Water Economics and Governance
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Lecture - 40
Evaluation of Water Projects: Capital Budgeting Methods (Contd.)

Hi everyone, let us continue discussing the capital budgeting methods and we have discussed a few methods that includes payback discounted payback net present value and internal rate of return in the earlier sessions

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This particular session, we will be talking about the rest of the 2 methods of capital budgeting which is average rate of return or average accounting return or the other one is profit profitability index or benefit cost ratio method.

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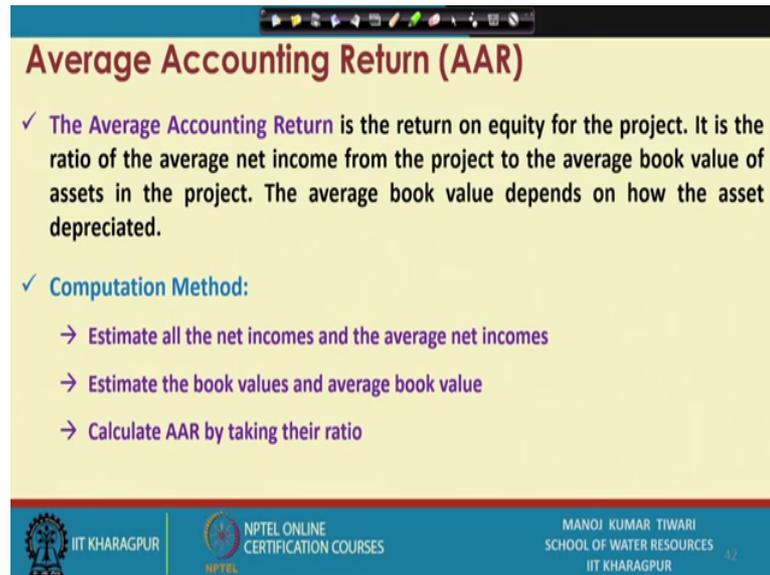
The average accounting return which is AAR or also called average rate of return and accounting rate of return that way, but average accounting return which is the one of the common terminologies used AAR is actually written on the equity of the project.

So, it is the ratio of net income averaged over the project span and the average book value of assets in the project the average book value will depend on to the how assets are depreciating. So, what is the average value of assets and what is the average net income of the project in its lifespan is taken and the their ratio is basically estimated as average accounting return it estimates all the net income and average net income that is will that is the typically first step for the computation of AAR and then estimate the book values and average book value and calculate the AAR by taking their simple ratio.

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So, the formula is simple, we take the average net income divide it with the average book value the book value, particularly, the average book value is based on the depreciation primarily.

So, the depreciation should be taken into the account and generally the straight line depreciation is taken. So, if we straight line depreciation our average investment becomes the historic investment a historic value or initial value minus salvage value by 2. So, what is this salvage value what is the final value after the end of life of the project that is to be subtracted from the invested value or initial value and is because we are taking average. So, we can divide it by 2 in order to get the average book value that way.

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So, if the accounting return or average accounting return is greater than a preset value we can accept the proposal or otherwise we can actually discard the proposal. So, let us take an example how these are calculated. So, assume an organization is investing one [FL] in a project for developing a mineral water bottling plant likely to be depreciated using a straight line method over 5 years with 40 percent salvage value. So, the project timeline is 5 years and salvage value is 40 percent so; that means, the 60 percent of it or equal to around 60 lakhs will be depreciated in 5 years.

The table is showing the revenues and operating expenses and we need to calculate the average accounting rate using 30 percent tax rates if taxes are application applicable on net cash flow and net cash flow after discounting for depreciation.

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Average Accounting Return (AAR)

✓ Example: Solution

Total investments = ₹ 1,00,00,000
Salvage value after 5 years (40%) = ₹ 40,00,000
Average annual depreciation = [₹ 1,00,00,000 - ₹ 40,00,000]/5 = ₹ 12,00,000

Years ->	1	2	3	4	5
Revenue (₹)	20,00,000	30,00,000	35,00,000	35,00,000	45,00,000
Operating expenses(₹)	7,00,000	9,00,000	10,00,000	10,00,000	14,00,000
Net Cash-flow (₹)	13,00,000	21,00,000	25,00,000	25,00,000	31,00,000
Depreciation (₹)	12,00,000	12,00,000	12,00,000	12,00,000	12,00,000

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So, there are 2 tax regimes 2 tax model and we will see how it makes difference when we go for calculation of average accounting returns the information that is available to us is that the total investment the salvage value after 5 year is 40 lakhs. So, our average annual depreciation because 60 lakhs has depreciated in 5 years; so, average annual depreciation is becoming 12 lakhs. Now, if we consider the data given to us in form of the revenue and operating expenses were given to us ok.

