

Infrastructure Planning and Management
Infrastructure Economics and Finance

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Cost-Benefit Analysis

- Compare the Costs and Benefits of a solution and decide whether or not it is feasible
- $B/C \text{ Ratio} = [\text{Benefits} - \text{Disbenefits}] / \text{Costs}$
- If $B/C > 1$, select the alternative
- If $B/C < 1$, eliminate the alternative



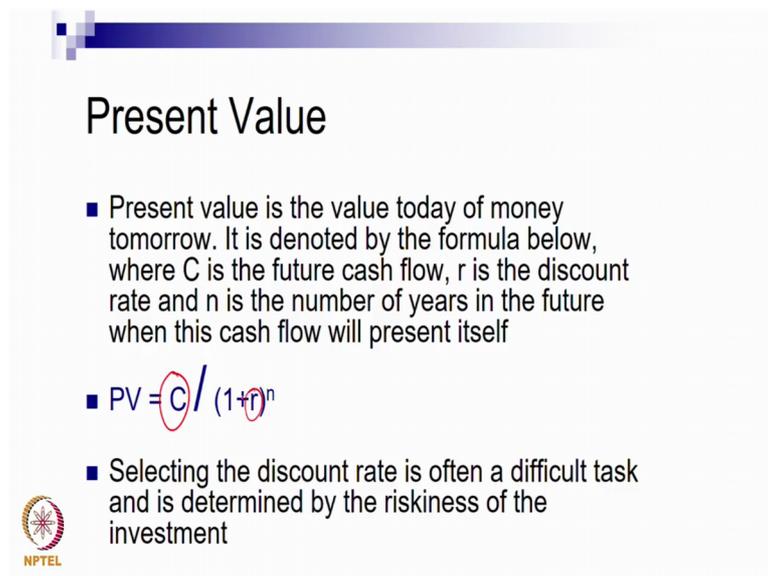
As the name suggests, very straightforward, you figure out what the costs are, that the product is going to incur. You obviously have capital cost write-in the beginning of the project, you have all kinds of operations and maintenance cost, you might have other kinds of costs as well. You might have environmental cost, and all of those kinds. So there are number of costs that are approved through the project. And at the same time there are also a number of benefits that are grooved to the project. Then again financial benefits, so people might be paying you a toll tariff or whatever it is.

You might be able to rent out if you have land attached to the project, you might be able to build hotels or whatever, and you might be able to make money out of that. There might also be intangible benefits that are grooved from the project. So perhaps one of the things that a transportation project does is that it saves people's travel time. And the travel time saved can be measured in terms of productivity and be given some kind of value. Maybe because your cars are proceeding at a much faster rate, your petrol consumption tends to be much more optimal or the wear and tear on your car tends to be little bit minimal. So all these kinds of benefits that can come.

So there are costs and benefits, costs are tangible as well intangible, benefits can be tangible as well as intangible. And essentially you do a cost-benefit analysis by saying look, my costs greater than or less than the benefits. And ideally for a project to go forward, benefits must be greater than the cost. Right, so we develop something called as benefits by cost ratio. If the benefits are greater than the costs, then the benefit by cost ratio should be greater than 1. So, this is the benefit by cost ratio, which some of you have seen the slide before.

The key thing though is that your costs and benefits get spread over a period of time. Right, not all of them occur at the same moment, not all of them occur on day one. And since you have cash flow in projects that are spread over time and because we know that money today is not the same amount of money tomorrow because money has the ability to earn interest. We have got to sort of look at the mechanisms of evaluating cash flows over a longer time period. And the most common method, the one method we all use, is called the discounted cash flow method.

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Present Value

- Present value is the value today of money tomorrow. It is denoted by the formula below, where C is the future cash flow, r is the discount rate and n is the number of years in the future when this cash flow will present itself
- $PV = C / (1+r)^n$
- Selecting the discount rate is often a difficult task and is determined by the riskiness of the investment

