

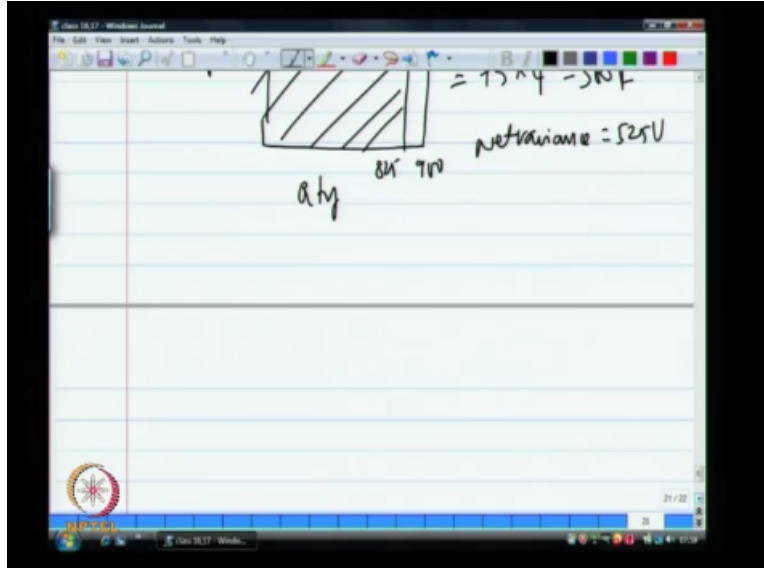
Business Analysis for Engineers
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Lecture-19
Labour & Over Heads Variance Analysis

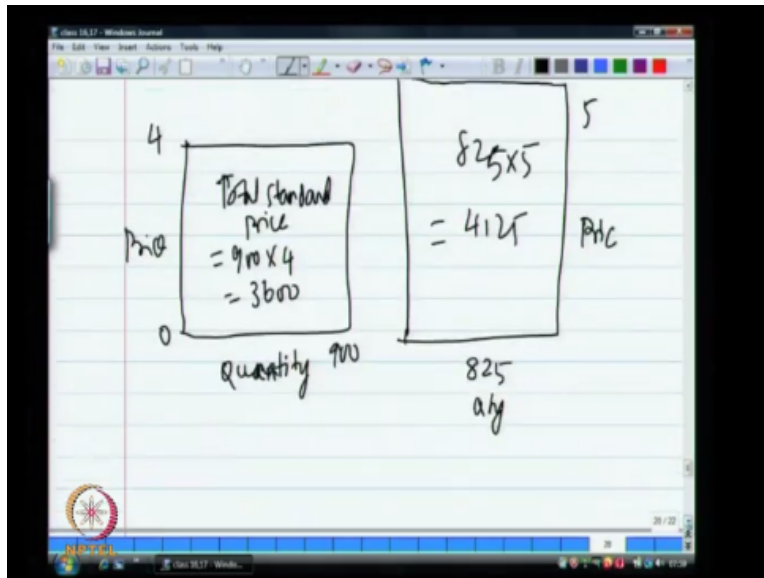
Last class we ended up with a graphical illustration of the material variance which had 2 components the usage as well as the price variance. In that example that we saw the direct material variance, the graphical illustration was easy to understand because you had one favourable variance and one unfavourable variance. Now let us just try to understand from a different example through a graphical illustration a case where both the variances.

The price as well as the usage or either favourable or unfavourable and then see how the joint variance behave, and then what decision when it comes to attributing the reason for a particular variance difference to either price or usage.

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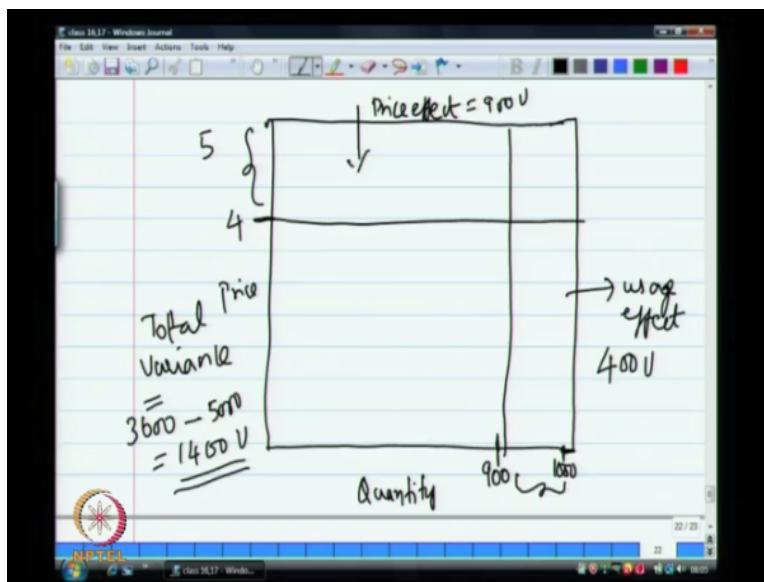


