# **MGT 8803 FINANCE MODULE**

# **Week 4 TRANSCRIPTS**

## Introduction- Part 1

>> Hello, this is Professor Jayaraman from Georgia Tech and I am continuing the lessons on Business Fundamentals for Analytics. You just learned the accounting modules. I'm going to walk you through the financial management modules. We have brief introduction about me as I started out as an engineer, mechanical engineer.

And then, went on to get an MBA from Indian Institute of Management Calcutta. And then after working for five years at car company as planning manager, I decided to pursue a PhD in finance. I graduated from University of Pittsburgh in 1986. Ever since I've been at Georgia Tech, so I completed 33 years of service at tech.

I really enjoyed teaching and doing research in finance. I hope it comes through in all these modules. Finally, I also do have a CFA charter. The only reason I'm mentioning this is, in the process of communicating, if I mentioned some companies as good investments, those are my personal opinions.

So if you have to invest on those, you have to do your own due diligence and either buy or sell those securities. Okay, let's get started. Here, I'm going to introduce you to the basics of financial management. So, in these modules, you're going to be with me, I'm going to cover several objectives.

First I'm going to explain to you the role of financial manager in corporations. How the value creation process is important. Then I'm going to introduce to you alternative investment rules that are used to select the projects. Then once we understand the different investment rules, I'm going to start talking about how to estimate a project estimated cash flows through the life of the projects, which forms an important input in the investment decision process.

Then, I link it to how stocks are valued as the present value of all future expected dividends. Continuing, I'm going to explain to you how risk is measured for financial instruments. Then walk you through the relationship between risk and expected return using capital asset pricing model. It would be of interest to note that capital asset pricing model won the Nobel Prize in economics.

Then we'll talk about the weighted average cost of capital, as determining the minimum rate of return that the corporation must earn on its invested capital to break even in economic terms. Then, we'll move on to estimating the value of the firm as the present value of projected free cash flows, discounted as its weighted average cost of capital.

Finally, the finance modules conclude with learning of the concepts of economic value added and market value added. And then I'll tie up all of the concepts to the value creation process, okay? Let's get started. I want to think about how what are the different metrics that makes an organization successful in the long run?

Most of my presentation and finance modules, I'm going to use Home Depot as a running example, for a couple of reasons. One, Home Depot is a very successful corporation, based out of Atlanta. And secondly, it has create a tremendous amount of shareholder belt over the past 40 years.

So I like to use Home Depot as an example and it's spread all over the US. And for that matter, they have some locations in Canada and Mexico too. So, I want you to think about, for a minute, what will make a company successful in the long run.

Normally, you jump out with the answers like make profits, create cash flows, Have continuous employment. But where I'm going to focus upon my attention is to highlight to you the importance of taking care of the customers. Because I am not aware of any company that can survive and thrive in the long-run unless they take care of the customers.

So, I want you to assume and I'm going to assume that for a successful company, before we learn about the financial concepts, if you are not taking care of customers who want to buy your product and services on a repeated basis, you're not doing a good job. You're not going to survive in the long, okay?

So let's assume that the company takes good care of customers. So where the finance person focuses his or her attention is what I would call investment decisions. So running with the Home Depot example, I want you to think of, what should a Home Depot do going forward? Which are the new locations they should think in terms of opening?

Which are the locations they should shut down, because there is hardly any traffic of customers? What type of people should they hire in the company, etc? Should they expand to more countries beyond Canada and Mexico? Those are the questions I would suggest to investment decisions. The second major set of decisions the corporate finance manager makes is how to access capital from the financial markets, in terms of debt and equity.

You would have learned in the accounting modules that debt holders are the investors who give capital to the company and you have to return the principal and the interest payment. After returning back the interest and the principal payments, if you have money left that belongs to the equity holders.

So equity holders are what we call the owners of the corporation. So our focus is always going to be on the owners of companies of corporations. But it's very important that if the company has debt, you do take care of the interest payment and principles repayment before you think in terms of distributing money to the shareholders.

I want to walk you through one more slide in the value creation process. Let's move on to the next slide where I want to demonstrate you the role of corporate financing, corporate strategy, right. This term, the value creation, you're going to be hearing hundreds of times through my presentation.

It's extremely, extremely important that the corporation is run with the objective of creating value for the shareholders. So in the process, the company is going to make operating decisions or you can again call it investment decisions. And the idea and the investment decisions is, how do you allocate the internal capital for future growth?

