Entrepreneurship Essentials
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Module - 11
Lecture - 55
Capital Budgeting Decisions (Contd.)

Welcome. So, we will continue our discussion from the previous session where we initiated talking about Capital Budgeting Decisions based on various models we have discussed about discounted cash flow and we did not give the formula for present value factor.

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So, here it is present value factor for annuity meaning, if you know that cash flow is equal amount every year and over a period of time then rather than discounting individual entries to the present we can actually have estimate a factor and then multiply that with the equal

amount that is happening every year; equal net cash flow happening every year we get the total value of number of a streams. For example, suppose your you foresee that there will be 500 rupees of cash inflow net cash inflow for say 5 years.

And your interest rate or discount rate is suppose 10 percent. So, every year 500 rupees is coming in and discount rate is 10 percent. So, you want to know what is the present value of this recurring amount every year it is happening for 5 years. So, what is the present value of this total amount? So, the formula is here there are only two variables one is r that is the discount rate; you call it interest rate, another is the number of years that is n.

So, if you know the number of years and you know the interest rate in decimal then you can estimate present value factor. So, for 5 years at 10 percent the factor is 3.79078. Similarly, if you have if you just substitute value of r with say 0.13. So, 13 percent you get a factor for 13 percent, 14 percent, 15 percent and you replace n rather than 5 you can put 10, you can put 20 and you get the factor. So, you can actually prepare a table of these factors.

And you do not have to estimate we just pick up the value based on discount rate and number of years you will get a value pick up the value and multiply that with equal cash flow that is happening every year. Say 500 is happening every year multiply that with 500. So, you get the total value here it is 1895 rupees whereas, if you add them up it becomes 2500. So, 2500 rupees is happening inflow happening, but its present value is only 1895.

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Now, the flip side or the opposite side of that or inverse of that is; suppose you borrow some money and you want to estimate equal equated monthly instalment or equated annual instalment. Let us talk about annual instalment first because interest rate is normally understood as on annual basis. So, you want to estimate what is my instalment every year if I borrow suppose 100000 rupees at say 10 percent rate of interest.

So, I want to know annually how much I have to pay. So, here is the formula it is just the inverse of that numerator comes to the denominator, denominator goes to the numerator and you get a factor. Multiply that factor with the principal amount of 1,00,000 rupees you get annual instalment that is to be paid for 5 years and the entire loan will be repaid with interest. If you want to estimate let us say let us see the data annual instalment factor is the r value is 0.1 n is 5 just substitute the data.

You get 0.263797 multiply that with 1,00,000 you get annual instalment and that is 26,380 you pay every year loan will be repaid with interest. Now if you want to make it a monthly instalment payment calculation, then the value of r will not be 10 percent because it is it has to be on a monthly basis.

So, what is the interest on a monthly basis? If interest for a year is 10 percent for 1 month it will be 10 divided by 12 that is the interest rate. So, 0.1 divided by 12 will be the interest rate and the period will not be 5 years now it will be 60 months; 5 year multiplied by 12 because we are estimating on a monthly basis. So, this is going to be r is equal to 0.1 divided by 12 n is equal to 60.

And the value factor comes to be 0.008361 multiply that with 1,00,000 you have 8361 that is the monthly, equal monthly instalment you have to pay.

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So, as to repay 100000 rupees completely along with interest. Now suppose here is just a very simple example of estimating net present value see you have you yours is a company called XYZ.

And you received a contract from another company where, you have to maintain something some of the equipment or something. So, you need some equipment to you know maintain whatever that is. So, your investment is about 2,50,000 rupees, your working capital requirement for maybe for fuel or salary to pay to the employees you are going to maintain say 20,000 rupees, then you could see that after 2 years you may have to actually invest another 90,000 rupees for overhauling your equipment or something.
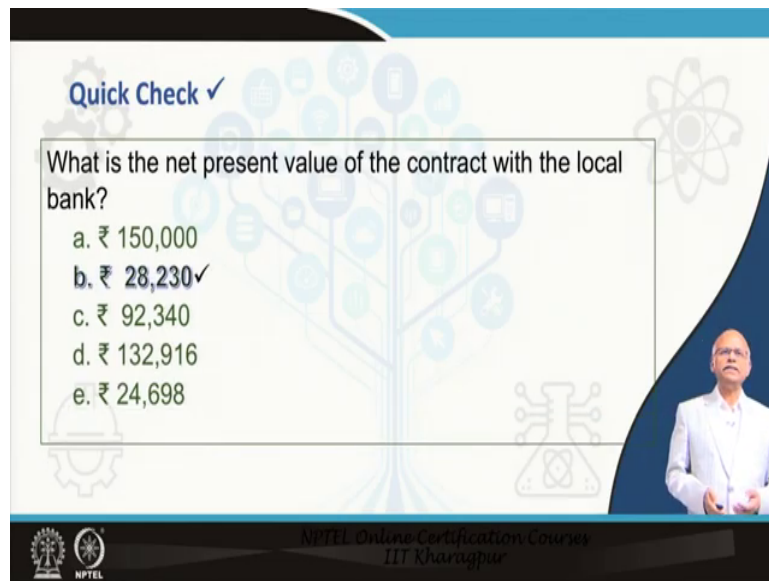
It is just to bring in some kind of a twist in the whole issue because, in the future whatever you do in a real world situation you will have many cash inflow many cash outflow. So, that just to