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Now in the previous example that we saw we had a standard quantity of 825, and standard quantity of 900 while the actual used was 825. And a standard price of 4 rupees per unit, and the actual price was 5 rupees per unit. Now in this case of an example that we would like to use let us assume that instead of the 825 that was actually consumed. We are consuming 1000 units as against the standard units of 900 and see how the variance behaves.

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This I will illustrate it through a graphical through an illustration. Now if you look at quantity our standard was 900 and now in our example we are saying that we are using 1000 units of that specific cost object. The standard price was 4 and the actual price let us say is 5 so, let us see what this means for the purpose of our analysis. Now if I decide to represent the variance in this

illustration. We know that the total variance which is material as well as the usage will be 3600 which is standard quantity time standard price of 4-the actual is 1000.

And the actual purchase price 5 per units so, it will be 5000 and in this case it is 1400 unfavourable variance. Now this 1400 unfavourable variance could be because of usage variance as well as price variance. And when we calculate independently what is the usage variance and the price variance. You will find that both have an unfavourable component and let see how this is let see, what is the effect of material usage variance on the total variance.

And what is the effect of the price differential the price variance on the total variance, now out of this 1400 a minimum of 900 unfavourable variance. I would attribute it to the effect of price. Because we find that there is an incremental of 1 for this entire 1000 units that we purchase. So, if you look at the price effect if I say this is because of the price effect. So, the price effect on the total unfavourable variance is a minimum of 900 this is unfavourable.

Why because this 1 dollar differential over this 1000 units of actual consumption now that is the price effect. Likewise there is also minimum effect that can be attributed towards the usage differential so, the usage effect, similarly a minimum that can be attributed because of the usages 400. Why because the excess 100 that we consumed here at standard cost of 4 will attribute to a minimum variance of 400.

So, this makes this $900+400$ 1300 unfavourable while the total variance is 1400. We can easily attribute 900 and 400 to the effect of price and to the effect of usage respectively. Now compare this with the previous example, where we have one unfavourable one favourable and the net favourable variance was easily attributed either slowly because of price or slowly because of usage in this case we have both the variances being unfavourable adding up to 1300.

But the total variance is 1400 that the question is this remaining 100 is it because of price or is it because of usage. And we do not have a standard interpretation that says it is because of price or it is because of usage. Because what we see here is price effect is only 900 and price effect I

mean usage effect is only 400. This is the number speaking for themselves then what account for this 100, technically we call this joint variance.

We say this is effect of both price and usage but it when it comes to the sharp flow decision making level. Because we are talking about the variance analysis on the perspective of deciding where or where is the scope to reduce cost to make sure that the variance the amount of variance is reduced and we can do that only if you are able to attribute the reason correctly. And in this case a joint variance only qualifies and it only says this 100 unfavourable is both because of price.

And because of usage and if that is the way in which you are going to interpret this, then it is little difficult to find the real reason. Whether it is because of price or whether it is because of usage. And how to reduce this 100 so, invariably what happens in real time miss this 100 is attributed as the price variance. Because these the reasonable expectation it is that it is the purchase managers job to make sure that he buys the materials at these standard price whatever be the quantity.