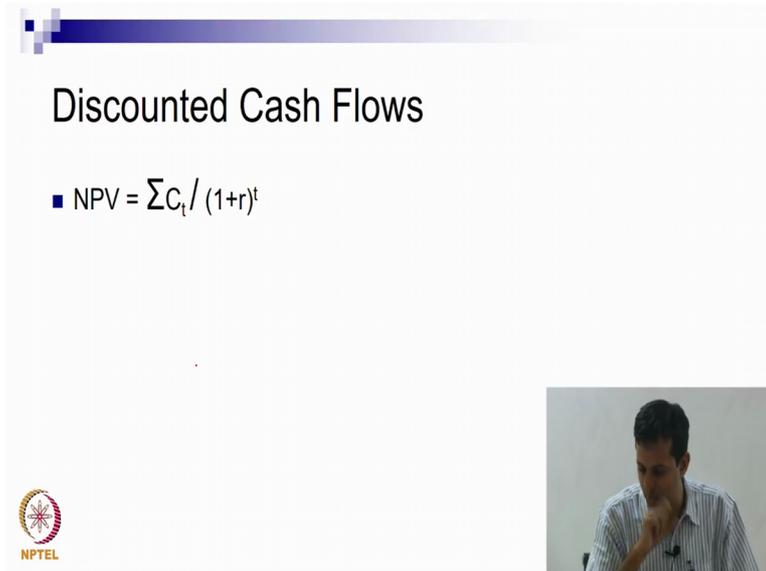


Like say you have cash streams over a period of time, like cash streams in the future are discounted by some interest rates and abroad to today's terms and when you bring all your cash flows to today's terms, you can add them, subtract them, multiply them, divide them, whatever, that is the cost benefit analysis. So, all this financial analysis rests on this notion of present value, discounted cash flow analysis, via the present value of the cash flow is C, right away. At essentially the logic is simple, if I have a cash flow C, that comes to me either as an inflow and outflow at n time period, n years from today, then of course I can value it up to a real value.

Suppose if I get a crore rupees 10 years from now, it is not the same as a crore today. So, I discount that crore by interest rate to bring it to today's terms, is essentially the host. So all my cash flows over time get discounted to today's terms, based on which I can actually then evaluate what are the sum total of cost are, the sum total of benefits are by bringing everything to today's terms. Alright, and then there is the reading, there is a small reading in

the Google drive, it is called (3:23) something or the other, it gives a very quick primer on this sort of matter, all right.

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The slide features a blue gradient header bar. Below it, the title "Discounted Cash Flows" is centered. A bullet point contains the formula $NPV = \sum C_t / (1+r)^t$. In the bottom left corner is the NPTEL logo, and in the bottom right corner is a small video inset showing a man in a striped shirt.

Okay, so this present value, net present value, I'm not going to throw all of this. So the 1st thing that we're going to do is after you calculate, so you take your present value of cost, you take present value of benefits, you come up with analysis and you say that the benefits are greater than the cost, then the project needs to go ahead, right. Once that happens, very often you would actually want to start preparing very detailed cash flow statement because you want to understand things well. I know the benefits are greater than the cost but what is the potential profitability of this project. Like how profitable is this project likely to be.

Okay, so that you can get whether a private sector player might be interested in taking this project or not. So private sector player might come in and say, look a family to get a 15% return on my investment, then it is worth considering. Right, if I am going to get a 6% return on my investment, I do not really understand why I should take the risk because I can take the same amount of money and put it in fixed deposit in the savings bank and without any risk make the same amount of money.

Right, so it is very important to understand what is the rate of interest that I get and so on. So just saves to make this easier, what I will do is I will show you a couple of these financial analysis.

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	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Revenue (Ink)																					
Increase from water supply	-	301	235	247	260	272	286	300	314	330	348	364	383	401	422	443	464	487	512	539	565
Profit on sale of assets	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Income	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Revenue	-	301	235	247	260	272	286	300	314	330	348	364	383	401	422	443	464	487	512	539	565
Expenses (Ink)																					
Operation & Maintenance	-	51	107	152	198	224	238	257	284	311	351	396	444	495	550	607	666	727	790	856	925
O&M of transmission & distribution	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&M of secondary energy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Financing Cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loss on sale of assets	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Expenses	-	51	107	152	198	224	238	257	284	311	351	396	444	495	550	607	666	727	790	856	925
Profit Before Dep. Int & Tax (PBDIT)	-	250	128	95	62	48	48	43	30	19	83	68	39	107	172	243	318	390	463	537	610
Less:																					
Interest	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest on WC loan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest on Senior Debt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest on Subordinated Debt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Profit Before Dep & Tax (PBDT)	-	250	128	95	62	48	48	43	30	19	83	68	39	107	172	243	318	390	463	537	610
Less:																					
Depreciation	-	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Provisionary cap. written off	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Profit After Tax	-	219	97	64	31	17	17	12	0	11	52	37	8	76	141	212	287	359	436	506	579
Less:																					
Tax (including def. Tax provisions if any)	-	17	2	3	5	6	6	9	11	12	14	15	17	19	21	23	25	27	29	31	33
Profit After Tax & Tax	-	202	95	61	26	11	11	3	11	39	23	22	13	57	120	189	262	332	407	475	546