And also, how are you going to grow the company through acquiring other firms or divesting firms or business units those are not doing well? So at the end of the day, you want to increase the cash flows or cash flows of the company. And simultaneously, the managers making the financing decisions.

The idea here is capital structure, how much debt? How much equity? That's an important decision. Then, how do you manage the risk in the company, okay? Suppose Home Depot's deriving lot of profits from Canadian operations. One of the things the manager has to be concerned about is the Canadian dollar versus the US dollar.

Because if the Canadian dollar is going down in the value, ultimately, when you convert it to US dollars, you're not going to have as many US dollars. So a lot of good finance managers focus their attention on exchange risk management. That's just an example of it. But the overall goal is to reduce the cost of capital to mange risk.

So at the end of the day, if you think about any company you have in mind, be it Delta Airlines or Google or Facebook Or Amazon, the upper level management focuses on two key aspects. Make good investment decisions to increase expected cash flows. Make good financing decisions to reduce the cost of capital or decrease the cost of capital to create shareholder value.

And that's the fundamental framework on which I'm going to cover in different modules. So, wrapping up this module, I want you to understand a good corporate finance manager makes good investment and financing decisions but the ultimate goal of creating shareholder value. Always, always remember that, if you don't take care of your customers, all this decision making is not going to help you.

So, number one focus should be on customers. Making sure that you are creating products and services they want on a repeated basis. And then, focus on the financing and investment decisions. So this wraps up the first sub-module. In the next module, I'm going to start talking about couple of very good examples of value creation.

And why so much focus is going to be on shareholders, okay? Thank you.

## Introduction- Part 2

>> Hi, welcome back, and this lesson plan, I'm going to talk about the goal of financial management. Lot of times, people always think maximizing profits and cost would cut it, or even maximizing market share. But as the lesson goes on you will see why it's always important to focus on maximizing shareholder wealth.

Let me give you a couple of rationale for focusing on shareholder wealth. Remember I said in the earlier video that shareholders are the owners of corporation. And the primary financial goal of any publicly traded corporation is to create economic value for its shareholders. Remember, shareholders are residual claimants, what do I mean by that?

Unless the suppliers have been paid, the workers have been paid, and you have paid the interest to the bondholders and taxes to the government, then only shareholders can claim the remaining value in the organization. So by construction, if you focus on shareholders, if the shareholders are happy, so are the other important stakeholders like workers, suppliers, the government, the bondholders, they're all going to be happy.

So that's important to understand. I have another slide of Delta Airlines. Delta Airlines is another famous company, many of you might have flown in that airline company. Every year they put out a report to the investors as to what they have done in the past year, and what they plan to do in the coming year.

So if you notice that they are very, very proud that they have consistently shown top line growth and margin expansion. And they want to keep working on it for 2019 and they are transforming their fleet with more efficient planes. And they want to control the costs of all the items other than the fuel to about 1% in 2019.

And I want to primarily show you how focused they are in returning money to the shareholders, right? So we're going to learn the term three cash flow going forward but they are commited to returning 70% of the free cash flows to the shareholders. Roughly they plan to return $2.5 billion dollars in 2019.

And from the operating cash flow which you have learned in the accounting models, they're going to use that money to invest in fleet product and technologies. So they position themselves in a powerful place in competition with other airlines operating in the US, and for that matter entire world.

So when you look at this schematic, what you notice is the firm is constantly interacting with financial markets. So whenever we are publicly traded company, you are in constant interaction with the public markets. So what that means is, let's say Uber is a company that went recently public.

So if you use Uber as an example, they did what is called initial public offering or IPO. So the investors on the market gave the money to the company, and the company in turn issued securities to the investors, okay? Assuming that Uber is run well, or Home Depot is run well, they are going to generate more money than what they got from the financial markets, either through equity or debt.

And because they're successful, they are going to generate profits and cash flows and part of the cash flows they are going to retain for future growth. Part of the cash flows they have to return as dividends to equity holders, debt repayments to debt holders. And of course standing in the line is Uncle Sam, the US government to collect the taxes.

So you can see that ultimately the firm must keep on generating cash. And the cash flows from the firm must exceed the cash flows from the financial market to thrive in the long run. So this is a good schematic to understand that a modern publicly traded firm operates significantly, interacts the outside world, the financial markets.

And also with the US government making sure that they pay the taxes. A couple of good examples before I wrap up this video lesson. One of the most famous companies is Coca-Cola company and he Mr. Goizueta unfortunately passed away in 1997. But he run the company from 1981 to 1997, when he took charge as a CEO of the company, it was worth $3 billion market value of equity.