show that there may be cash outflow at some point of time. So, upgrading of equipment after 2 years is a cash outflow, salvage value at the end of the period end of the your contract horizon you are going to get back 10,000 rupees by selling the equipment.

Then the contract value itself is 1,20,000 every year every year the company is going to pay XYZ company 1,20,000 rupees. So, after your this 1,20,000 is a net cash flow meaning that the salary of the employee that you are engaged in will be paid by the company means wherever you are sending them for the work.

So, you do not have any other expenses other than 1,00,000 other than whatever means you just receive 1,20,000 and these are the only data and you expect that the business should return at the rate of 14 percent only then you will accept it. So, should we accept it what is. So, the decision will be based on net present value if the net present value estimated with the discount rate of 14 percent for the entire contract period of 4 years. If it is 0 or above 0 meaning positive then you accept, if it is negative you do not accept 14 percent is the discount rate.

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So, just pause for a while estimate and then move forward you will be better move which one is the answer find out answer is 28,230 positive. So, we accept the business proposition because its positive.
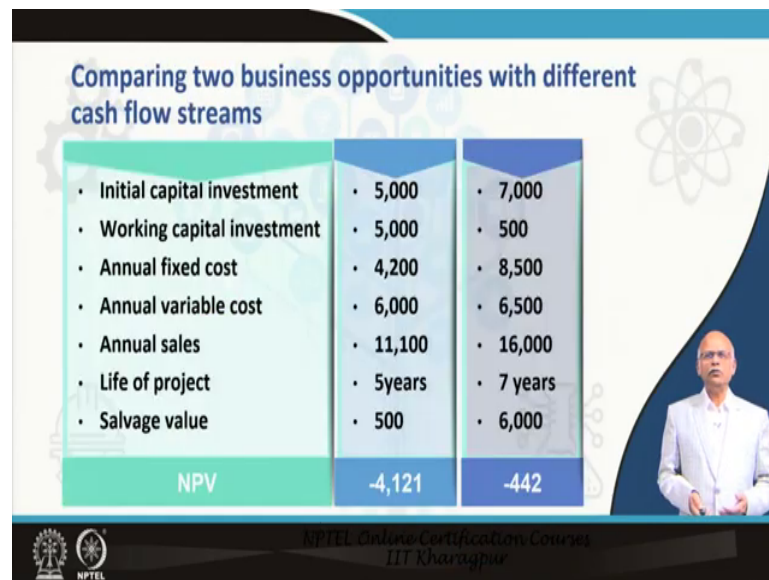
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Here is another example; very quick example say the same contract now have initial investment is more working capital is more, but there are other twist like annual cash inflow is 2,20,000 rupees.

Then there is some cash net cash inflow meaning that there is no other expenses all expenses taken together every year you are getting 2,20,000 rupees. Then upgradation after 2 years and salvage value after 4 year working capital is returned back. So, remember that working capital comes back always and then here I just wanted to show that this 14 percent present value multiplication factor is estimated.

So, for every year 2,20,000 rupees cash inflow is happening. So, you estimate that separately rather than estimating 4 cash flow separately what is the present value in the 1st year, 2nd year, 3rd year, 4th year you just multiply with 2.914 you get the total present value of the 4 is

inflow of revenue or say cash net cash inflow. It becomes 6,41,080 and you add them off you get 42,820 negative. So, you do not accept it if your expected rate of return is 14 percent.

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Now, this is just an isolated case that you just estimate net present value. Suppose you have two business proposition say, one business proposition your initial capital investment is 5,000 working capital is 5,000. Whereas, another business proposition where capital investment is 7,000 and all data are different. One business is valid for 5 years another business will continue for 7 years.

So, which is better it is a complex situation even on a ballpark basis you would not be able to say for sure that this business is better. You estimate the total profit or estimate the cash flow even then it will not be clear. So, you have to do you have to estimate the net present value or you can do many things actually we have already learned that you can make a cash flow

statement, you can estimate the profit you can compare their ebitda, their return on equity, their return on investment made so far all of that.