So, we can get the net cash flow by subtracting revenue minus operating expenses. So, if we subtract revenue generated minus operating expenses, we get the net cash flow and we have the depreciation value as 12 lakhs per year based on the remaining salvage value of the asset.

So, this information is available to us we know what is our net cash flow and what is the depreciation now as discussed as basically given that there are 2 different tax regimes.

So, let us consider first the tax model a. So, the tax model a suggests that there is going to be 30 percent tax onto the net cash flow. So, we have revenue we have the revenues known to us operating expenses known to us then net cash flow known to us depreciation is also estimated.

So, the taxes are going to be 30 percent on to the net cash flow. So, what is cash generated 30 percent onto that. So, we multiply with 0.3 to these numbers and we get the taxes and then we can get the net income by subtracting taxes from the net cash flow and depreciation as well. So, our net income becomes the net cash flow minus depreciation minus taxes and that is how we get these different net incomes.

So, our average net income if we see; so, the 5 year is the project duration. So, we get annual net income from these 5 years. So, we will take the average of these values and that is coming out to be 410,000 rupees as our average net income now consider the average book value. So, it is a straight line depreciation as was assumed initially. So, the average book value for a straight line depreciation will be initial outlay minus salvage value divided by two. So, initial outlay was one [FL] salvage value 40 lakhs divided by 2. So, basically 60 lakhs divided by 2 will be equal to 30 lakhs.

So, our average accounting return or AAR becomes average net income by average book value. So, that is 410,000 divided by 30 lakhs which is coming out to be 0.1367 or 13.67 percent is the average accounting return. So, that is how the average accounting return is

estimated and if let us say, we have a cut off value of say 15 as an average accounting return then we should not accept this proposal if we have a cut off value of 10 or 12 for average accounting return we can accept this proposal.

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Average Accounting Return (AAR)

✓ Example: Solution – Tax Model (b)

Years ->	1	2	3	4	5
Revenue, R (₹)	20,00,000	30,00,000	35,00,000	35,00,000	45,00,000
Operating Expenses, OE (₹)	7,00,000	9,00,000	10,00,000	10,00,000	14,00,000
Net Cash-flow, NCF (=R-OE) (₹)	13,00,000	21,00,000	25,00,000	25,00,000	31,00,000
Depreciation, D (₹)	12,00,000	12,00,000	12,00,000	12,00,000	12,00,000
Taxes, T (= 0.3*(NCF-D)) (₹)	30,000	3,00,000	3,90,000	3,90,000	5,70,000
Net Income NI, (=NCF-D-T) (₹)	70,000	6,30,000	9,10,000	9,10,000	13,30,000

Average Net Income = ₹ (70,000+6,30,000+9,10,000+9,10,000+13,30,000)/5 = ₹ **7,70,000**
Average Book Value = (Initial Outlay– Salvage Value)/2 = ₹ (1,00,00,000–40,00,000)/2 = ₹ **30,00,000**

AAR = Average Net Income / Average Book Value = 7,70,000/30,00,000 = 0.2567 = 25.67 %

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So, that is how the decision is making now this was the tax model a; we have another tax model where the taxes are applicable on to the depreciation the value after depreciation. So, for this case these 4 estimates are we have already done that now the taxes in earlier case, it was applicable on net cash flow.

So, the net cash flow was revenue minus operating expenses and we apply 30 percent taxes on to those, but this tax model says that you can actually subtract depreciation also because there is a loss in the value. So, you can subtract depreciation and then apply taxes on to the leftover value after depreciation. So, 13 lakhs for example, is the net cash flow and 12 lakhs is the depreciation. So, net income for the taxes becomes 1 lakh in first year and 30 percent of 1 lakh means net cash flow minus depreciation becomes 30,000.

Similarly, here 21 lakhs was the net cash flow and 12 lakhs depreciation making it 9 lakhs and 30 percent of 9 lakhs is 3 lakhs. So, that way the taxes can be estimated and then net income again becomes the net cash flow minus depreciation minus taxes. So, this will become our net cash flow or net income. So, average net income will be again taking the 5 years income independently and taking average of that now this is coming 717,000.

So, earlier it was 4 lakh something and now it is 717,000 why because the taxes were paid onto the net cash only and be this in this model the taxes on depreciation were waved off. So, there was when we discount for depreciation the net incomes become very less and that is why the taxes become very less. So, all the saving that is seen is actually in the form of taxes because net cash flow is still remain the same depreciation remains the same only thing is that taxes has reduced because earlier taxes was applied on to the net cash flow and now it is applied on to the depreciation.

So, the government could have a different taxation model. So, if they are allowing depreciation to be discounted from net cash flow for estimation of taxes. So, that that way the average net income becomes more because taxes will be less, but if they are considering and know that the depreciation is the organizations or firms own problem and we are not interested in accounting for depreciation we will impart tax on your net cash flow then taxes are going to be higher and average net income will be lesser.