Sl.No	Factor	Unit	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1 WATER VOLUME																							
1.1	Diers of Operation	Diers	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
1.2	Water input to TTP	MCD	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59
1.3	Influence of TTP	% of input	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
1.4	Water output of TTP	MCD	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	
1.5	Losses and NWT	% of production	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
1.6	Water supplied	MCD	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
1.7	Treat supplied	KCl	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	17,485.750	
2 REVENUE																							
2.1	Water Rate	Rs. per KCl	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00
2.2	Evolution	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.3	Operating Revenue	INR Million	521.00	526.50	534.50	535.25	535.25	535.25	535.25	535.25	535.25	535.25	535.25	535.25	535.25	535.25	535.25	535.25	535.25	535.25	535.25	535.25	
3 O&M Costs																							
3.1	Employee Expenditure	INR Million	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.2	Consumables	INR Million	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.3	Power	INR Million	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.4	Repairs and Maintenance	INR Million	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.5	Other plant profit	INR Million	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.6	Other plant profit	INR Million	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.7	Other plant profit	INR Million	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.8	TOTAL	INR Million	521	526	534	535	535	535	535	535	535	535	535	535	535	535	535	535	535	535	535	535	
4 OPERATING SURPLUS																							
4.1	Operating Surplus	INR Million	276	291	307	322	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329
5 CASH FLOW																							
5.1	Capital Investment	INR Million	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.2	Operating Cash Flow	INR Million	276	291	307	322	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329
5.3	Net Cash Flow	INR Million	276	291	307	322	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329

So this is, again, this is something that a consultant did a long time ago. But essentially what they have done is they have prepared this very elaborate spreadsheet, right. So for instance, they have all of these inputs on project costs (4:52) the point sends out to you. So they have a construction cost, development cost, so you have all of these costs that you put in. So that the total construction cost, the construction cost get split over 2 years, it gets split in 40% in year 1, 60% in year 2, then there are all kinds of, there are all kinds of cash flows that go in, so here is a very large revenue.

If you look at these columns, you have certain amount of revenue, this is of course a water treatment project. So there is a capital cost in building the water treatment project, that happens in year 1 and year 2. Then you have revenue, that it comes in at annual basis or the

Similarly 2 years down I will divide it by the interest rates, squaring the interest rates and so on. So, when I do that, I find out that the project in itself has a formula as you can see on the top here, which calculates what is called the internal rate of return. In other words itself, what is the rate of return that I can expect from this project, right. So if the rate of return is positive, I am making some profit, but what extent is that profit and here it is about 19.4%, which looks like pretty good rate of return. And this is something which I would be happy to talk about.

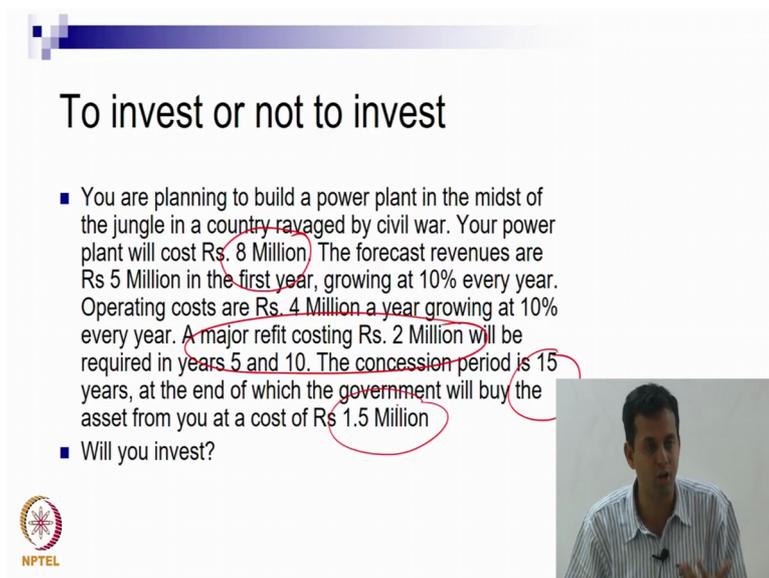
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	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	
Revenue (Rs)																						
Increase from water supply	-	381	335	287	268	272	286	269	314	330	348	363	383	408	432	445	464	487	524	539	565	
Profit on sale of assets	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Other Revenue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total Revenue		381	335	287	268	272	286	269	314	330	348	363	383	408	432	445	464	487	524	539	565	
Expenditure (Rs)																						
Operations & Maintenance	-	51	87	122	128	124	120	127	144	151	159	166	174	183	192	202	212	222	233	234	238	
O&M of transmission & distribution	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
O&M of secondary sewerage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Planning Cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Loss on sale of assets	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total Expenditure		51	87	122	128	124	127	144	151	159	166	174	183	192	202	212	222	233	234	238		
Profit Before Dep. and Tax (PBDT)		330	248	165	140	148	141	170	163	159	182	187	209	225	240	243	242	265	291	295	327	
Less:																						
Interest	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Interest on WC loan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Interest on Senior Debt	-	-	78	73	68	62	57	52	47	42	36	31	26	21	16	10	5	-	-	-	-	
Interest on Subordinated Debt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Profit Before Dep & Tax (PBDT)		330	248	165	140	148	141	170	163	159	182	187	209	225	240	243	242	265	291	295	327	
Less:																						
Non-Cash Expenditure	-	-	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	
Depreciation	-	-	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	
Provisionary exp. written off	-	-	39	39	39	43	44	48	50	53	57	62	68	75	82	90	99	109	120	134	150	
Profit Before Tax		330	248	165	140	148	141	170	163	159	182	187	209	225	240	243	242	265	291	295	327	
Less:																						
Tax (including def. Tax provision if any)	-	17	2	3	5	6	8	11	12	14	15	17	19	21	23	24	-	-	45	97	102	
Net Profit		313	246	162	135	142	133	159	151	148	167	172	190	204	217	219	217	220	246	198	193	225