And you can also do a breakeven point analysis like breakeven point for business proposition one, breakeven point for business proposition two and then see which one is breaking even early or where you have higher margin of safety and you also estimate the cost indifference point and you see cost in different; were the cost indifference point is happening are you going to operate it beyond that point or below that point depending on that you have to make a decision which one is better.

Now while yes while talking about breakeven point analysis I discussed about number of units the number or the quantity q.

Now, quantity can be number quantity can be in terms of tons or kilograms or anything it is as good as good as in terms of rupees as well. So, what how do you estimate breakeven point in terms of rupees of sales. So, you know the price you know the quantity multiply that you get in terms of rupee.

Now just to elaborate that point suppose you take this first business proposition number one where 11,100 is a sales. So, your contribution to sales variable is say contribution is sales minus variable expenses it is not contribution margin it is contribution. Now contribution margin is contribution divided by sales or unit contribution, forget about unit just margin means it is percentage of contribution. So, total contribution is 5,100 contribution margin should be 5,100 divided by 11,100 dived by sales.

So, it is 45 percent or for something slightly more than that. And then break even to breakeven you have to meet the entire fixed expenses and fixed cost was 4200. So, at what sales your total contribution becomes 4,200 that is the breakeven point. So, you know the percentage of contribution. So, you divide this 4,200 that is to be met with the contribution by 0.4595 you

get the sales at which your total contribution is 4,200 and that is the breakeven point in terms of sales.

Therefore, breakeven sales is equal to fixed expenses divided by contribution margin which is nothing but 4,200 and then margin of safety is breakeven sales minus total sales; which is total sales minus breakeven sales which is 1959.

You can do this for the other business as well and compare see this is this comparison is not between an apple and an apple because, both are not of the same capacity their capacity is different, their total sales is different, their capital investment is different that is why it is not a real means you cannot rightly away make a comparison.

What you have to do is you have to now do a first of all a breakeven analysis and see what is the margin of safety. Suppose margin of safety here is on a percentage basis total sales and margin of safety. So, margin of safety divided by total sales if you are if that is a great percentage. So, you are highly comfortable if it is marginal nominal say 10 percent or 15 percent it is risky.

So, whichever gives you a higher percentage of margin of safety is better in a way it is not absolutely better. But in a way its better then you have to do the net present value calculation and make a comparison. So, that assignment is given to you estimate the margin of safety for the other business we let us move forward with the breakeven analysis discussion.

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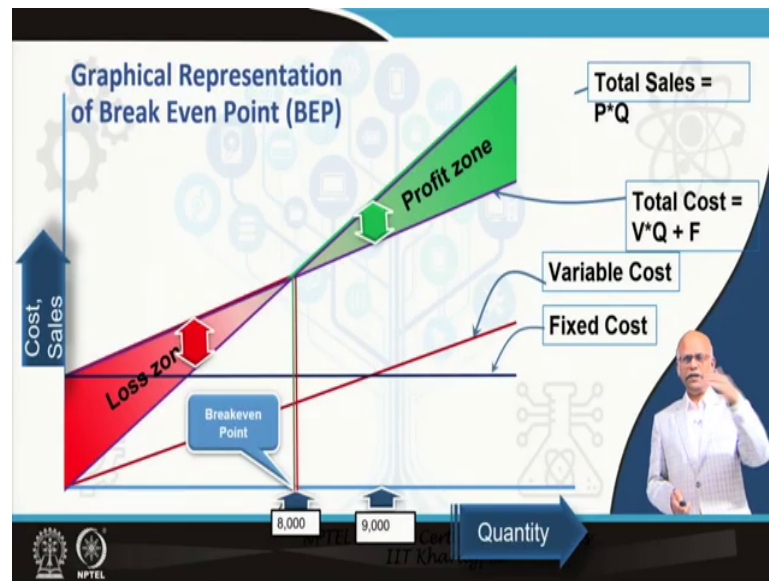
So, earlier we saw breakeven in terms of quantity meaning the x axis is quantity so in terms of quantity it came.