How do you get market value of equity? You multiple the shared price by by number of shares you get $3 billion. When he passed away in 1997, it was worth $150 billion. So he really worked extremely hard using all the concepts you're going to learn through this finance models to create tremendous value for the shareholders.

And his growth strategy included growing the business in India, China and Mexico where close to 3 billion people live, to create value for the shareholders. Let me walk you through one other example and I'll wrap up this video. That is the famous Warren Buffett company called Berkshire Hathaway, it's been around for 50 years.

And interestingly, if you had put money in Warren Buffetts cash flow, the amount of return you would have earned is 1,000,000%. Whereas if you had put money in the S&P 500 stocks you would have earned 2500%. 2500% is a great return on the top 500 companies in the US.

But you can see that Warren Buffett because of his ability to pick stocks and follow buy and hold strategy for a long time, has created a huge shareholder wealth. So this wraps up our video for this module, and I'll continue with capital investment analysis in the next recording, thank you.

## Capital Investment Analysis Part 1: Capital Investment Analysis – Introduction

>> Hi, welcome back, if you remember in the previous two videos, I talked a lot about investment and financing decisions to create shareholder value. And I also gave you a couple of illustrative examples of Coca-Cola company and Berkshire Hathaway company. Now, where I'm going now is to focus on investment decisions that a company makes.

It goes with different titles, capital expenditure decisions, capital investment Analysis- Part, and let's get started on this lesson. So the capital budgeting decision is simply to decide how much to invest for future growth. And a typical corporation for it to be successful in the long run, has to spend considerable amount of Analysis- Part, to make sure that they are making good decisions, right?

So the companies we are aware of today, be Delta, or Home Depot, or Coca-Cola, are where they are today, because somebody made some good decisions 5 years 10 years, 15 years back. So it forms a basic important activity of the finance person in addition to the CEO to select good investments for future growth.

So if we want to give an overall framework of what happens in the decision making process, this is a good schematic to understand. It's all starts with identification of the project, what is identification? Let me use Delta Airlines as an example, so Delta Airlines has to continue to make safety related investments to maintain their flights.

So those are no questions asked here to make them to comply with the rules and regulations of FAA, and other agencies. Then secondly, they have to focus on replacement of their fleet, should they be buying from Boeing or Airbus, so what is it they should be doing? Supposing they're providing engineering services to other airlines operating out of Hartsfield Jackson Airport.

Should they expand their hangar and should they diversify? A good example would be should they invest in some other operations unrelated to airline business? Most well run companies do not easily get into businesses that are not germane to their investments. So Delta has a good well run company and they seldom diversify their investment.

But occasionally companies do, so where do these ideas come from? When you think about it, it could come from market research. You can find out what the competitors are doing. Recently, Delta is experimenting giving free Wi-Fi on their flights. So they're testing out and seeing whether consumers would loud the product so that they can introduce on all the planes.

So once they identify the project, then they have to spend considerable amount of time estimating the benefits and costs of the project, right? So we are going to spend some time trying to understand how to estimate the benefits and the discount rate for the project. Discount rate or the cost of capital are interchangeable terms I be using in my presentation.

Then once they estimate the benefits and cost of capital, then the selection of the project becomes important. So I'm going to talk about four important decision rules, net present value rule, profitability index, internal rate of return and payback period. Once we talk about these techniques, lastly it's important to monitor your actions.

So if you're Delta Airlines, you made a decision four, five years back, it's important to go back and revisit whether you got the expected benefits, or you fell short in terms of your estimation. So you have to always ask a question, does it make sense to continue on the project or stop wherever you are?

And this is an important decision for many companies when they're focused on long run projects. So this is how a typical capital investment Analysis- Part unfolds, identification, evaluation of the benefits and costs, and the estimation of the discount rate. Then using the appropriate technique and lastly, implementation aspect of it to make sure that things then as per the plans, okay?

So just to give you an idea of how important this is, I pulled up the cash flow statement for Home Depot. And from the earlier accounting lessons, you would have learned that one of the important part of the cash flow statement is the cash flow from investing activities, the capex.

So this is what I'm talking about that is how does Home Depot finance department and upper management decide on the deployment of this $2.4 billion? Because where Home Depot would be in the next five, ten years critically is going to depend upon the type of decisions they're going to use in investing this $2.4 billion, okay?

