakh rupees, the benefit cost ratio is 1.19 and net benefit cost ratio is benefit cost ratio minus 1 is equal to 0.19. These are the two questions we have answered here.

And then what is the next thing we have to try to find out here? To find out the internal rate of return, to find out the internal rate of return and for calculating the internal rate of return here, if you means, we can apply or try the different rates. And if you apply the means our job is to find out the internal rate of return - IRR.

So, because the processes you know, that is the trial and error we have to apply, you have to apply different rates and then you have to see that where the present value of the outflows is equal to the present value of inflows, we have to find out the point where the NPV of the project is 0. That is called as the internal rate of return.

For calculating the internal rate of return here, for example, we have already tested and tried it here. So, if you apply the 18 percent internal rate of return, then NPV comes here as 1750,

if you apply the internal rate of return, NPV comes up here as the 1750 and if you apply a discount rate of 19 percent, not 18 percent if you apply the discount rate of 19 percent, so this NPV will come here as, this NPV will become negative.

Means you can do the detailed calculation and if you try to find it out, then the say, if you if you say try to find out, it will become as minus 780, this will become minus 780. So, this is positive, this is negative, it means it is very clear cut idea, that IRR is somewhere between 18 percent and 19 percent.

It is somewhere between 18 percent and 19 percent and we have to find out the exact rate now here that is the exact internal rate of return. So, how can you find it? 18 percent that is a lower rate of return at which the NPV is positive and then you have to take 1 plus sum of these 2, sum of these 2 by say ignoring the minus sign, this becomes, this amount becomes is the what is NPV at the lower rate of return, that is the 1750 and sum is 2530, sum is 2530 and then the higher rate of return minus lower rate of return and in this case this becomes the 1 percent, this becomes the 1 percent.

So, if you solve this, you will get some interest rate here internal rate of return which will be very clear something like this will be something like 18.69, it will be 18.69 percent. So, internal rate of return available from this investment proposal or this particular capital expenditure proposal is 18.69 percent, very good.

So, it means it is clear and we can calculate the, we learned how to calculate the NPV, how to calculate the benefit cost ratio, how to calculate the internal rate of return, we have already discussed this process, we are applying it to some say project evaluation process and we have calculated it and we have done it.

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Now, next thing asked to be done in this case is how much? Modified internal rate of return. If you have to calculate the modified internal rate of return, so it means, in this case, if you want to find out the modified internal rate of return, you can, you have to find it out that how much is the investment available here. And if you try to find out the investment out of this say entire process, you have to calculate for modified rate of return you have to calculate two important things.

One important thing you have to calculate is the present value of the cost and second thing is means in the modified internal rate of return, what we are required to calculate? Present value of the cost and second thing is the terminal value, we have to calculate the terminal value, we have to calculate the two values here and if you calculate the terminal value, and then you calculate the say present value of the cost. So, ultimately we can apply this modified internal rate of return.

So, you have to for calculating the terminal value, you have to calculate the future values, future value of the benefits, whatever the benefits coming out of, what are the cash flows coming out of this project, they are called as the benefits. So, we have to calculate the future value of those benefits all those cash inflows, this compound compounded at 12 percent.

Here now for calculating the say modified internal rate of return, we apply the concept of compounding, not the concept of discounting. Discounting is only for calculating the present value of the cost, there we apply the concept of discounting and further calculating the terminal value, we apply that concept of compounding. So, we have to calculate the future value compounded at 12 percent rate of interest for all the cash inflows, then you have to apply the model of MIRR.

So, let us calculate this future value, sorry terminal value. So, for calculating the (compund) compounded value or the terminal value TV, what you have to do is, you have to take the first inflow is how much, 20,000. If you look at the first inflow is 20,000. So, you have to take this 20,000 and you have to now multiply by 1.12 earlier for discounting we divide and now you have to multiply but this 25, so 20,000 is coming when? In the first year and this is going to be re-invested for how many more years? 4 years.

So, you have to compound it for 4 years, plus next inflow available is 30,000. 30,000 again, you have to compound at the rate of 1.12 but for a period of 3 years. Because this cash flow we are going to re-invest back for a period of 3 years. Then we have to take here the next

inflow and that inflow is 40,000; 40,000 into 1.12 and we are going to compound it for a period of how many, 40,000 into 1.12; 40,000 into if you take care this particular part, 40,000 is into 1.12, 40,000 into 1.12 power 2, so you have to compound it only for 2 years.

And then is next one is plus 50,000. 50,000 is going to come to us in which year? This is going to come to us in the say, after 0 year, it is coming to us at the end of the fifth year, so it fourth year, so you are investigate only for how many years? You are investigate only for 1 year. So, it means we are going to compounded for 1 year and that is 1.12 and then it is plus the final value is the last cash inflow, this is 30,000, and 30,000 is available at the end of the last year. No compounding is required to be done in that case 30,000 will be equal to 30,000.

So, what is the total terminal value means of this project? If you calculate the terminal value by summing up all the compounded value of all the cash inflows, this comes up as rupees 209790; 209790 this is the value we call as the terminal value, which is based upon the compounding of future cash flows at the rate of at the rate of 209790 which is found out by compounding the future cash flows for a period of next 5 years at the rate of cost of capital and that cost of capital is 12 percent.