So, earlier it was 410, now it has actually increased to 770 that way the average book value remains the same 1 [FL] minus 40 lakhs. So, 60 by 2 is equal to 30 lakhs and then if we compute the average accounting return again by the average net income by average book value. So, 770 divided by 30 lakhs is becoming now 25.67 and then the average accounting return is of the order of 25.67 percent now for this.

So, earlier it was some 13.6 or that kind of number was there now it has exceeded to 25. So, if because of the tax relaxations so that way the average accounting return can be estimated. Now if our earlier criteria was 15 for this to be accepted.

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So, this tax model or this scenario can be accepted while earlier cannot be so that is how the average accounting return is estimated and helps in the decision making towards capital budgeting the advantages and basically includes that it is easy to calculate and need information will be usually available whatever information needed and if the internal rate of return is high enough again we may not need to estimate these numbers the disadvantages on the other hand that it is not true rate of return, it is based on the average value that way and one of the major problem is like the simple payback period method the time value of money is ignored in this one also because we are taking average.

So, the time value of money has not been taken into the account even in this approach and that is one of the major drawbacks further it uses a arbitrary cut off point that if it is exceeding this I can accept if otherwise I cannot. So, all these issues are there and it is the based on accounting net income and book values and not the cash flow and market values. So, these are some of the disadvantages of the approach.

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And then there is another method for capital budgeting which is benefit cost ratio or also known as profitability index ok.

So, what benefit cost ratio is we have already discussed earlier that it is a ratio of the benefits to the cost, but in terms of capital budgeting or profitability index what we determine is the ratio of present value of the future cash inflows to the present value of the cash outlays.

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So, the present values of the cash flow is divided by the initial investment in order to get the profitability index the computation method is again simple we need to estimate the expected future cash flow estimate the required return for the project and find the present value of the cash flow and divide it by the initial investment in order to get the P I the basic formula is actually as if you see the in the discounted cash flow or the net cash flow with the time value of money is actually this number as we have seen earlier also in case of NPV and this thing.

So, that becomes our net income and C 0 is the capital investment net income in terms of present. So, this becomes the net income discounted to present which is discounted and if we divide it by the C 0; what we get is the our profitability index or benefit cost ratio. So, this can be solved it is it will eventually come as one plus NPV by C 0. So, if we are able to get the net present value so, then because the net present value if you see NPV is this discounted rate minus C 0. So, let us call this as a net income NI. So, this is NI minus C 0 is NPV, ok.

Now, NI from the equation can be written as NPV plus C 0 because C 0 can be taken here. So, we can replace NI as NPV plus C 0 divided by C 0. So, it will eventually become NPV by C 0 plus one or one plus NPV by C 0. So, we actually get this number the decision rules are simple accept if benefit cost ratio is greater than one the higher benefit cost ratio or profitability index the better the scenario the better the project is let us take an example how this is used for capital budgeting.

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Benefit-Cost Ratio(BCR) or Profitability Index (PI)

✓ **Example:**

The investments for a water park was estimated as ₹ 2.2 Cr. The expected O&M expenses, and revenues generated from entry fees are provided under. The tax rate on net cash flow (excluding externalities) are 30% up to ₹ 20 Lakhs income, 40% for additional income between > ₹ 20 - 50 Lakhs, and 50% on any higher incomes. Further, EIA of the project has valued all positive externalities at Rs 1.6 Cr, while negatives social and environmental impacts were valued at Rs 2.1 Cr for the total project duration of 10 years. **Asses if project is economically feasible by estimating the Profitability Index at 10% discount rate.**

Years ->	1	2	3	4	5	6	7	8	9	10
O&M Expenses (Lakhs ₹)	20	22	25	25	29	30	30	21	24	20
Revenue from Fees (Lakhs ₹)	45	72	79	100	118	125	136	120	104	85

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So, the investment for a waterpark was estimated as 2.2 crores the expected operation and maintenance expenses and revenues generated are given in the table the tax rate on net cash flow excluding externalities are 30 percent up to 20 lakh income 40 percent for additional income between 20 to 50 lakhs and 50 percent on any higher income.

Further the EIA of the project has valued all positive externalities as 1.6 [FL] while negative social and environmental impacts are valued at 2.1 [FL]. So, externalities in terms of externalities if you see here. So, this is 1.6 [FL] and 2.1 [FL]. So, there is a net loss because 2.1 is negative and 1.6 is positive. So, there is a net loss of 0.5 crores for the project duration of 10 years. So, these externalities are wholesome for a project duration of 10 years see asses if project is economically feasible by estimating the profitability index at 10 percent discount rate. So, that is the problem we have been given the operation and maintenance expenses here.