There are also all other kinds of details, the equipments that you buy depreciates over time and depreciation becomes an expense. So every value traded depreciation as an expense and that influences your cash flow, right, you have something called a, this is what we call a profit and loss account, which again is a different way of saying the same thing but was the income that you are making, what is the expenditure of that you are getting, finally what is your net profit every year. So, on year-on-year basis, how much money will you have. And of course it is nice to say that 15-20 years down the line, I will have 207 crores or whatever.

But because of interest etc., that is valued far less today. So these are the kinds of spreadsheets that you often prepare to really understand the economics of a project. So you start off by doing a cost-benefit analysis, very often that need not be very precise. Then the moment you actually start looking into contracting, we need to actually get into a much more elaborate exercise of what are the returns that I am going to get on these projects. So these are the kinds of decisions that you have to look at, right.

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To invest or not to invest

- You are planning to build a power plant in the midst of the jungle in a country ravaged by civil war. Your power plant will cost Rs. 8 Million. The forecast revenues are Rs 5 Million in the first year, growing at 10% every year. Operating costs are Rs. 4 Million a year growing at 10% every year. A major refit costing Rs. 2 Million will be required in years 5 and 10. The concession period is 15 years, at the end of which the government will buy the asset from you at a cost of Rs 1.5 Million
- Will you invest?



So you are planning to build a power plant in the midst of the jungle in a country ravaged by civil war. Your power plant will cost Rs. 8 million, right, so that is what my cost is going to be. And I will probably have to spend this cost in the 1st year or in the 1st couple of years. But there are some revenues that finally, in the 1st year, growing at 10 percent every year. So, it looks like I am getting a lot of revenue but remember that 15 or 20 million, 25 years down the line is not really worth as much in today's contest, because I have today is counted.

I have certain operating cost as well, which also seem to be quite high which is growing and this operating cost might not only be operating cost with respect to the plant, but obviously the safety, protection, you know there is a lot of fighting going on and there might be an explosive and all of that has to be filtered into my operations and maintenance costs. From time to time there is a refit, right, so that is what we call is major maintenance or capital expenditure that is required. But many of these assets cannot just be left for the next 10, 15, 20 years, you will have to retrofit all of that.

And there is a 15 year period when the government wants me to run it and at the end of 15 years, they will pay me 1.5 million. Really 15 years from now, so that will be worth less today. So the question is, will you invest or not. You can build these kind of financial columns just like the one I showed you. These are my capital costs, these are my operating costs, this is how they view over a period time, all of that, right. Of course you are putting in a lot of assumption, there is no guarantee that revenue will grow at 10 percent every year, it may, it may not, okay, and then you can compare.

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Funding

100 Cr
80% D
20% E
D/E = 3:1
4:1

- 2 major components
 - Debt → 12%
 - Equity → 20%
- Weighted Average Cost of Capital
 - $WACC = K_d (D/D+E) + K_e (E/D+E)$

$WACC = 12\% \times 80\% + 20\% \times 20\%$
 $= 9.6\% + 4\% = 13.6\%$

NPTEL

So that is essentially the financial analysis part, right. So you do a financial analysis, typically for the client or a consultant to show that this project has mettle. I mean the benefits are greater than the costs, and again there marginally greater than the costs, right. If they are marginally greater than the costs, it might still be worth doing it, but the profitability might not be high enough to incentivise the private sector to come in into it, right. So the private sector to come in, there needs to be a financial benefit that far outplays the cost, right.

Now what is the kind of benefit that the private sector looks for? 10 percent is that fine, 12 percent, is that fine, 14 percent, is that fine? It depends also to some extent on the kind of funding that the private sector brings in, okay. So the private sector normally will bring in money into 2 ways, there is something called debt, right and there is something that is called equity. Debt is a essentially a loan that you take from a bank or from any financial institution. Equity is your own money that you invest, right. The difference of course is that whatever I take from the bank, you have to repay with interest, right.