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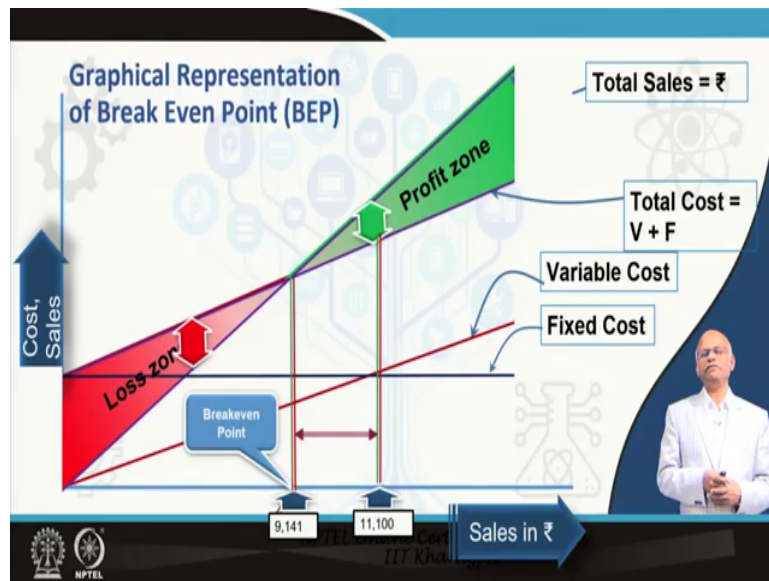
Now let us see in terms of sales. So, it is almost the same thing only thing is that the x axis is now sales and your breakeven point is the sales at which you break even whatever we got 9141 and we are actually making a sales of 11,100. So, the difference between the two is the margin of safety. Which was 1900 and something here is just the NPV calculation which is 4,121 and minus 442.
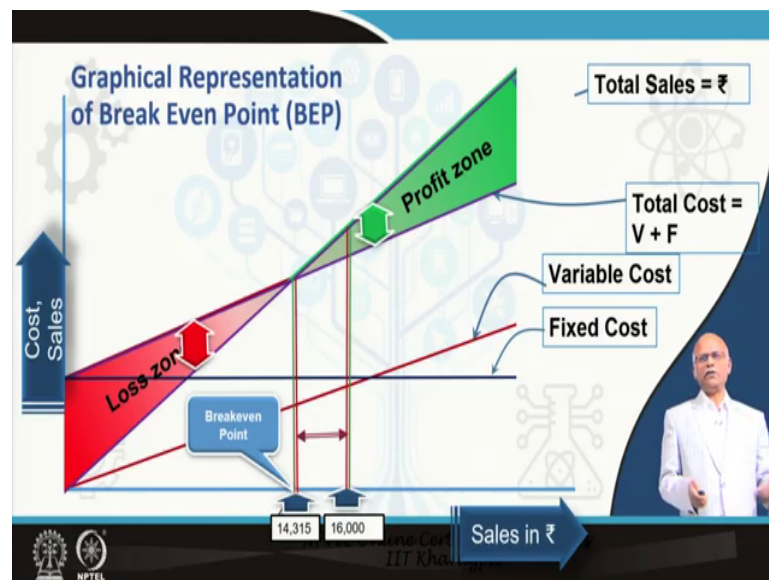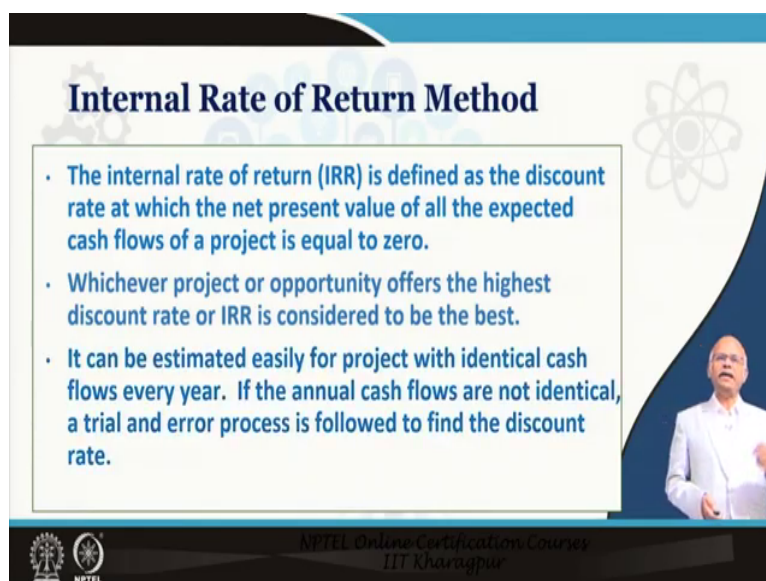
I have just put the breakeven here for the second business which is 14,315 is the breakeven point and 16,000 is the op level of operation that we are doing. If you make a percentage calculation of the margin of safety you will find that margin of safety for the business number two is narrow. Whereas, if you see the net present value of business number two is much better here it is minus 4,000 here it is only minus 400.

So, net present value wise business number two is better whereas, breakeven point value wise number one business is better. So, you have to now make a subjective decision as to which one should we do that will depend on many other discussion which is not part of this discussion will may be some other time we will try.