So, 209790 will be the terminal value and now we have to, we already have only one cost. So, present value of the cost is 1 lakh rupees only. So, if you apply the model of this your MIRR, so you will be doing something like this 1 lakh into 1 plus R. And how many years are there? 1 plus R you going to call it as MIRR, so we signified sometimes R star, MIRR is signified like R star and for a period of 5 years, and that is going to be how much?

This is the equal to the terminal value of all the cash flows that is a 209790. And then, if you out of this, if you solve this equation, if you want to find out the value of the R star, which is the modified internal rate of return, this comes up as 15.97 percent and this is in a way you call it as my MIRR, modified internal rate of return 15.97 percent in this case.

So, it is very simple, it was not very complex because the cash flow was only, cash outflow was only in the one period and that is in the current period. That is only the one period and that too in the current period, had there been multiple cash outflows, then what you have to do is?

You have to do calculate the present value of the cost by discounting the cash outflows at the future subsequent number of years. For example, there is a cash outflow in the first year, fine 0 period is equal to 100 percent, third year you discount it add it up in the first one and then

the fifth year then discounted and then add it up in the say the first and the say third years inflows, so, that we have to calculate the present value of the cost.

Since it was not required to be done, anything was not required to be done here. So, we have to simply find it out that for calculating this, if you had to say find out. So, it will be something like future value of the, sorry present value of the cost is equal to terminal value divided by the 1 plus R, 1 plus MIRR power 5.

So we have taken the if you have solved that we have taken the one step forward and directly we have means after solving it, we have found out this equation which is 1 lakh into 1 plus R star, R star means MIRR power 5 is equal to 109790 that is when 1 lakh rupees means what this signifies. If you look at this, what does it signify?

This signifies that if you, means 1 lakh rupees if compounded at the rate of 12 percent for a period of 5 years, the cash flows which are coming out for a period of 5 years, if they are compounded for the next 5 years period of time the cash flows coming out then the total value available here will be 209. The terminal value of this project means the compounded value of all the future cash flows will be 209790.

And when you solve it out, then you find out something that the value of R star in this equation is 15.97 percent which is in a way is called as the modified internal rate of return or MIRR, which is the modified internal rate of return.

Now, next question is to calculate the PBP say the payback period and if you look at the payback period for example, simply if you want to calculate the non-discounted payback period, so it means you have to do a very simple job, you have to sum it up, how many years we got in the, we are investing here 1 lakh rupees. In the first year we got 20,000, second year we got 30,000, fourth we got 40,000.

So, it means how much it is? 90,000 we have recovered at the end of the third year and remaining 10,000 will be coming to us, so in the in the beginning of the fourth year or maybe by the fourth year. So you can say payback period is if you want to write here, payback period is slightly, it is slightly more than slightly more than 3 years. It is slightly more than 3 years, the payback period is slightly more than 3 years.

In this case simple if you want to look at at the with the naked eyes then it comes up as slightly more than 3 years. And if you want to go for the discounted payback period, so far

we have already calculated the discounted values also, and if you want to look at the discounted value, so you can sum up these values and if you calculate these values, so it means it comes up as how much?

First year we got discounted value of 20,000, 17,860 then it is 23,910. So, this becomes somewhere around more than 41,000, then it is 69,000 because it is 28,480 and then it is a 31,800. So, it means you can call it as if you sum up these 4 cash flows. So, it means this will be a roughly becoming say discounted value only by say summing up the cash flows discounted values of the cash flows of the 4 years.

So, this will become say the discounted payback period you can say is going to be simple non-discounted is more than slightly more than 3 years and if you want to calculate the discounted PBP payback period, then you can call it as say slightly less than, slightly less than 4 years, slightly less than 4 years.

So, all the questions we have means try to answer here means whatever was asked here, we have to try, we have tried to answer all the questions here and this is very simple proposal where we could means try to see that if you have got this information, which is very complex to get about the cash inflows and outflows, if this information is available, we can apply any of the 6 discounted and not-discounted criteria which we applied in this case and we have say try to answer all those questions.

So, when you try to answer these questions, first thing was asked to calculate NPV we calculated NPV is in this case was positive 19,060, benefit cost ratio is 1.19 which is more than 1. So, the decision says yes go for the project means finally if you have to take the decision, every criteria says you go for the project. First says NPV is positive, go for the project, benefit cost ratio is more than 1 and net benefit cost ratio is more than 0. So, yes, it says go for the investment.

IRR is given to us available from this project is 18.69 percent internal rate of return and our cost of capital for example, if it is 12 percent, if the cost of capital is 12 percent, then internal rate of return here it is 18.69 percent. Again it also says go ahead we can make investment.

Modified internal rate of return if you calculate it is still more than the cost of capital because here we have found out the modified internal rate of return is also more than the cost of capital, cost of capital is 12 percent. Modified internal rate of return is 15.97. So, it means again it says go ahead with the investment and PBP is means normal which is 3 years and discounted PBP is less than 4 years or maximum 4 years you can say.

So, it means by taking into account the all the results by means applying all the 6 discounted and non-discounted techniques, we have found out the answer that this project is worthwhile,

this investment can be made. And if you make this investment, finally, we are going to add something to the value of the firm that is ultimate objective of any capital expenditure or capital investment proposals to add values to the existing value of the firm or ultimately the value maximization is the objective.

So, this is one problem we did here at this point. So, like this say 2, 3, 4 more problems we will do in next one or two classes, and then I will close the discussion on this say the capital budgeting techniques or the say evaluation say investment criteria, or maybe the say the process of evaluation of the capital budgeting or the capital expenditure proposals, till then, thank you very much.