**Lecture 45 : Depreciation - II**

Hello everybody, once again welcome to this course. In the previous lecture, we discussed depreciation and its application in cost accounting. Three methods of depreciation were discussed, and now in this particular lecture, we will continue with depreciation and two other topics are added to it. The two methods of depreciation that we will be discussing in this particular lecture, along with two other topics, are amortization and depletion.



Depletion and amortization will be added. Other than that, in the beginning, we will be discussing two methods of depreciation One is the units of production method of depreciation and the sinking fund method of depreciation, okay. Let us see what these two methods of depreciation are, one by one. Depreciation, just to remember the ideas related to depreciation, as I said, is a distribution or a prorating of a tangible asset's cost

over the asset's life. That means we are capitalizing these things not in the first year itself but over the entire estimated period of its life.



So, by this, we are trying to measure the wearing out or the loss of the value of this asset arising from its use over the period of its life. So, this is allocated to charge a fair proportion, as I said, of the depreciable amount in each accounting period. That means, for example, if we have purchased something worth 1 crore and the salvage value is, say, 1 lakh or 2 lakh, then the cost of this machine minus the salvage value will be the depreciable amount. And we should charge a fair proportion every year, which is fair in the sense that it aligns with the use of this machine, as far as we try to understand the uses and the wear and tear, and accordingly, we charge a portion of the depreciable amount every year. That is the idea. So, this is also

Again, it is considered as an indirect cost because this is included in the factory overhead expenses and then allocated to the units manufactured during a reporting period. That means it is directly added to the cost ultimately, but it is considered as an indirect cost. It is an indirect cost through overhead. It is being charged. So, the price of the units or the cost of manufacturing one unit will be affected by the value that we use as a depreciation amount for any particular machine, which is used for the production of the item.

In the previous lecture, we talked about five. Straight-line method, declining balance method, sum of the years' digits method of depreciation, units of production depreciation, and sinking fund method of depreciation. These three we have already discussed in the last class. In this class, we will be talking about the units of production depreciation and the sinking fund method. They have unique features and are followed by different management philosophies.

So, let us see what this units of production method of depreciation is. This is a very simple method or simple idea. This determines depreciation cost based on how much the asset is used. That means if you have produced, say, 1000 units or 2000 units, and this machine is capable of producing this many units. Then, that proportionate value will be depreciated. It is as simple as that. This approach is especially useful for equipment, vehicles, or machinery involved in production, where you can calculate, 'Okay, I have produced this much this year. It has a capacity of, for example, 1 lakh or 2 lakh or 20 lakh,' and then a ratio of that. That means if I produce a quantity, for example, Q, and it has a capacity to produce Q, then this will be the fraction that will be charged on the.

The depreciable value P minus S. This is the simple calculation. This Q will vary the quantity, the unit number of units that we produce will vary every year. This is usual. So, this fraction will change depending on its usage. I mean, as you use it, then how much you depreciate it.



So, that means this is more usable, rather more practical to use where it is related to production, some kind of manufacturing units where you can accurately determine the number of units produced by using that machine. So, the unit of production method calculates the depreciation expense by dividing the total cost of the asset minus its

salvage value, called the depreciable amount T minus S, by the estimated total number of units the asset is expected to produce. So, all services that it is expected to render over the useful life, that is what I explained in the last slide. Now, the depreciation expense is calculated by:

- $\text{Depreciation Expense} = \dfrac{(\text{Asset price} - \text{salvage value}) \times \text{Actual units of production}}{\text{Estimated total units of production}}$

So, it is a proportionate distribution of the depreciable amount. Proportionate distribution: if you are using less, you depreciate less; if you are using more, you depreciate more. That means the wear and tear is directly proportional to the use of the machine. That is the concept behind the units of production depreciation method. We will give an example that will be easier for us to understand.

For example, a company has purchased the machine for 50000 dollar with an estimated useful life of 5 years and the estimated total production of it has the capacity of say 1 lakh units. of 5000 dollar for example. So, in the first year for example, we produce 25000 unit from that machine and during the second year we produce 15000 unit from that machine. So, we have to find out the amount of depreciation in the first year as well as second year simple thing. What we do?

**Example 1:** suppose a company purchases a machine for $50,000 with an estimated useful life of 5 years and an estimated total production of 100,000 units. The machine has a salvage value of $5,000. During the first year, the machine produces 25,000 units and during the second year it produces 15,000 units. Find amount of depreciation in first and second year.