So if I take 100 rupees from the bank, I will have to repay that with the interest, no more, no less, right. But for the money that I put in, if the project is usually profitable, then whatever increase the money I will get is mine, right. On the other hand if the project is doomed to failure, then I might lose all of my money, right. The debt is the same as the loan, it has a relatively fixed risk reward structure. Equity has a much higher, more volatile risk reward structure. Right, so typically what people do is, they begin some amount of equity because they want that, they want to invest money and see it grow but they also take a certain amount of that.

Roughly very often you will find what we call as a debt equity ratio, right, the ratio of debt to equity, often the debt to equity ratio tends to be 3 is to 1, 4 is to 1, 75 percent of your project might be there, project cost might be there. 25 percent you put it, sometimes it is 80-20, right, so whatever, sometimes it could be 70 to 30. But these are the kind of numbers that you normally see in terms of debt equity ratio, right. Now there is a concept called as weighted average cost of capital, right. In the concept is very simple. Essentially it says I can borrow, if I have 100 crores, okay, I borrow say 80 crores in terms of debt and 20 crores in terms of equity, okay.

The debt charges me let us just say 12 percent, the financial institution I am borrowing from charges me 12 percent interest. The equity when I put it, I expect to get more or less? Right, I expect it more because that is addressed Taking, the money which I am putting in, I want to get more out of that. So maybe I am expecting 20 percent, Okay, so maybe I am expecting 20 percent. So in other, in this case, my weighted average cost of capital to my right is 12 percent, which is the cost of debt multiplied by 80 percent which is the percentage of that, which is this 80 crores out of 100 right here, right. +20 percent within my cost of equity multiplied by the percentage of equity which is again 20 percent, all right. So what does this work out to?

This says, 9.6 percent +4 percent, equals 13.6 percent, equals 13 at 6 percent. So in other words some of my money comes from debt, some of it comes from equity. Debt has a certain price which I need to pay, equity has a certain price that I need to pay. So I weigh the 2 in the proportion of 10 equity. So in this particular project I am looking for an overall return in the 13.6 percent rate, right. If you are only going to give me an overall return of 12 percent, right, is that calculation that I showed you the spreadsheet only gives me an overall return after percent, what does that mean?

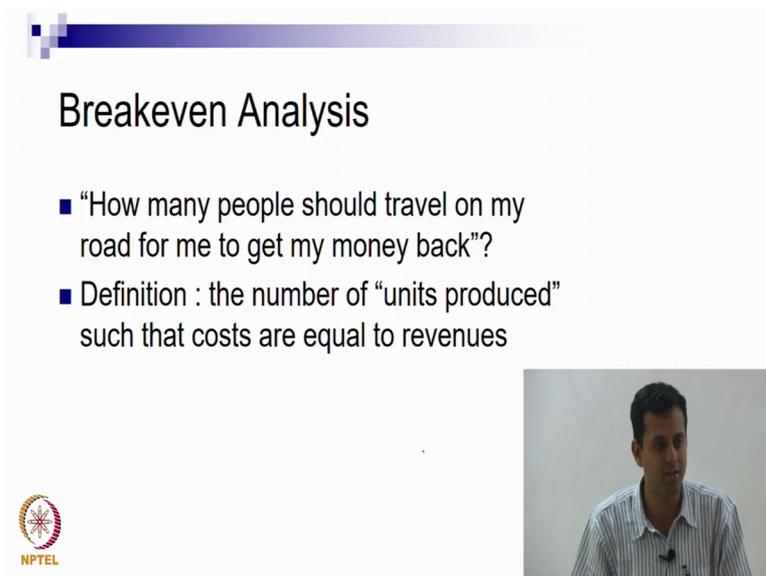
I have to pay the bank 12 percent, right and I will probably only that forget another 12 percent return on my equity, 12 percent all around. And if I look at that and say why am I putting in my hard earned money into a project where I can get about 12 percent, right. Whereas on the other hand it looks like this project will give me a 50 or 60 percent return and the bank is going to give me an interest rate of 12 percent. This very likely that my cost of equity is going to be higher.

Right, so if I want to make this 13.6 into 15 percent, then I can change this 12 percent. Then I must change this 20 percent, or maybe it becomes 26 percent, 27 percent, so it is a very sweet

deal for me, right. So the private sector brings in the money, they will look at their cost of debt, they will look at their cost of equity, right, put that together and find out what is the weighted average cost of capital, what is written that they expect on the project. Go towards the financial analysis to say, can this project deliver this kind of return and then decide whether to take up the project or not.

Right, and of course please understand that these are all assumptions that they make. How did I get 19.4 percent in that Excel spreadsheet I told you, I gave you some assumption on how much revenue I will get. Where I get that number from? Presumably I thought there X number of consumers, each consumer will pay me certain amount and therefore I will get a certain amount of money. And what is the guarantee that 25 years down the line you will have that many consumers? What is the guarantee that those consumers will say, what is the identity that operations and maintenance costs will be much higher because cost of material is higher and lots of assumptions.