That's the focus of the capital investment Analysis- Part. So to understand how the capital investment Analysis- Part is done, I have to spend about five minutes on the time value of money Analysis- Part. And basically, many of you who are listening to this modules might have had their senior undergraduate classes either in engineering or finance.

But just to be sure that even if you had this lesson before, I want to spend five minutes trying to explain to this concept. Basically, the idea is dollar as a time value of money. And money coming in the future is worth less compare to money you are receiving today.

So to understand how to do this translation across time, I'm going to start with the very simple example of whether your uncle is giving you an option of $1,000 today or $1,500 in five years. And your opportunity cost of capital is 5%, so opportunity cost is the rate of return you sacrifice, On the next, Best, Alternative.

So in this example, I've assumed your opportunity cost is 10%, what does that 10% mean? That if you can, on your own invest your money in a bank at 10%, to earn interest. So whether to accept $1,000 today or $1,500 via five years from today, it's going to critically depend on this opportunity cost of capital.

So what I'm going to do is wrap up this video and walk you through the example in more detail in the next video, thank you.

## Capital Investment Analysis- Part 2: Future and Present Values

>> Okay, I'm continuing my presentation of time value of money. So in this video, I'm going to introduce you to the concept of future values and present values. So, let's start with the future values. We want to calculate, remember the example we talked about in the previous video, I talked about $1,00 your uncle promises to pay you, and your opportunity cost of capital at 10% for 5 years.

So how would I compute the future value? I'm going to keep track of How the money grows over time. So if you leave the money for one year at 10%, you're going to get $100 interest. So at the end of the year, your bank balance is going to be 1,100.

So if you leave it for one more year, 1,100 is going to earn $110 interest, that's going to accumulate to $1,210. So continuing the process for five years,ultimately you're going to be accumulating to $1,610.51. So remember your other alternative was,1,500 From your uncle. So clearly, you're better off taking the $1,000 today, because your uncle's offer of $1,500, so you can do a lot better by investing on your own at 10%.

So this is a principle, we call it principles of compounding. It's very, very powerful, and that's why if you're investing money for your personal wealth accumulation for retirement, It's extremely important to start saving earlier so that your money accumulates to a huge amount. General formula for future values, PV x (1+r) to the power of t, and r is in our example, 10% t = 5 years.

Supposing I ask you to redo the problem if r = 5%. You can say a FV at time 5 = 1000(1.05) raised to the power of 5, and that translates to 1,276.30. So, if your opportunity cost of capital is 5%, you would prefer your uncle's offer of $1,500.

If your opportunity cost is 10% you would definitely like the $1,000 check today. So let's move on to the present value concepts. So before I do that, most of you are very familiar with Excel, and these days, Excel has a future value function, you feed in the interest rates, the number of time periods, -C2, because we always feed in the present value with a minus sign, and it will compute the future value at 1,610.

Olden days, we used to use financial calculators, still you can use financial calculators, but many people prefer using Excel, and this is out how you would do the problem in Excel function, okay? Let’s move onto present values. A more common method of evaluating your investment alternatives is to calculate the present values.

So the idea of the present values, how much money you would need today, in order to duplicate some future value amount? So in our current example, we want to duplicate $1,500 your uncle is promising in 5 years, we want to find out what the present value is today.

So how would we do it? So what we are going to do is flip the formula for the future value, and say present value is future value divided by (1 + r) to the power of t. So we are going to say 1000 divided by (1.1) to the power of 5, and If you do that, that comes to $931.38.

So the meaning of $931.38 is, if you put this money in the bank account for 5 years It's going to accumulate to $1,500. So clearly, if we do the kind of problem in the present value terms also, it makes sense to accept your uncle's present offer a $1,000, because all you need is $931.38, right?

So the remaining $68.62 can definitely enjoy a nice dinner with the $68.62. Just like we did the problem with alternative 5% example, right? We can redo the problem with 5% the PV = $1500 at (1.05) for five years, that = 1,175.29. So much larger amount you need, so, but you would take your uncle's $1,500 option in 5 years.

That's idea of present value and future value. So I'm going to, assuming that you understand, let me also show you in the Excel spreadsheet, how it is done. So there is a present value function in Excel, you feed in the interest rate, the time period, and the future value, and the present value is $931.38.