**Solution:**

The depreciation expense for the first year would be calculated as follows:

Depreciation Expense $D_1$ = ($50,000 - $5,000) × 25,000 / 100,000 = $11,250

Depreciation Expense $D_2$ = ($50,000 - $5,000) × 15,000 / 100,000 = $6,750

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First we deduct the salvage value from the price 50000 dollar minus 5000 dollar and then the 25000 units we have produced in the first year. So, the 25000 divided by the full capacity 1 lakh that means 1 by 4 total 25000 divided by 1 lakh is 1 by 4. So, this 50000 minus 5000 into 1 by 4 is 11250 dollar is the depreciation expense in the first year. That means the D_1 is equal to 11000 divided This is the first year depreciation expense.

Next what we do that the depreciation expense D_2 will be 50000 dollar as is the price minus the salvage value and then 15000 is the production in the second year. So, it will be now the fraction will be 15000 by 1 lakh you can calculate and find out that the depreciation is 6750. The book values accordingly we can tabulate in schedules. So, this is how it is calculated I think it is the simplest method that we have studied so far. It is a very very simple method if more if you are using more you depreciate more that is all if you are using less the depreciation will be less.

So, this way it is calculated. Now, this can be particularly useful for assets that are heavily used in the early years of their life or for assets that are subject to significant wear and tear over time. That means, I mean, you can really calculate the units that it can produce. Otherwise, the units of production method can be more difficult to apply in practice because it requires a more accurate estimate of the asset's useful life, which I was talking about. Unless you can accurately estimate the asset's useful life, how can you derive that fraction, that q by q, as I have said? Unless this part is clear, how can you make this work? So, it becomes complicated in that case.

You must know the production capacity over the asset's useful life; then it is possible, okay. I mean, there are certain equipment where you can say that you can produce, for example, 1 lakh units with this or 10 lakh units with this. You go ahead with that. There will be some salvage value after the utility. In that case, you can easily use this. It may not exactly match that 10 lakh units, but it will be close to that because the manufacturers can say that you can use this for producing this many units.

Secondly, it may be less appropriate for assets that do not have a clear usage pattern or production capacity or are not clearly known. For example, office furniture or computers. So, you cannot say that it has been used for producing this many units. So, it is not applicable in those cases. Of course, the method is quite simple and logical in certain cases where the exact usage pattern and the capacity of that machine to produce the number of units is known.



**Sinking fund method**

- It is a useful method for an asset which loses value slowly during the initial years and more rapidly during the later years. The annual depreciation charge is constant if earned interest is not included.

- This is the method of providing for depreciation by means of fixed periodic charges which, when added with compound interest over the life of the asset would equal the cost of the asset.

- Simultaneously, with each periodic charge an investment of the same amount would be made in fixed interest securities which would accumulate at compound interest to provide at the end of the life of the asset, a sum equal to its cost.

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Now we are coming to an interesting method called the sinking fund method. It is a useful method for an asset which loses value slowly during the initial years and more rapidly during the later years. The annual depreciation charge is constant if earned interest is not included. Now, as I was saying, the choice of method depends on which field and for which item using a particular method.

So, when you are trying to choose a method, look at this statement: it is useful for an asset which loses value slowly in the beginning and then fast in the later years, which was not true for the previous one. This is the method of providing for depreciation by means of fixed periodic charges. which, when added to the compound interest over the life of the asset, would be equal to the cost of the asset that will be shown. It is compounding of the interest—the same problem utilized in the sinking fund method. So, simultaneously with each periodic charge, an investment of the same amount would be made in fixed-interest securities, which would accumulate at compound interest.

which will, in turn, provide at the end of the life of the asset a sum equal to its cost. That means what I am telling is that it is nothing but a replacement strategy. That means you have purchased a certain thing and then you are investing a certain amount So, in such a way, knowing the interest—for example, you are going for fixed-interest-rate securities, where you get the interest rate, for example, 10 percent or 12 percent—something you have purchased. So, you go on investing in that security in such a way that over the life of the machine