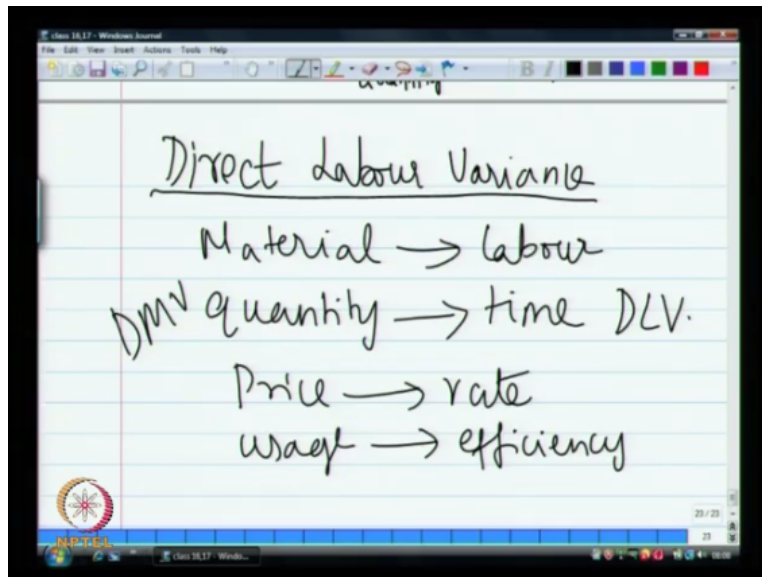
Even if the actual quantity is more than the standard quantity then it is the role of the purchase the responsibility of the purchase unit to ensure. That even that excess quantity is purchased at the standard price. So, that is why the fix this joint variance technically we call this joint variance otherwise this 100 unfavourable variance as a price variance for the purpose of identifying as specific reason for an variance mathematically formula wise.

The price effect is 900 the usage effect is 400 the joint effect is 100, that explains the mathematics behind this understanding. But then the managerial understanding is well independently price effect is 900, independently usage effect is 400. But because I do not want middle level answers to say that this is joint variance is a via media solution. I do not want via media solution I want to pin point and say this 100 unfavourable.

Because of a particular variance, and in this case more often then not we say it is because of the price variance. The reason is we believe that it is the purchasing units responsibility to ensure

despite the usage being more than the standard the price has to be fixed at the standard price. So, this explains the direct material variance now just as we have the direct material variance. The next thing that we are going to see is direct labour variance.

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In the case of direct labour variance the understanding remains the same just as material. Instead of material we are talking here about labour instead of quantity since it is a labour variance we are here talking about time. And instead of price we have a particular labour rate still retain labour price. And instead of usage we are talking about the labour efficiency. So, this is about direct material variance and this is the direct labour variance.

So, just as we have direct material variance, we have direct labour variance, and the technical definition is we are understanding. How much of labour is required to produce 1 unit output of the standard cost object. And, that labour required how much is it going to cost at the given labour rate hours. So, we need to understand that just as we have direct material variance the labour variance will try to see how much of labour is required to produce 1 standard unit output of the cost object.

And how much of that is going to cost when that cost is measured by a way of standard labour rate. That will be applied on the extent of labour that is mean perform so, just as we had the material usage variance and material price variance. We will also have in this case.

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The image shows a digital whiteboard with handwritten text. At the top, it says 'Labour efficiency Variance + Labour rate Variance = Direct Labour Variance'. Below this, it defines 'Efficiency Variance = ΔTime x Standard rate' and 'Rate Variance = Δrate x Actual time'. The whiteboard interface includes a toolbar at the top and a taskbar at the bottom.

$$\begin{aligned} &\text{Labour efficiency Variance} \\ &+ \\ &\text{Labour rate Variance} \\ &= \\ &\text{Direct Labour Variance} \end{aligned}$$
$$\text{Efficiency Variance} = \Delta \text{Time} \times \text{Standard rate}$$
$$\text{Rate Variance} = \Delta \text{rate} \times \text{Actual time}$$

Labour efficiency variance this is link this is parallel to the material usage variance and then we also we have the labour rate variance is equal to the direct labour variance. Now why do we have this 2 because the direct labour variance can arise due to 2 variances one this standard labour hours that is estimated to perform a task let say x, x minutes. And then when actually performed the task I am in end up doing it in x+delta or x-delta.

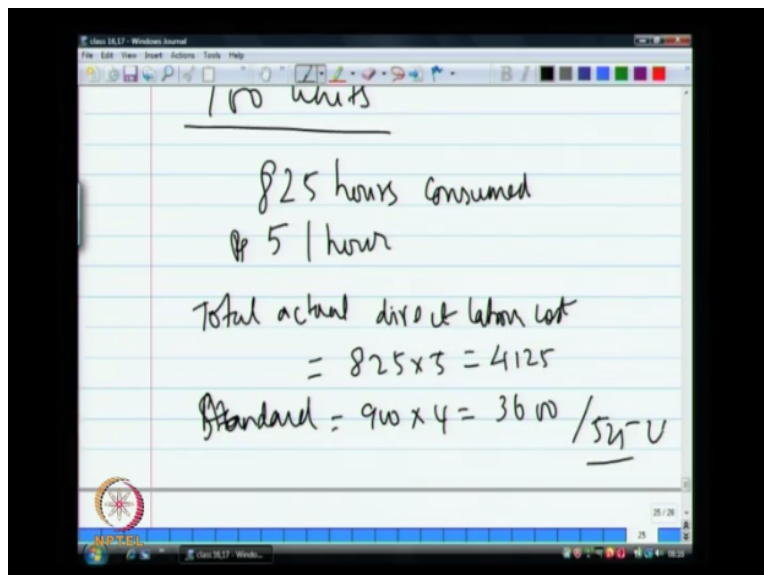
So, the actual is different from the standard labour hours that we expect the task to be completed with it. So, this is the efficiency variance now just as we have the price variance in materials. There is also this labour rate variance which will arise because we expect that this particular labour which is going to be undertaken for a particular period of time is going to cost me certain amount say why and actually when I do that the task the labour rates may vary