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Breakeven Analysis

- “How many people should travel on my road for me to get my money back”?
- Definition : the number of “units produced” such that costs are equal to revenues

So they will have to do some sensitivity analysis, etc., does not vary, tips reasonably straightforward but you will have to do a little bit of analysis. Right. So one of the analysis that people do is a breakeven analysis. The breakeven analysis says, okay, fine, what is the minimum number of years I need to operate so that I achieve positive on returns. Well, technically breakeven is no profit no loss, but nobody wants to look at breakeven with no profit no loss, we want to have some minimum rate of return that you are looking at, right.

So breakeven analysis, how many people should travel on my road for me to get my money back was upon how many years should I operate this for me to have a minimum, for me to get my money back. And I can look at that assumption and I can say is this reasonable or not. Right, if I need to like scars on my road per day, is that a reasonable number, right, what do my demand petitions say. So these are ways in which private sector normally, Financially looks at these stuffs.

So we talked about the kind of analysis, like cost analysis, cost benefit, then do a much more detailed analysis, whatever the rate of return, the private sector will do its own analysis, what is my weighted average cost of capital, does it match with the rate of return I am getting, all of those kinds, what is a breakeven, all of that. Let us say at the end of it, we are all happy, benefit cost ratio is greater than 1, we go and read with the project, internal rate of return of the project is high enough, so the private sector wants to comment, right.

Very often when the private sector comes in, right, the private sector does, so let us say there is a company say XYZ Private Limited, XYZ Private Limited is like L&T or GMR or whatever. I mean it is a large organisation that develops infrastructure projects, right. They have done this analysis, they want to develop your road. Very often what they do in these kind of cases, is that they create a subsidiary which we will call ABC Private Limited. They create a subsidiary, ABC Private Limited is now a completely separate company, right.

Right, it might be controlled by XYZ Private Limited, it might be owned by XYZ Private Limited but for all intents and purposes, it is a separate company. It has its own CEO, managing director, what not, okay. So what they often do is this ABC Private Limited, right, enters into an agreement with the government of PQR, with the government of PQR to do the project, right. XYZ Private Limited is not entering into that agreement, ABC Private Limited is specially created, what we call a special purpose vehicle, SPV is entering into this agreement, right.

ABC private limited, right, is taking a loan from banks for this project. So if the project is a 500 crore project and I want to do and 80-20 debt equity mix, right, I will ask the promoters XYZ here, I will say you guys put in 100 crores, okay and banks here put in 400 crores, right. I cannot lending to XYZ, banks are lending to ABC, right. So this is a very popular structure, that is called project finance. Right. Another name for it is non-recourse finance. The reason it is called non-recourse finance is, case 1 project does fine, all right, so you build the roads,

you got your traffic, revenues are coming in, etc. And every year you are repaying the banks their loans.

Case 2, the project does badly, there is not enough traffic on your road, you are not making enough money, you are not able to repay the bank loans, okay. What happens then? In project finance, what happens to the banks, only have a recourse to ABC. They can go to ABC in any which way they want, they can take any assets that ABC owns, right. So ABC might for some construction equipment because they are paving the roads periodically. They might own some computers, right, they might have built the tollbooths and they might have kind of electronic infrastructure, so the bank can go after any of that.

Right, but the banks cannot touch anything of XYZ Private Limited. XYZ Private Limited can have a wonderful balance sheet, hugely profitable, but the banks cannot touch XYZ Private Limited under this structure. So another way of doing it is what the banks will say is, they will say, look this XYZ Private Limited, yours is a large company, I know you have a lot of money in the bank, I know that everybody goes south, then you will have money to pay. I will be willing to lend to you at 10 percent.

But if you are going through company ABC, then the risks are higher. Even though it is the same person, the risks are higher because now I cannot go back to your balance sheet, right. I will lend to ABC at 12 percent. So then I will give you a choice, come to me as XYZ, 10 percent, come to me as ABC, 12 percent. So that is the way in which the banks might hatch the difference. So this project finance option tends to possibly be costlier. Right, so the interest rates are likely to be higher, but it protects the private developer.

So the project goes back, only the project and the project related items are addressed, right, the company is not. So, they may build a power plant, yes, and there is not enough power that has been bought, the bank is welcome to come in and take that power plant, right, as the asset. But they cannot come after me and take my assets from my balance sheet as XYZ. Is this concept clear, what project finance is? So, this is what the private sector is going through, so the 100 crores that we talked about for the plant, for the road, sorry, XYZ will build the road but it will 1st form ABC, all right.