When you are going to the place, the cost will be fully recovered. That is the idea of the sinking fund method. We will give an example, and you will immediately understand. The company purchases a machine for 50 lakhs with a useful life of, say, 5 years. So, the estimated salvage value at the end of its useful life is, for example, 5 lakhs, and the company plans to replace the machine. This is what I was telling: the company plans to replace the machine at the end of 5 years, and it follows the sinking fund method for depreciation.
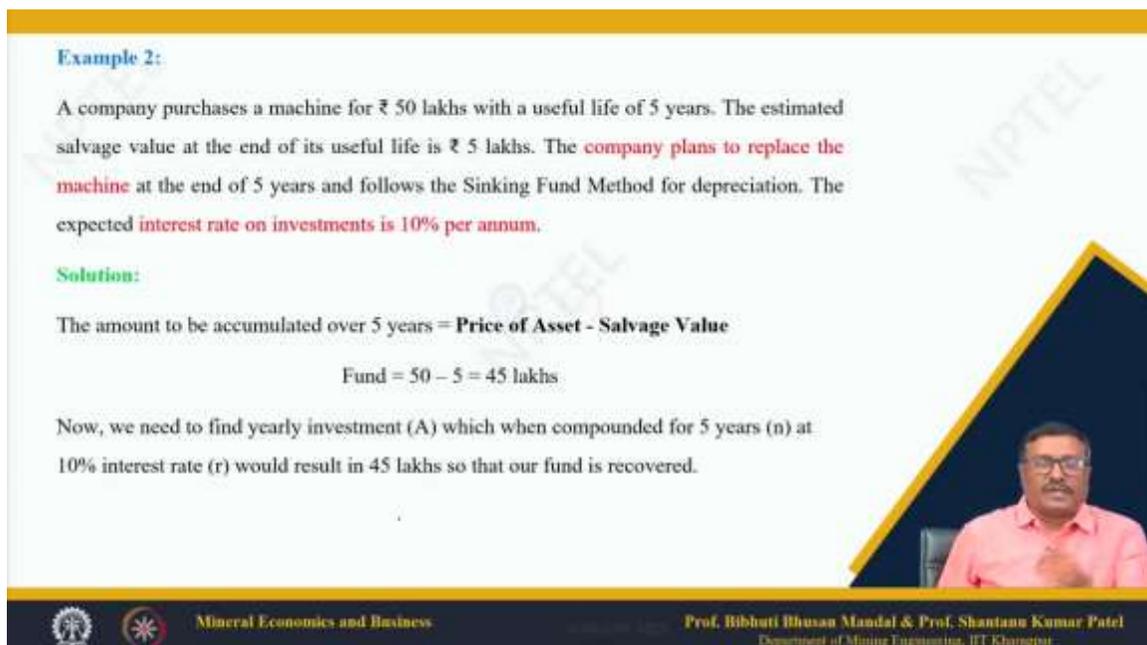


**Example 2:**

A company purchases a machine for ₹ 50 lakhs with a useful life of 5 years. The estimated salvage value at the end of its useful life is ₹ 5 lakhs. The company plans to replace the machine at the end of 5 years and follows the Sinking Fund Method for depreciation. The expected interest rate on investments is 10% per annum.

**Solution:**

The amount to be accumulated over 5 years = **Price of Asset - Salvage Value**

$$Fund = 50 - 5 = 45 \text{ lakhs}$$

Now, we need to find yearly investment (A) which when compounded for 5 years (n) at 10% interest rate (r) would result in 45 lakhs so that our fund is recovered.

So, the expected interest rate on investment is given, which is, for example, 10 percent per annum. So, now, how do we calculate? The amount to be accumulated over 5 years is the price of the asset minus the salvage value. That means we are assuming that the machine after the use of 5 years will be sold, and we recover the salvage value. Which, when added to the last accumulated amount in the security we purchase over the period of the life of the machine, will add to the amount of 50 lakhs.

Now, we need to find the yearly investment A. Every year, we have to invest an amount A. Which, when compounded for the period of 5 years at the interest rate of 10 percent, as I am telling, would result in 45 lakhs. This 45 lakhs, when added to 5 lakhs, will give us the 50 lakhs back. We are ready to purchase by replacing the machine with a new one. We use the simple formula for compound interest, and this should be equal to the fund required, that is, 45 lakhs.