Next topic is internal rate of return; internal rate of return meaning what is the rate of return at which the business is giving you profit. So, there is a business now you know the cash flow for net present value calculation we started with a rate because we know that there is a hurdle rate we have to cross that this is something like 14 15, whatever is your expected rate of return.

Suppose your expected rate of return is 16 percent below 60 percent 16 percent you do not want to take up a business that becomes a hurdle rate, and you discount the future cash flow with that rate and you see whether net present value is positive or 0 or negative. If it is negative you decide that this business is not going to return means 16 percent, but less than that so you do not accept.

Now suppose you know the cash flow you want rather than having some discount rate after I decided you just see what is the rate of return rather than it is discounting at a particular rate.

So, you estimate the actual rate of return at which the business is giving you money that is called internal rate of return.

And that is estimated by, equating all the cash flow all the cash flow with the discount you discount all the cash flow and then the net present value is placed as zero. Meaning zero is equal to all the cash flow discounted to the present day at what rate that becomes the IRR that is not known that is what we are trying to estimate.

So, you first of all you project the cash flow then you write the same formula that we have we have given like say for estimating net present value difference is rather than net present value now you write this is equal to zero. Now you start on a trial and error basis you take some data take some discount rate say 10 percent or 20 percent you try with 10 percent and see what is the net present value if it is positive great amount of positive; that means, the IRR actually much larger compared to that.

So, you try with 20 percent if you see it is coming negative net present value is coming negative; that means, it is between 10 and 20 percent. So, depending on the absolute value of the data for 10 percent and 20 percent, you will decide which side the actual value lies and eventually suppose actual data is 15 percent. So, eventually you will come to that that placement you will use 15 percent and you will get net present value as zero so you decide that is the internal rate of return.

Now, trial and error is a TDS process and you never know how many trials you have to do to really hit on the net present value to be zero. It is almost like impossible you will get something like very close to zero, but there is a short cut that is if the cash flow like in the examples that we showed this is a very very hypothetical and normally no business is going to return you equal amount of cash flow, but for simplicity we have assumed equal cash flow.

But suppose you invest some money in a bank or for fixed deposit or something or say you give the money to somebody and the somebody promises you or say promises you some return absolute return say something like say 50,000 rupees per month or something. Suppose you want to decide about purchase of a property say a big house or industrial state. So, you

want to buy that and then you want to rent it to somebody if you know how much money at which you can rent it out.

So, you know that there will be equal amount coming to me every month. Now in this kind of a situation where the cash flow is equal you can use a chart that is internal rate of return factor. You can use the factor and the chart and then you can actually identify the actual internal rate of return will show it very soon. So, first thing is you have to place it is equal to zero second you solve for that and you get IRR.

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And the third is that there is a shortcut for equal amount of cash flow. And the decision rule is if the internal rate of return is say greater than or equal to minimum hurdle rate. So, if it is greater; obviously, we accept if it is zero or equal to you will accept, but if it is less than hurdle rate; obviously, you do not accept it. So, greater the IRR better it is.

Now suppose you have five project proposals you are trying to understand which one is better which one is slightly less better and you want to make a kind of a list ordered list. So, you estimate the IRR. So, highest IRR comes first then gradually the list is prepared.

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So, suppose we have this proposal that where you need to invest 4,00,000 rupees at the beginning and then by investing 4,00,000 rupees you are going to save 80,000 rupees that you are incurring now. So, that can be construed as income meaning saving means income.
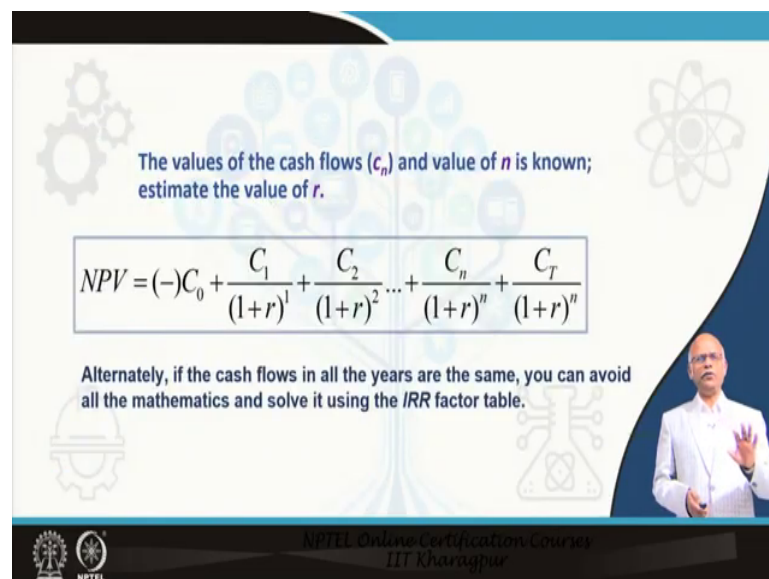
So, you are saving 80,000 rupees that is your cash flow positive cash flow happening 80,000 rupees against an investment of 4,00,000 rupees plus some working capital of 18,000 rupees these are data these are the data available. Next data is for internal rate of return we do not

use discount rate, but then we need to know what is the expected rate of return of the company; suppose it is 13 percent and the machine is going to run for 10 years.