So ABC has 500 crores, so XYZ will put in 100 crores in equity to ABC, they will take 400 crores of loan from the bank. Alright, if the project goes well, great, the foreign crores gets repaid, the profits are made, and 100 crores become 200 crores or whatever it is, it goes

back. If things go south, this 100 crores is at risk, right, but only the 100 crores, 400 crore, the banks have no recourse, they can take the route they want, right, on whatever assets they have. Yes...

Student: Why would a bank (22:20) act according to the risks they are taking...?

Professor: Exactly, so they have to price that risk, right. So if the project makes no sense, the bank will not do it. The bank will do its own diligence and they would say that look, the traffic on this road is going to be pretty good, so this is the industrialised corridor, etc., so the bank will also have to do its due diligence and convince itself that this project is most likely going to succeed. Right, and then lend the project at higher interest rate, in which case it is actually good for the bank.

Student: (22:48) the bank is trying to achieve through XYZ too...

Professor: Correct, but except that all of these assumptions, so the banks tend to be a little more pessimistic, because they have something to lose. XYZ tends to be a little bit more, the promoters tend to be a little bit more aggressive, right. So there are various shades of it. It is unlikely that XYZ will say, there is a 20 percent return on this project and the bank will conclude with a 6 percent return, right. But it is possible that XYZ might say 15 percent, right, but the banks might say, oh, this is tricky, right, I do not think you guys can do more than 12 percent.

Student: That might be (23:30).

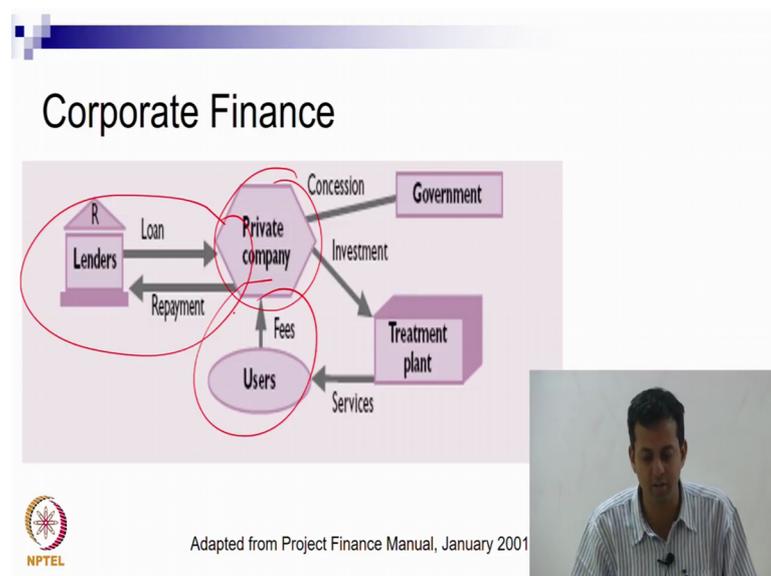
Professor: Sure, XYZ thinks that this whole thing is fine, but this is, but these projects are essentially long-term projects. Right, so things can change over a long period of time, right. It is often better to reassess yourself, right, so you have that protection. This is, you will find projects in the world where companies go directly to banks. So in the oil and gas sector, for instance, like Nexon and Mobil for instance will borrow directly for its next equal exploration or whatever. But there are also cases where, particularly in construction companies come together.

Like I have an airport designer, contractor, operator coming together. It often makes sense for them to form a special-purpose vehicle and they can start special-purpose vehicle. Okay.

Student: Potential of the parent company is only (24:25) or if the government wants to pay within the company.

Professor: Correct, there are many reasons, government wants to take equity in the company, I want to do a joint-venture, right, because I have a really good expertise with construction but I do not know how to operate and maintain something full so I want to come in as a joint-venture partner, so there are many other reasons for doing this. But once you do that, right, you essentially very often structured as a non-recourse finance deal. Right, if it is with recourse, then you can go back to the parent company, rate, but if it is non-recourse, you do not. Okay, so these are all just the same thing.

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The evolution of project finance

- Is it a recent phenomenon?
 - No it isn't! It has been around since medieval times.
- Became very popular in mining and oil exploration projects in the 70s
- Adopted by the power industry in the US in the 80s
- PPP's in other sectors now use it extensively