It might become y+deltay or y-deltay so, mixed of both the efficiency variance which is the measure of how quickly or what is the delay in an undertaking a particular task+the rate variance again how financially prudent I am in ensuring that the labour rates that I pay is close to the standard estimates. It could be more or it could be less how much more or how much less then the estimated rate or the estimated time determines the overall direct labour variance.

So, the same formula if we are going to apply to labour variance as well when the efficiency variance. Efficiency variance will be the delta time*the standard rate and the rate variance will be delta rate*the actual time same thing like the price variance and usage variance just in this case the usage is replaced by the term efficiency and the price is replaced by the term rate. Let us just take an example to understand this better suppose we say that to produce a cost object y.

We require a standard time of 9 hours so, to produce 1 unit of a cost object we need 9 hours, and the standard rate at which I engage the labour is let say 4 rupees per hour. So, the standard time is 9 hours the standard rate is 4 rupees per hour. Now actually when we let us say I am going to produce 100 units.

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Handwritten notes on a digital whiteboard showing calculations for labour variance:

100 units

825 hours consumed

₹ 5 / hour

Total actual direct labour cost
 $= 825 \times 5 = 4125$

Standard = $900 \times 4 = 3600$ / 525 U

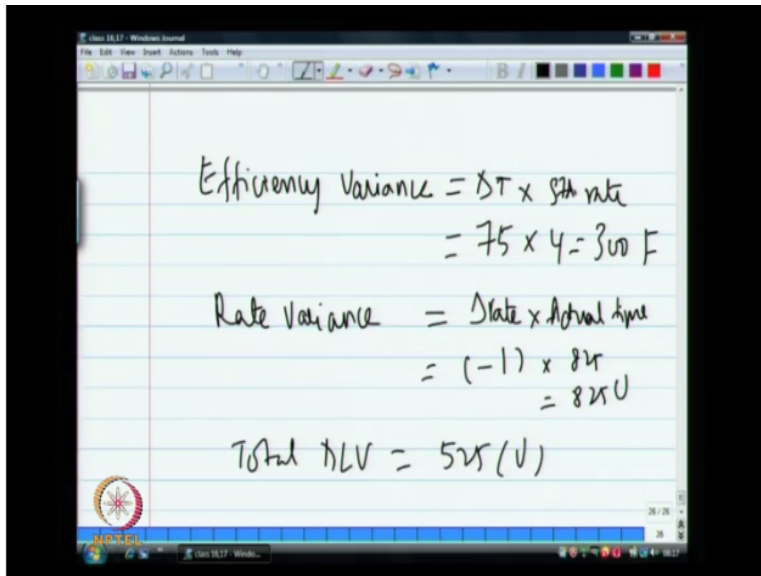
So, I am going to produce 100 units of that particular cost object and the total labour hours that was consume let us say 825 hours was consumed. And the cost that actually paid was rupees 5 per hour the same example as we did for material. So, the there is some variance because our standard should have been 9 hours per unit in this case 100 should be 900. Then 4 rupees per hour but in this case it is 5 rupees per hour.

So, that should definitely be a variance and what is the variance is what we are interested in knowing. So, we will calculate that, because now if you need to calculate the total actual direct labour cost it will be is 825 times 5 right, 825 times 5. But actually it should have cost me only

900 times 4,3600 I mean standard expected is this that is the difference of 525 and this is unfavourable.

Because the actual is overrun the estimate by 525, so this is the direct labour variance. Now if I want to really probe into this understand how this 525 came it is not just this 3600-4125 it is correct. But then if I want to know how I can break this into 2 components then we calculate the efficiency variance and rate variance.