So, the horizon of the estimation is 10 years and the hurdle rate is 13 percent and we have other data. Now this is just for starting to suppose you are using formula that trial and error process then you have to start from somewhere if you start at 10 percent you see the net present value is 73,565 if it is since it is quite large value and it is positive.

So, you can guess that the actual rate of return internal rate of return will be far more than 10 percent. So, next trial may be at 15 percent you will find that it is not 73,000 it will be much smaller data it may be even negative is small negative. So, it will be closer to 15 percent means depending on the absolute value.

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The values of the cash flows (c_n) and value of n is known; estimate the value of r.

$$NPV = (-)C_0 + \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} ... + \frac{C_n}{(1+r)^n} + \frac{C_T}{(1+r)^n}$$

Alternately, if the cash flows in all the years are the same, you can avoid all the mathematics and solve it using the *IRR* factor table.

So, here is the formula the same formula only thing is that rather than writing NPV we substitute that with 0 and then you take all the cash flow and the value of r will be based on trial maybe 10 percent of the beginning and then gradually I depending on the value if it is positive move upward if it is negative move downward and n is the number of years.

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So, everything else is known we just have to estimate. So, that is one way of doing it this is one way of estimating, but if you know the regular cash flow particularly in this one we know that every year we are going to save 80,000 rupees.

And our initial investment is 4,18,000 rupees and life is 10 years. So, we know this data and because equated amount equated cash inflow we can use that chart and I am going to show how this chart is used; this chart is used with the help of internal rate of return factor. And that factor IRRF factor, is equal to net initial investment which in this case is 400000 rupees plus

working capital of 18,000. So, it is going to be 4,18,000 rupees divided by annual net cash inflow which in this case is 80,000 rupees.

So, IRR factor is equal to 4,18,000 divided by 80,000 is equal to 5.22 it is actually 5.1216, but here it came to 5.22.

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So, let us see move forward. So, we have this data number of period is 10 years internal rate of return factor is 5.22. Now we have to look at the present value of annuity table this table looks like this is short form of the table because of paucity of a space I have just put it like this.

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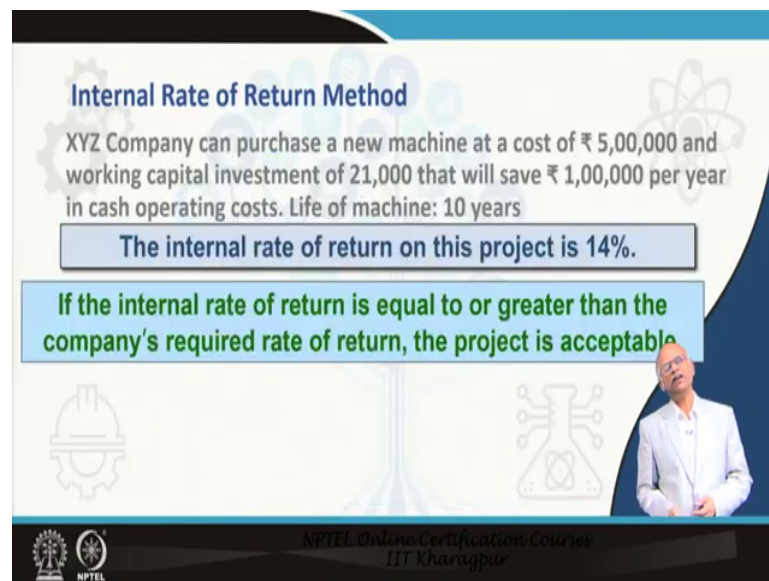
So, we know that 10 year period. So, in this table you have to start from the period is 1 year, 2 year, 3 years, 4 years up to 10 years. So, move downward stop at 10 year and then move rightward. You have this data the 5.22. So, you have to see where in this table I have 5.22. So, you move start moving rightward you hit upon this data 5.22 and then move upwards say 4 and you see it is 14 percent the top line top row has the interest rate or return rate it is 14 percent; that means, this business is returning at the rate of 14 percent.