A is the annual investment amount, and this is the interest rate for every year, as you can see here. So, this will be the total when you calculate over a period of 5 years; it should be 45 lakhs. Using the sum of the GP formula, we get A into this as 45 lakhs, from where we can find out that A equals 6.7 lakhs. That means you have to invest 6.7 lakhs every year, keep investing, and then at a 10 percent interest rate, it will amount to 45 lakhs. By that time, your machine is utilized and has reached the end of its life, and you are left with the salvage value of that equipment.



$$A \times (1+r)^n + A \times (1+r)^{n-1} + \ldots + A \times (1+r)^1 = Fund$$

$$A \times (1+0.1)^5 + A \times (1+0.1)^4 + \ldots + A \times (1+0.1)^1 = 45 \text{ lakhs}$$

Using sum of GP formula,

$$A \times \left( (1.1) \times \left( \frac{(1.1)^5 - 1}{1.1 - 1} \right) \right) = 45 \text{ lakhs}$$

$$A \times 6.72 = 45 \text{ lakhs}$$

$$A = 45 \times 0.1489$$

$$A = 6.7 \text{ lakhs}$$

So, you have to dismantle it or do something similar and then sell it in the market to get that 5 lakhs. If you get more than 5 lakhs, fine—that is okay, no issue—but it should not be less than that; otherwise, you will be at a loss. 45 lakhs and that 5 lakhs assumed is 50 lakhs. So, you get back. Remember that we are not talking about the time value of money here because, even though we are using this formula, that is fine, but we are not using the time value properly here. For example, today we have spent 50 lakhs.

And then, after 5 years, we are recovering 45 lakhs plus 5 lakhs from the salvage amount. So, it is giving again 50 lakhs by the time 5 years have passed, for example, and you are again left with 50 lakhs, which is not fair. That means this problem can be rewritten keeping in view the time value of money, and you get a realistic sinking fund—a realistic amount recovered after the end of the life. This, in a tabular form—if we are showing it in tabular form—the 6.7 lakhs, as we have seen, is the annual amount to be invested, as we have seen here. So, every year we will be investing 6.7 lakhs, 6.7 lakhs, 6.7 lakhs every year for 5 years.

It is inverted year that means this is the first year, second year, third year, fourth year and fifth year this is the purpose. For the last 5 year the interest factor will be 1.1 that means 10 percent, but the previous year in the 4 year it will be multiplied twice that means 1.1 into 1.1. So, you get the value of the investment at the year end of 5 years this is the end of 5 years. So, at the end of the year say 5th year ah ah what we will get the 7.37 this will be the value of investment. Now, for investing 6.7 lakh in the 4th year the value of investment will be high 8.107 because you are multiplying this 1.21 twice.

| Annual investment (lakhs) | Year | Interest factor | Value of the investment at end of 5 years (lakhs) | Salvage value 5 Lakhs |
|---|---|---|---|---|
| 6.7 | 5 | 1.1 | 7.37 | |
| 6.7 | 4 | 1.21 | 8.107 | |
| 6.7 | 3 | 1.331 | 8.9177 | |
| 6.7 | 2 | 1.4641 | 9.80947 | |
| 6.7 | 1* | 1.61051 | 10.79042 | |
| | | Total amount | 45 | |

*Amount invested in 1st year would be compounded 5 times, in 2nd year 4 times and so on

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So, 1.21 twice, here you are multiplying 1.21 into 1.21 and 1.21 right. So, you get more here like that in the first year when you invested this one this one then you multiply by 5 times why because you invested in the first year. So, you can easily see from the equation or the in the formula that every year you will be accumulating 10 percent interest 10 percent interest. So, you will be ultimately left with this value for the investment that you made in the first year.
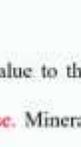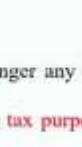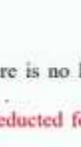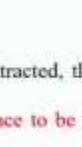
So, this is the schedule of the investment ah for the 5 years total it is we are coming to 45 lakh. So, ah for example, as we have explained here that amount invested in the first year would be compounded 5 times 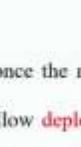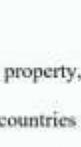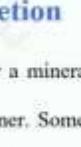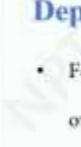naturally in second year 4 times and ah you are in in in in third year 3 times like that it will go on. So, this 45 lakhs at the end of the of the of the fifth year, we are accumulating 45 lakhs, where we have estimated salvage value of 5 lakhs. So, total we are getting that    50 lakh back which I said should be little bit corrected or rather modified in practice to to   to ah include the importance and effect of the inflation or for example, the time value of money.

The 5 methods of depreciation is already they are all discussed these are more prominent and widely used very widely used. Now, we add two another two method two other not these are not these are these are not depreciation methods, but these two topics rather depletion and there is one amortization these are related to our cost. We are now discussing different aspects of cost accounting. So, here we are adding one which is very important the depreciation part is already completed in my lecture. Now this   the mineral property is not endless that means, once the mineral is extracted   to the owner it has got no value, it is fully extracted sold and he has got the money.