That concludes this lesson, so I'm going to this video and I'm going to start with application of present and future values to do capital investment Analysis- Part in the next video, thank you

## Capital Investment Analysis- Part 3: Annuities and Use of Excel

>> So if you remember in the previous video, I talked about present value and future value. And just to refresh your memory, future value was present value times 1 plus R to the value of T. Now, the point of these next couple of examples is to let you know that if you know three out of the four things, you can solve for the fourth thing.

Suppose Zachary's parents are anticipating that the college education will cost $80,000. In 18 years, they only have $10,000 to invest today then you can ask a question, what's the rate of return must they earn of that investment to covered the college education? So that is a rate function in Excel that you will feed in all the values and the future value, the present value, and the time.

And it will give you back the 12.25%. So your money has to earn 12.25% to accumulate to $80,000. Similarly, you can find the unknown number of periods. So suppose you want to save up to buy a $20,000 speedboat and you have $16,000 in account, paying 6% great. So you can invoke the end period, number of periods in the Excel function and feed in the present value, interest rate and future value and say, it's 3.83 years, so you have to wait four years to get the boat and enjoy yourself in the lake.

One last thing before we get into net present value Analysis- Part. Often times when somebody wins a lottery ticket, you're given a choice to get a lump sum or take the money in ten annual payments at 12% interest rate. So you can compute what that ten equal payments is going to be to get you to the same equal into $50,000.

So the formula is 0.12 times 50,000 divided by 1 minus 1.2 raised to the power of -10. And it comes to 8,849, okay? But I know it is a complicated formula. So what I'm going to show you in the next slide is a very easy way to get it from the Excel function.

So before I leave this slide, what it says is $50,000 cash is equivalent to getting $8,849.21 for ten pay dates at the interest rate of 12%. So the Excel function is called payment. And the payment function you invoke the present value,the interest rate and the time periods and they will return the same number six makes our life relatively easy and simple.

So I would advocate using Excel for time value of money computation. Now, so we spend a lot of time talking about present and future values. We are going to apply this for, remember, ultimately, our goal is to evaluate corporate investments to create shareholder value. One of the most popular techniques is called the net present value rule, and net present value simply is forecasting the benefits and costs of the project for period T.

So the question in your mind is, what should T be? So delta 9 says buying a planes, and it's going to last for 25 years. They're going to use projection for 25 years. On the other hand, if they are buying some engines for five years use, T would be five years.

If you have pharmaceutical company and you're developing a new product and the benefits of the product is going to last for 20 years, then T would be 20. It's always the useful life of the project that drives the number of periods. So once you have that period, you estimate the cash flows for those periods.

So the way I'm going to cover this material is first, I'm going to introduce to you the techniques assuming that we have already computed these cash flows, C naught, C1, C2, etc. Then once we understand what is a good technique to use, then I would go to explain how to compute the cash flows for different projects.

So the net present value simply is taking all the cash flows, typically C naught is going to be negative because upfront, you have to invest a lot of money on the project. The benefits are going to be coming in the future years, C1, C2, etc., likely to be positive.

So once you determine the net present value, the simple decision rule is if NPV is greater than 0, accept the project. If it is less than 0, reject approach. Of course, you're already asking in your mind, what do I do if NPV is zero? The answer to that, depends.

A lot of time you have to go back and look at all your cash flow projections and see whether you really want to put money into the project that barely breaks even. Sometimes it may make sense to go ahead with the project. For example, let's say Home Depot wants to expand in Colombia.

There, the first five store locations they think are not going to be great, just barely breaking even. They may still do the project because that give some benefit of learning from the project, and then can decide on following investments. But the key is accept the projects, then the net present value's positive and do not invest in projects if the net present value's negative.

Of course the rule looks simple, but as we go along in the finance lessons, you will see that how important at the end of the day for a company to accept projects with positive net present value, because that alone is the only metric that's going to result in shareholder value creation.

So let me talk about a very simple example that's going to help you understand all the four different techniques I'm going to introduce. One is called NPV, the second is called internal rate of return. I'm going to talk about all of them. Third is called payback pay rate.

And last is called profitability Index. So this is the example I'm going to use, and I'm going to explain it under 3 different discount rates 5, 15 and 25. This is a very detailed example. So what I'm going to do is just introduce the numbers so your company's looking at three different projects, A, B and C.

The benefits for the first project comes in year one. Benefits for project B comes in three different tiers. And benefits for project C, nothing in year one and two, but everything in year three. So this is the example I'm going to continue on in my next video. Thank you.