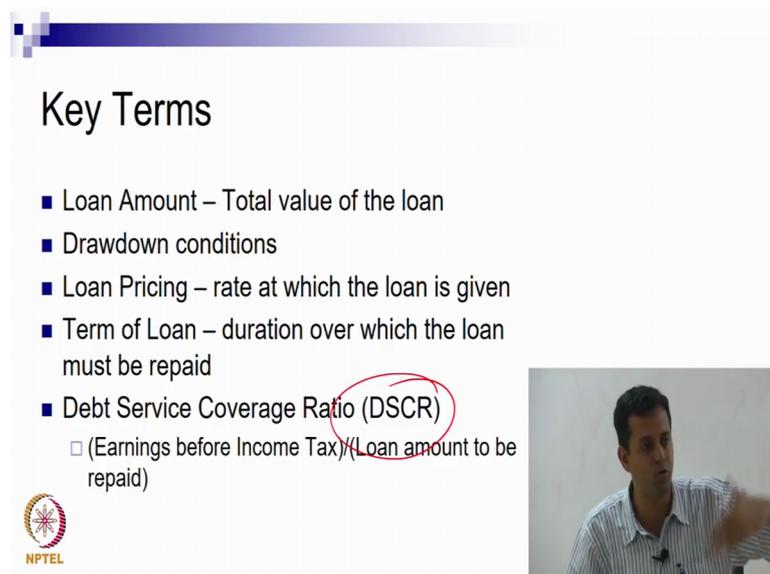


This is sort of an example. It says project company, right, so the project company, and this project finance manual is there in your, in the reading list, it is only the product company that deals with the lenders. Okay, whereas in this, where this is public finance, and a typical

corporate finance, the private, this private company which is the parent company, which is not the special-purpose vehicle deals directly with the lenders. Right, and directly gets user base, okay. So those are essentially the differences between.

So a private sector company is often as you say are joint-venture between multiple companies, although it does not have to be. Right, and it generally allows companies to expand quite a bit, all right. And project finance has been around is been around for a while, it is not new.

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Key Terms

- Loan Amount – Total value of the loan
- Drawdown conditions
- Loan Pricing – rate at which the loan is given
- Term of Loan – duration over which the loan must be repaid
- Debt Service Coverage Ratio (DSCR)
□ $(\text{Earnings before Income Tax}) / (\text{Loan amount to be repaid})$

And at the last point is often the project finance is structured. There are a few key terms that make their way into the financial calculation that I talk to you about. Of course the loan amount is an important, how much are you drawing, what are the drawdown conditions, when do you get that money. But you do not know, you always get it in drafted the beginning. You get it for a pint of time, you get it based on milestones, right, us. So you might say that I need 1000 crores to build the, but I am going to take 300 crores over a 3 or 4 years period.

I moved to build 2 lanes in the 1st year, I spend to 3 and 4 planes. So if I do not meet my targets, then maybe I do not get my next chunk of money, right. So those are conditions that you are going to look at carefully. Loan pricing, what the interest rate, what is the term of the loan, this is something that is very important. Right, something called as debt service coverage ratio, in fact this is the ratio of, so every come at every time period, every year, you expect to make a certain amount of money.

Right, you expect to make say 2 crores profit, okay, out of which you need to now repay the bank, right. Let us say you have to repay the bank a crore, right. So your debt service coverage ratio is the ratio between the debt that you repay versus your total capability of repaying, right. So I have able to cross, I have the ability to repay 2 crores because I make 2 crores profit. But I am repaying 1 crore, because that is what our agreement said. So my debt service coverage ratio is about 0.5 in this case. Right.

Or you can sort of calculate it in, so it is the earnings before, so it is the opposite, the earnings before income tax divided by the loan amount to be repaid. So in other words I have 2 crores of earning, have the loan amount to be paid, so it is 2 by 2. If I have to pay 1.5 crores as my loan amount, it will be 2 by 1.5 or whatever it is. So this debt service coverage ratio, which essentially tells you what is the ratio between what you are running and what you will then have to pay to the bank, gives you also an indicator of how healthy the project is.

Here we come according to this, the debt service coverage ratio is less than 1, right. That means your earnings are less than what we have to repay to the bank, right. So if my debt service coverage ratio is 0.75, then for every Rs. 75 I earn, I give Rs. 100 to the bank, how is that possible? So, debt service coverage so is less than 1 is automatically a bad idea. Debt service coverage ratio should be greater than one. Okay, what is that 1.1 or 1.05? Then that might represent quite a bit of a risk in the project.

Essentially it says whatever you get, you are paying back, so in one time period, your demand did not pick up and you actually did not earn as much as you wanted to, you might not be able to pay back your debt, right. So potentially high-risk. Similarly it is too high, if your debt service coverage ratio is 3, right, that the question might arise that has to why you are paying back so little. Cannot you pay back more of the loan quickly and then start enjoy the equity. So the debt service coverage ratio is a metric that people look at. Typically somewhere in the 1.6 to 2 range is thought of to be a good metric, when you have enough buffer Built-in, that even if your demand fluctuates a little bit, you will still be able to pay your lenders and all of that.

Okay, all right. This is essentially a very quick overview of the basics of finance, all right. Any questions at the moment? Basic cost benefit analysis, discounted cash flow and then how do you actually, what do, what do the private sector look at, and how do they come out with their weighted average cost of capital, how do they project finance, debt service coverage

ratio, which is something that will look at. Right, so these are some key ideas. So, we will stop here and we will now move on to the next group.