So, the resource is utilized, it has got no other value. So, what we do as you go on mining, we get a depletion allowance. There are certain countries which will allow you to enjoy a depreciation allowance to be deducted for the tax purpose. The mineral depletion is most claimed by percentage if you have ah if you can prove that you have 1 percent or 2 percent ah depletion you have you have you have done 1 percent or 2 percent depletion of the reserve you get a similar   depletion allowance for the tax purpose.

Now, the percentage depletion as ah this assigns a set of percentage a set percentage of depletion to the gross income derived from extracting this renewable non-renewable. So, you have income from this non-renewable resources because you are mining some ore or

say for example, coal. So, you cannot renew this, this is forever you are you are not getting them back. So, you are getting this income by depleting the resources.



So, a set percentage of depletion is given to you as a tax benefit. This deduction is actually intended as an incentive for the dealers for exploration purposes, for example, or investors to develop domestic mineral and energy production. This is given to the people who are investing money for exploration and mining both. But the problem is that ah, in all the countries, this is not ah followed—ah, I mean, in the same pattern.

In certain countries, the rules of the mining cost—ah, cost accounting—will require that the cost incurred to find, locate, the mineral deposits and obtain minerals, oils, or gas-producing properties must be capitalized. 'Must be capitalized' means that you have spent this money now, and we are capitalizing. What does it mean? To capitalize is to record a cost or expense on the balance sheet for the purpose of delaying the full recognition of the expense. So, it is a systematic record of the expenses that you incur.

**Depletion and cost accounting**

- In some countries, the rules of mine cost accounting require that the costs incurred to find, develop, and obtain minerals or oil and gas-producing properties must be capitalized*.

- Percentage depletion allows for an income tax deduction for these capitalized costs, reflecting the declining production of reserves over time. The percentage depletion is a measure of the amount of depletion associated with the extraction of nonrenewable resources.

- It is an allowance that independent producers and royalty owners can apply to the taxable gross income.

(*Capitalization: *To capitalize is to record a cost or expense on the balance sheet for the purposes of delaying full recognition of the expense.*)

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So, the ah, the percentage depletion will allow you an income tax reduction, very attractive for this capitalized cost. This will reflect the declining production of reserves over time. In the beginning, it will definitely rise, and then it will start declining. The percentage depletion is a measure of the amount of depletion associated with the extraction of the non-renewable resources that we are mining. So, this—this is not, as I said, the same for all the countries.

For example, in the US, this is very clearly documented. The implementation of the percentage depletion allowance—how much percent you have depleted—and accordingly, a set percentage for the purpose of income tax is well documented and practiced in the US. But for some other countries that may implement similar tax incentives for the resource extraction industry, the specifics can vary widely based on local tax and policy matters. Because it is not exactly the same, but we also use similar tax incentives in a different way—not exactly based on how much you have produced from the mine. So, we calculate—we have set a fixed percentage related to that—and we allow you an income tax benefit there.

**Depletion and cost accounting**

Implementation of the percentage depletion allowance is well-documented in the U.S.

Some countries may implement similar tax incentives for resource extraction industries, but the specifics can vary widely based on local tax laws and policies.

So, the application is different, but the broad concept is the same. In India, for example, the Income Tax Act 1961, Section 42, allows for certain deductions in respect of expenditure. This is for prospecting, extraction, and production of mineral oils. Here, we allow some deductions in respect of expenditure incurred in prospecting, extraction, and production of mineral oil.



**Depletion and cost accounting**

- In India, Section 42 of the Income Tax Act, 1961 allows for certain deductions in respect of expenditure incurred on prospecting, extraction, or production of mineral oils.

- These deductions are not identical to the percentage depletion method, which permits a fixed percentage deduction based on gross income from mineral extraction, regardless of the actual capital investment.

These deductions are not identical to the percentage depletion method, which I have explained before, which permits a fixed percentage based on the gross income from mineral extraction. I have earned this much—say, a fixed percent will be deducted—and then you calculate the tax. So, it is regardless of the actual capital investment; it is about the money you have earned, and a fixed percentage will be deducted from there. This is something like a standard deduction—you get a fixed percent deduction before the tax is calculated.

So, you enjoy the tax benefit right from there. So, the Indian tax framework does not explicitly adopt the percentage depletion allowance as I explained, as it is practiced in the US. But it focuses on allowing deductions for specific expenditures related to mining operations. For instance, the expenses that we incur for scientific research related to the business of mineral extraction can be deducted under Section 35 of the Income Tax Act.