## Capital Investment Analysis- Part 4: NPV, Payback, & IRR

>> If you remember I finished up the last video with this example. So just to refresh, we are looking at Analysis- Part of three projects in a company A, B and C. And the benefits of coming over the next three years. And just for illustration purpose, we are going to use three different discount rates.

So I'm going to start talking about different techniques. For example, if you wanna compute the net percent value for project B, remember that project B at $100 cash flow at time 1, 100 at time 2, and 100 at time 3. And then, you would subtract $200, and I'm using the 5% discount rate.

So the second $100 are to divide by 1.05 to the power of 2. And the third one, 1.05 to the power of 3, subtract the 200, you get 72.32. Suggest showed how the 72.32 has come about. Similarly, you can do for the remaining eight cells using either 5% or 15% or 25% for three different projects.

So we have three projects. Before we decide on how to apply the net present value rule, there's one important distinction I want to make about different types of projects. So those are what I would call independent versus mutually exclusive projects. What are independent projects? Independent projects are those that acceptance rejection decision is independent of the acceptance, rejection decision of the other project.

So for example, in the delta lines, one project could be to expand their fleet by buying another 25 planes. The second project could be introduction of free wireless Wi-Fi in the flights. So the acceptance decision of buying new planes and introduction of new Wi-Fi with all the planes are completely independent decisions.

Each one can be made on its merits. So those are independent projects. On the other hand, the mutually exclusive projects are those that if you accept one, you cannot accept the other. Of course, you have the option of rejecting both of them but simply cannot accept both of them.

A good example would be the fleet expansion decision by Delta Airlines. Let's say they have narrowed down their choice to Boeing 747 and Airbus 320. They want to go with one of the two manufacturers. So if you decide to go with Airbus 320, you will not be investing in Boeing 747 and vice versa.

So independent versus mutually exclusive projects, it's important to understand when we make decisions. So let me go back to that example of project A, B, C, if the projects are independent. In this case, assume that company's cost of capital is 15%. If the projects are independent, which one would you accept?

The answer would be all of them because every projects Every projects A, B, C are good to go. If they are mutually exclusive, You will rank order the project and choose C, why? C has the highest NPV. So the decision rule for independent projects, simply accept each one if NPV is about greater than 0.

If they're mutually exclusive rank order them and pick the one with the highest NPV. That's how we do the decision making. If we go to next decision rule called payback period, what we are trying to do is trying to figure out how quickly we can recover the original investment made on those three different projects.

So if you think about project A, notice that you're able to recover the project A's initial investment within one year. If you look at project B, you're able to recover the $200 investment within two years. If you look at project C, your first cash flow's coming only at time three so it takes you three years.

Some many companies that use this decision rule, they would have some statement. For example, they may say payback cutoff is two years. So if they're independent projects, you would do project A, you would do project B, but not project C because it takes more than two years if they are independent.

If they're mutually exclusive, you would take only the project which is the quickest payback period, which is one year. For reasons, I'm going to explain now, the payback period is not a great technique. Let me point out couple of reasons for it. One is, who decides that two years is optimum?

That's a problematic issue. The second problem is, it penalizes long-term projects like project C. Project C benefits are coming in year three. So you are ignoring that. Cash flow is coming at the later part of the year. And the third is, you completely ignore the cash flows, CF stands for cash flows, beyond two years.

So for all these reasons, I'm not a big fan of payback period but l want to include it in the lesson because many companies do run, do make decisions using the payback period method. It's a very simple technique to use, but that's not taking account time value of money and other things.

Moving along to the third technique called internal rate of return. Internal rate of return is that rate of return, or that discount rate, that makes the NPV of the project equal to zero. So let me one way motivate the internal rate of return technique. So if you remember, if I draw a picture of, on the horizontal axis, the discount rate, vertical axis net present value, the NPV picture or NPV profile would be declining as R increases.

There is a point and time where R becomes zero, NPV becomes zero, this is called internal rate of return. So internal rate of return is that rate of return that makes the NPV equal to zero. And the acceptance decision simply would be just pick the projects where IRR is greater than cost of capital.

So for the project A, B and C, in the next video, I'll show you how to compute IRR and also ultimately, I'll show you how to compute NPV, IRR, etc., using the Excel function. So in the next video, I'll start talking about how to do the IRR, actual computations for the projects A, B and C.

Thank you.

## Capital Investment Analysis- Part 5: Profitability Index and Problems with IRR

>> So remember, Internal Rate of Return is that return that sets NPV equal to zero. For the three projects, we have been talking about A, B and C, you can easily compute the internal rate of return as 25, 23.4 and 18.5%. I'm going to show you how easy it is to get this using the Excel function in a few minutes.