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So, what we will do for such problems that operation and maintenance is given to us and revenues is given to us. So, we can get the cash flow by subtracting operation and o and m expenses from the revenues. So, that way we will get actually this cash flow. So, those numbers were in lakhs.

So, this is going to be in the lakhs. Now there is going to be the tax on to the cash flow now the tax on to the cash flow will actually is divided into 3 slabs the tax rates have been given. So, the tax rates are 30 percent up to 20 lakhs, then 40 percent up to basically greater than 20 and 50 lakhs and 50 percent for any higher income.

So, now, if you see the net cash flows this becomes very important row over here because that will give us an idea how much tax is being imparted. So, this is net income is 25. So, first twenty will be charged at a 30 percent while the other 5 will be charged at a 40 percent, this is how typically government takes slabs are in the second year net income is 50.

So, 20 is going to be charged at 30 percent and 30 is going to be charged at 40 percent there is no income to be charged at 50 percent in the first 2 year, but since third year onwards when it is becoming 54. So, 20 will be charged at this 30 will be charged at this and 4 will be charged at the uppermost slab. So, that way for all future years because the net income is higher than 50. So, 20 is going to be charged at 30 percent, next 30 is going

to be charged at 40 percent while the anything that is higher than 50 is going to be charged at a 50 percent.

So, the net calculation of taxes for example, year let us take an example of year 4. So, net calculation of taxes will be 20 into 30 percent. So, 0.3 plus 30 into 0.4; 40 percent and in year 4 we have 25 in the upper slab. So, plus 25 into 0.5; so, if you sum this up it is actually becoming 30.5. So, that way the charges will be calculated for the total tax and then we can estimate what is the net tax on to this income.

So, net cash flow after tax will be we know; what is the cash flow and; what is the taxes. So, we can subtract taxes from the cash flow and we can get net cash flow after the taxes. So, this is this column will give us the net benefits after taxes and we will have to apply the discounted cash flow as we have been doing earlier for other methods as well. So, we will apply the10 percent discount rate onto the cash flow in order to get the discounted cash flow the discount rate is 10 percent.

So, for example, the net cash flow if let us say 60 here. So, it is going to be 60 divided by this seventh year. So, 1.1 to the power 7; that will be 30.79. So, that way we can estimate the discounted cash flow now once we know the discounted cash flow this is going to be our net income from the project as we have been estimating for NPV also.

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So, this a similar exercise that way now, the discounted cash flow or the net cash flow is the sum of this is actually 252.89 lakhs, sorry, 253.53 it should be 5 3. So, that would be and it eventually is coming 2.53 [FL] rupees. So, when it is 2.53 [FL] rupees the initial outlay expenditure is 2.2 [FL] and if we want to estimate the benefit cost ratio straightaway excluding externalities let us say we are not considering externalities yet.

So, it is simple that the sum of the discounted cash flow or net income divided by initial outlay. So, our BCR becomes 2.53 divided by 2.2 equal to 1.15 and project can be accepted; however, if we include externalities. So, there are overall positive externalities of 1.6 [FL] overall negative externalities of 2.1 [FL]. So, the net benefit becomes 2.53 minus 2.1 negative externalities and plus 1.6 positive externalities.

So, this becomes 2.03 [FL]. So, this becomes 2.03 [FL] and then we can take the benefit cost ratio because now our benefits is 2.03 [FL] and cost is 2.2 [FL]. So, ratio becomes 0.92 and this project probably will not be accepted. So, this way it is actually one can actually see that the benefit co benefit cost ratio method can be used or can be adopted for the estimation of benefit to cost ratio. So, that one can actually get an idea of whether this project is going to be beneficial or not.

And we can account for externalities also in not only in this, but in all other method. So, like even if we want to calculate NPV for this project including externalities. So, the NPV for this project will actually be in that case 2.03 which is my net income minus 2.2. So, that way minus 0.17 [FL] is going to be my NPV and it is negative. So, actually will be rejected. So, that kind of estimation can be helpful in order to see or in order to make a decision whether a certain project should be accepted or not the method also has certain advantages and disadvantages.

So, the advantages is that this indicates the maximization of the firms value and is useful in case of capital rationing when we are taking the ratios; however, on the other hand it cannot give accurate decision if the amount of investment of mutually exclusive projects is not same.

And it may not be easy to understand for many people that how the concepts how the profitability or how the ratio values less than one or greater than one can be utilized for making certain decision nevertheless these were the basic capital budgeting methods which are typically used for the for the helping in decision making towards the accepting a project or not and we have discussed these with examples.

So, I hope that you will be clear in how to apply these methods there are some specific special cases like when the; you are comparing mutually exclusive projects of different time frame or of different initial outlay. So, how we can assess those. So, we will discuss that as well in further sessions, but for today we will close the session here and subsequent discussions will be made in the next session.

Thank you.