So, IRR is 14 percent now it may not always be. So, simple suppose you have a 9 year period and your value is 5.22. So, it may not be you may not have a 14 percent 13 percent 12 percent it will go or straight upward where there is no rate. So, now, you know that it is slightly above 5.33, but far less than 4.95 which is 14 and then 13 perhaps there will be a data. So, you know

that it is between 12 and 13 percent. So, you can kind of depending on the you know using unitary method you can decide at what place this interest rate will be.

So, it is a movement going to the right direction then moving upward to find at what rate this business is returning that is what is internal rate of return.

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Now, suppose another example very simple example suppose XYZ company can purchase a new machine at a cost of 5,00,000 rupees, working capital is 21,000 that will save 1,00,000 rupees per same sum and then internal rate of return is estimated to be fourteen percent in the same way.

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It is just a repetition this is another example you just read that and find out whatever is the value it is 12 percent.

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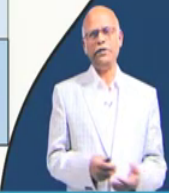
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So, this is another example that you can practice other approaches to estimate or to make capital budgeting decisions. This is known there are many methods actually one very popular method is payback period method. So, in if you see any project report you invariably will see the breakeven analysis the net present value the IRR and payback period these are the four data that will be provided.

And a decision maker whether it is an investor or a banker or say a cofounder they will look at these data and then they will make a decision nothing is sacrosanct is not a golden rule or anything, but then in absence of any other data people trust on these and they make all the decisions based on this. There may be a simple rate of return that is a simply just total income divided by total investment over a period of time.

So, what is the annual rate of return without time value of money even payback period method does not take into account the time value of money this is very important payback period method does not take into account time value of money; whereas, net present value takes into account time value of money IRR takes into account the time value of money.

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Let us see the payback period method of estimating whatever is the payback period. And how we make decisions see payback period if it is if the annual cash flow is same every year it is just investment required divided by annual net cash flow then you get the payback period as simple as that, but in most cases it is not the same.

So, when it is not the same then you estimate the sum of the cumulative net cash flow over the years in the 1st year suppose cash flow is x 1 in the second year it is x 2, 3 year it is x 3.

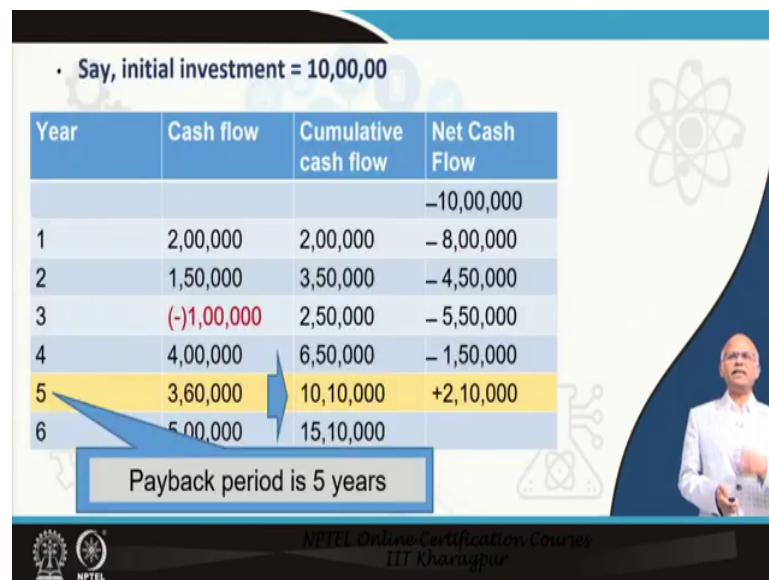So, you keep on adding this x 1 plus x 2 plus x 3 till the time when you just cross the initial investment see initial investment is say 5 million rupees. So, suppose 1st year the cash flow is 1 million, 2nd year cash flow is 2 million, 3rd year cash flow is 2.5. So, 1 plus 2 plus 2.5 makes more than 5. So, within 3 years you are recovering 5 million rupees. So, payback period is 3 years that is it as simple as that.