But so supposing that three projects are independent and your cost of capital is 15%. And the projects are independent, we would say accept A, accept B, accept C. So that's how the decide on the projects. On the other hand, if they are mutually exclusive, We will choose the highest IRR, which is A.

So that's how you make decision based upon internal rate of return. Managers love this technique because it gives in percentage terms, the rate of return on the project. The last technique I want to introduce you, is called, Profitability Index, sometimes people call it benefit/cost ratio. So the idea here is for every dollar of investment, how much benefits you are getting.

The simplest way to compute it is original investment cash flow at zero, plus NPV, divided by the cash flow at zero. So if you look at project A, NPV is 19.05, $100 is the original investment, $1.19 is the profitability index. The decision rule is profitability index is greater than one, accept the project.

So, you would accept all three projects. On the other hand, if the projects are mutually exclusive, you would rank order them in the profitability index. And pick the one, with the highest PI, which is 1.44. So, independent, pick everyone, which is PI greater than one. Mutually exclusive, pick the one with the highest profitability index.

So these are very easy to do in Excel. And once you feed in to Excel for example, for project B as an illustrative example, you feed in all the cash flows. NPV function is, you have to feet in the interest rate or discount rate, the positive cash flows.

The way the Excel function is constructed, it's important to remember that the original investment has to be separately added outside the NPV function. For whatever reason, NPV function as constructed in Excel only focuses on the benefits. So, do not forget to add the cost or the initial investment outside the bracket.

As far as internal rate of return, just invoke the IRR function or the four cash flows, B3 through B6, will get that 23%. And the profitability index, add to the NPV, the original investment and divide by the original investment you would get. So, once we add the cash flows to invoke any of these functions, it's not very complicated.

You can easily do it using Excel. Now, my goal in the next few slides is to tell you some of the difficulties with the internal rate of return techniques. And I'm going to show you that sometimes you are faced with the challenges of multiple internal rate of returns for the same project.

Also IRR criteria can fail if you have a scale problem. That is, the investment decisions that are mutually exclusive differ in the Scale and the timing of the cash flow. So I'm going to walk you through some simple examples to show you why the IRR technique may fail.

That's why I'm going to push my view of thinking, which is NPV rule is by far the best to adopt in the corporate world. Because some of these other techniques we talked about, may fail in some situations. So, for example, here is a project which has two internal rate of returns.

You may be thinking in your mind, can we come across a project in the real world which has negative cash flows at the end of the project? The answer is yes, think of a mining project, where to recover the mine to the original environmentally sustainable condition, we have to invest a lot of money at the end of the project.

If that is a situation, you would notice that you will have two internal rate of returns, one at 0 and one at 100%, right? So the challenge becomes which one to use. Of course, we can easily use the NPV rule in this situation. Suppose a company's cost of capital is 25%, I can say that NPV is positive and exit the project.

With IRR I'll have a problem, so that's why if there're changes in the sign of the cash flows you're going to have multiple IRRs, minus to plus and plus two minus. You'll 11 to internal rates of return. The other example I want to bring up is scale problem.

The question is, would you rather make 100% or 50% on your investment? For example, 100% return is on a dollar investment, whereas the 50% return is on a $1,000 investment. Without doing any much computation you can see that it makes lot more sense to do the 50% return on 1000 investment.

Whereas our internal rate of return rule is going to fail us and say, pick the dollar investment that earns 100% rate of return. Let me also show you an example with the timing problem, where project A generates big benefits at time 1, whereas project B, big benefits are coming at time 2.

And if you try to compute the internal rate of return for these projects, what we are going to find is project A as described is this blue line. And project B is the green line and you can see that they have different net present value profile. As a matter of fact, we can compute what is called the crossover rate, where, NPV of A is equal to NPV of B.

If we do that, we get 10.55% of the crossover rate. So the key to understanding this is, if our r is between 0 to 10.55, using the NPV rule, we would choose, B, right? Because the green line has higher NPV than the blue line, which is project A.

But if r is greater than 10.55, that is to the right of the crossover rate, you can see that you would choose project A. And beyond certain point and time you won't choose project A because it's becoming negative cash flow o the internal rate of return is lower than the cost of capital.

So you can see that in mutually exclusive projects, our IRR criteria can fail if the cost of capital is less than the crossover rate. So, whenever the timing of cash flows are different, that creates a problem. So 12.94 and 16.04 are the internal rates of returns for project B and A.