Not only that, capital expenditures on the acquisition of rights to extract minerals may be eligible for depreciation under Section 32. So, these are indirect ways of implementing the same broad concept of depletion. So, this is all about how to use the concept of depletion and what its importance is in cost accounting. Now, in this particular lecture, this is the last item that we discuss today—the amortization. You must have heard this word before in one of the lectures. So, amortization is the process of gradually reducing the value of an intangible asset—not a tangible asset—or repaying a loan over a specified period through regular payments.

**Amortization**

- Amortization is the process of gradually reducing the value of an intangible asset or repaying a loan over a specified period through regular payments.

- **For Intangible Assets**:
  - Used for assets like patents, trademarks, copyrights, leasing costs, R & D expenditure and goodwill.
  - Reflects the allocation of the cost of these assets over their useful life.
- These capital expenditures may be **amortized for tax purposes** that are not included as items under depreciation or depletion.
- Amortization permits the recovery of these expenditures in a manner similar to straight-line depreciation.
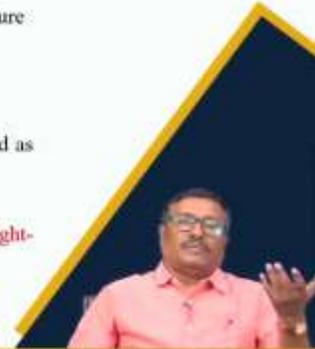
Amortization is very much—previously, we discussed how to amortize a loan. So, for intangible assets—for example, patents, trademarks, copyrights, leasing costs, R&D expenditures, goodwill expenditures—this reflects the cost of these assets over their useful life. But these capital expenditures may be amortized for tax purposes. How do you do that? Those that are not included as items under depreciation or depletion. Previously, we talked about depreciation—a purchase. We have purchased new equipment, and then we have also shown how it is depreciated, how the depreciation is charged.

In depletion, we have shown how we get the tax benefit by showing that this much we have earned. From mining or non-renewable resources. So, we must get this benefit by deducting a set percentage from the income. Here, we are talking about amortization, which permits the recovery of intangible assets, expenditures, and intangible assets in a manner similar to straight-line depreciation. It is similar to straight-line depreciation.

**Impact of Amortization on cost accounting**

1. **Income Statement:**
   - Higher amortization results in lower profits in the short term but ensures gradual cost recovery.

2. **Balance Sheet:**
   - The intangible asset's book value decreases each year as amortization is applied.
   - Helps in showing a realistic value of assets over time.

3. **Cash Flow Statement:**
   - Since amortization is a non-cash expense, it does not impact cash flow directly.
   - Added back in the operating activities section when preparing cash flow statements.

Now, what is the impact of amortization on cost accounting? So, in the income statement, higher amortization will result in lower profit because we will be showing more in the beginning in the short term, but it ensures gradual cost recovery. In the balance sheet, the intangible assets' book value decreases each year because we have invested something and we are charging the amortization amount every year. It looks something like depreciation, but in the case of intangible assets, we use the word amortization, and we apply it following the straight-line method, as I have told earlier. So, this basically helps in showing a realistic value of the asset over time, distributing it in the books of accounts over time using the straight-line method.

In the cash flow statement, how is it affecting? Amortization is a non-cash expense; you are showing it every year, but it does not impact cash flow directly. So, it is added back in the operating activities section when preparing the cash flow statement. That means, when you are preparing the cash flow statement, you are adding this back in the operating activities.

Otherwise, they have no direct effect on the cash flow statement. With this, I come to the end of the discussion on depreciation, depletion, and amortization. These three were very key concepts related to cost accounting. This is a big subject, of course, but I have picked up important topics which are very important for understanding, and especially the basics must be known to you. For further reading, you can definitely use the book by Chandra, and there are very useful resources on the internet which you can go through to gain more knowledge.

## REFERENCES

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- *https://www.investopedia.com*
- *https://corporatefinanceinstitute.com*
- *Corporate depreciation accounting by* Subrata Kar. SBS Publishers. Delhi

And, be an expert in understanding at least and applying these methods that we discussed when you become a practicing mining engineer—for example, preparing cost statements, understanding cost statements, understanding the balance sheet, and understanding the different aspects of the utility of depreciation, amortization, and depletion—these concepts. Hope you enjoyed this lecture. Thank you very much.