Let us take an example suppose you have initial investment of say 10,00,000 rupees there should be one extra 0. So, 10,00,000 rupees is the cash flow sorry is the initial investment. Now suppose your business has cash flow like the first column 2,00,000 rupees in the 1st year 1,50,000 rupees in the 2nd year 1,00,000 negative cash flow, in the 3rd year 4,00,000 in the 4th year and the like and last one is 5,00,000 rupees. So, we want to know when we are recovering the entire 10,00,000 rupees in the from the business without considering the time value of money.
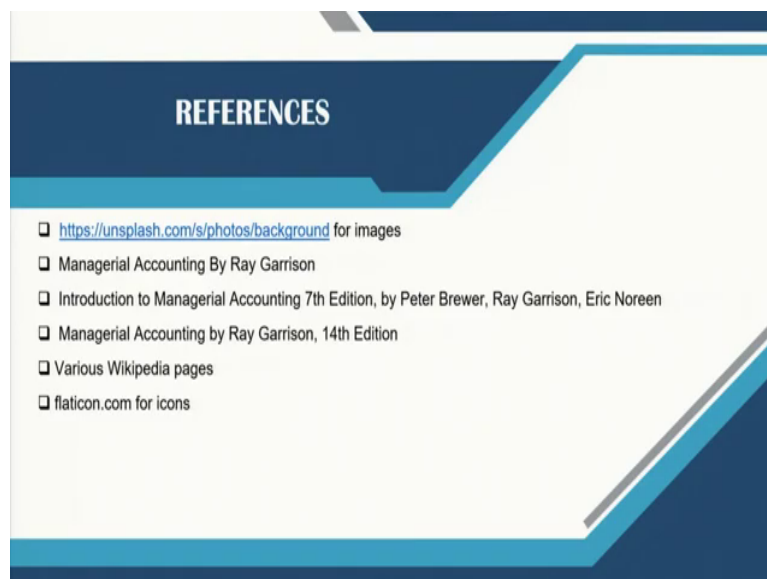
So, we are not going to discount anything we are going to take the absolute value. So, in the 1st year our cash flow is 2 years. Now if you go for a cumulative approach then first year zeroth year there is no cash flow or the negative 10,00,000 rupees you can write it there 1st year total cash flow is 2,00,000, 2nd year you add 1,50,000 with that you get to 33,50,000,

3rd year it is minus. So, you deduct that from 3,50,000 you get 2,50,000, 4th year is 4,00,000 so it becomes 6,50,000.

And eventually in the 5th year you find that the total cash flow is 10,10,000 rupees; that means, it is becoming positive. So, when it becomes positive that is the payback period here it is 5 years is the payback period. So, you can also take into account the 10,00,000 rupees at the beginning and see whatever is the net cash flow year after year that is it.
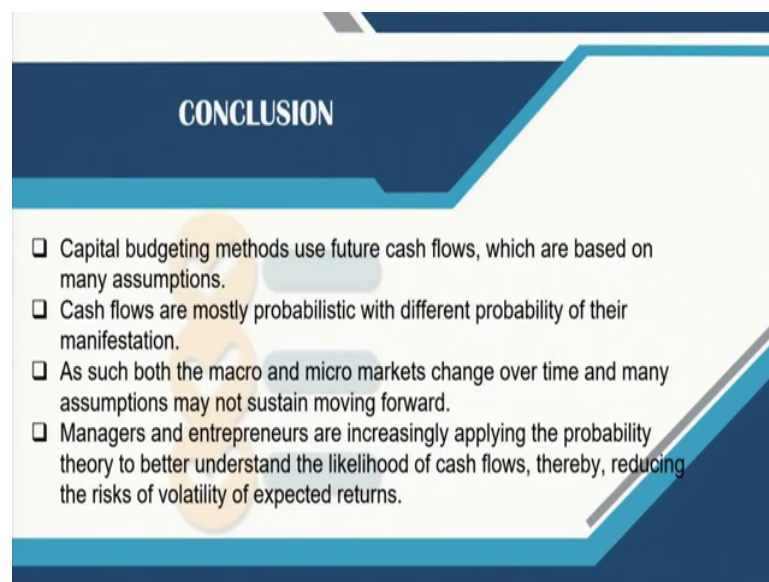
So, eventually I think there some mistake here either in either column number three or four it should be 10,000 rupees actually either 10,000 rupees or 2,10,000 rupees 10,00,000 then 8,00,000 then 4,50,000 is right, 5,50,000 is also right you estimate. So, it should be it should be 10 means the total should be same.

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So, capital budgeting methods use futuristic cash flow some word of caution actually is not really conclusion uses future cash flows which are based on many assumptions. So, it is not nothing is sacrosanct and there is no golden rule then cash flows are mostly probabilistic with different probability of their manifestation, you never know which one is going to.

So, you may actually estimate based on optimistic realistic and maybe pessimistic approach and then you may have three different cash flows, three different net present value three different IRR you can estimate all of that as such both the macro and micro markets change over time and many assumptions may not sustain moving forward.

Managers, entrepreneurs are increasingly applying the probability theory to better understand the likelihood of cash flow thereby reducing the risk of volatility of expected return you multiplied your cash flow with probability and then eventually estimate the expected cash flow or expected net present value.

Thank you very much.