Okay, so you can actually try this out in your Excel spreadsheet and check for yourself. And one way to do the crossover rate is to construct a project called A minus B. So every period subtract the project cash flows of B from A, you would get this. Or if you do B minus A, you would get this.

And if you do the IRR for this, you will get that same number we got in the earlier example. So that's a simple way to calculate crossover rate, just create a new project called A minus B or B minus C. Okay, so that 10.55% is the rate of return for the crossover rate.

So, the big point I wanted to say is IRR has a lot of problems. So what I'm going to do in the next recording is wrap up the module by talking about the NPV versus IRR and then move on to how to computer cash flows. Thank you.

## Capital Investment Analysis- Part 6: NPV vs  IRR

>> Okay, so let me talk about net present value versus internal rate of return technique. Generally, if you're dealing with independent projects, you're going to make the right decision whether you use net present value or internal rate of return. But as I explained to you in the previous video, there are going to be challenges that cash flows are non conventional.

What are non conventional cash flows? Cash flows that change in signs more than once or when the projects are mutually exclusive and the scale of the project or timings of the cash flows are different. That's why I'm a big fan of just using the net present values technique to make decisions on projects.

So what we will find in as we go along different recording says, every now and then I would have a problem listed and I would not work through the problem. The idea is when you view the recording and we have the weekly conference called video conference call, Professor Flurry and I would go through the solution to this problem.

So the idea is you work on this problem and you can check your answers as I walk you through the solution during the weekly calls. So here is an example of Project A and B, what I want you to do in this example is calculate all of this using Excel, whatever method you prefer, calculators, etc, payback, IRR, profitability index.

And also, I want you to answer the question which one would you choose if the projects are independent and if they are mutually exclusive. So this is a problem I want you to work out. And we will walk you through the solution in our weekly recorded calls, okay?

So this is a great summary slide to keep your eye on. So remember the net present value technique, the inputs you require are the cash flows and the cost of capital. And the decision rule is NPV will be greater than zero accept the project, reject the project if NPV is less than zero.

And the technique is very good because it takes time value of money and risk. Risk is coming through cost of capital profitability index, same thing. Remember, you will take NPV plus the original investment divided by NPV and accept the project AP is greater than one. But reject it if less than one, takes into account, time value of money and risk.

Same thing with internal rate of return. Once you compute it, if IRR is greater than cost of capital, accept the project. If IRR is less than cost of capital, reject the project. Yes for time, yes for risk. Payback period, its company-determined cutoff period. If payback is less than cutoff period, they accept, otherwise reject.

It does not take into account time value of money or risk, so I'm not a fan of this technique. If they are independent, you can use any one of the three techniques. But if they are mutually exclusive, as I've explained to you a couple of times, this fails, this fails.

So you get my message when I say the most preferred technique is NPV. So you'll see the reasons for it as we proceed with presentation but net present value method will never fail you when you make project selection decision. So we have spent time on talking about the techniques.

Going forward, what I'm going to talk about is how to estimate cash flows. Before I do that, what we did some time back, a couple of my professional colleagues. Did a survey of different techniques by sending it out to three or four subcorporations. And the question they had sent to ask them to respond was, what techniques do you use in your company to select projects?

The good satisfying news is that they use internal rate of return and NPV. They also use other techniques that they seem to also use payback period, which I'm not a fan. But having said that, if a company is faced with a very close call on a mutually exclusive projects, you can break the tie by using payback period.

The hurdle rate, oftentimes you here in a company, your company, and the idea here is we are going to learn towards the later portion of the lesson plan. the notion of cost of capital. Let's say for Home Depot, the cost of capital is 8%. But Home Depot would internally tell everyone not to use 8% but use something like 12%.

The reason for that is they don't mind managers of the company to push upwards of projects which have barely meeting this 8% hurdle cost of capital so the companies do it. And later on, I'll talk about simulation and sensitivity Analysis- Part as we go along. Profitability in debt seem to be in limited use in the real world.

So the good comforting thing here's the internal rate of return and net present value rules are the prominent techniques used in the corporations. And of course I'll teach you how to use simulation and sensitivity Analysis- Part in the next coming up modules. So what I'll do in the next video session is walk you through a couple of examples as to how to compute or estimate the cash flows of the projects.

So this would conclude this recording and I'll start with the cash flow computation in the next module. Thank you.