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The image shows a whiteboard with handwritten calculations for labor variances. The calculations are as follows:

$$\begin{aligned}\text{Efficiency Variance} &= \Delta T \times \text{Std rate} \\ &= 75 \times 4 = 300 \text{ F} \\ \text{Rate Variance} &= \text{Rate} \times \Delta \text{Actual time} \\ &= (-1) \times 825 \\ &= 825 \text{ U} \\ \text{Total DLV} &= 525 \text{ (U)}\end{aligned}$$

So, the efficiency variance in this case is delta time times the standard rate in this case the delta time is have taken 75 hours less and the standard rate is, so since I have taken less than actually I estimated this is a favourable contribution to the efficiency. The next is the rate variance will be delta rate into actual time, the delta rate actually overshoot by 1, the actual time is 825. Since the overshoot time factor is unfavourable, so it is 825 unfavourable.

Now this rate unfavourable variance of 825 and a favourable efficiency wherein of 300 put together is the reason for the total direct labour variance of 525 still unfavourable. So, this explains where this 525 comes from, it comes from the combination of an unfavourable rate variance of 825 under favourable efficiency variance of 300 put together is this 525 unfavourable variance.

So, now we understand that just as we fix responsibilities when it comes to direct material variance here also such variance analysis is done to see where the responsibility lies. If it is rate variance then labour rates have increased could be reasons within our control or beyond our control will have to make a study. If it is because of efficiency variance then we know that it is not because of rate variance.

But then because of some efficiency in the engagement of labour that I am able to do a particular task quickly or I am taking more time than it actually has to. So, that analysis can be made if you are able to split the labour variance and the efficiency and rate. And then when we are able to identify the reasons for this variance then we will quickly jump into action to take some managerial decisions.

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The image shows a digital whiteboard with handwritten text. At the top, it says "Overhead variance". Below that, the formula for Standard Cost is written as:
$$\text{Standard Cost} = \text{Material cost} + \text{Labour cost} + \text{Overhead cost.}$$
 Underneath, the formula for Pre-determined overhead rate is given as:
$$\text{Pre-determined overhead rate} = \frac{\text{estimated production activity level (Standard volume)}}{\text{Standard volume}}$$

Now the next thing that I would like to very briefly touch upon is the overhead variance. Now overhead variance we found that the standard cost will have a material cost will have a labour cost and will also have an overhead cost. Now in the case of material and labour we are able to allocate by way of usage and rate by way of efficiency and rate, the extent to which a material is being consumed to produce 1 unit of the cost object.

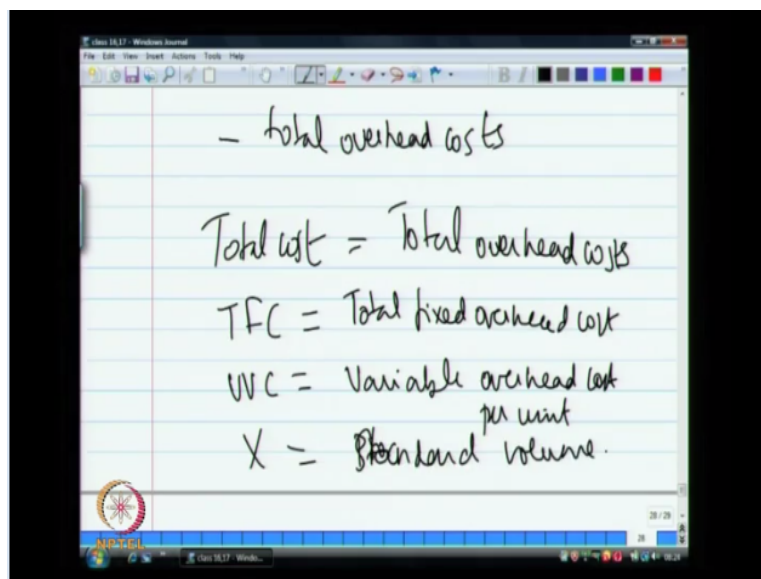
The extent to which labour is being consumed to produce 1 unit of the cost object, so you are able to directly allocate cost components when it is comes to material and labour. The overhead

cost is also a particular cost element which can also be trace to a particular cost object I am talking about direct overhead cost.

Because this entire is about direct material cost, direct labour cost and direct overhead cost which means that relevant cost for a particular cost object is traceable which means I can say that this overhead cost this overhead and the extent of this overhead can trace to a particular cost object. While in material and labour we know the direct quantity that is consumed, the direct material quantity that is consume.

The exact labour, the hours that is being consumed while in overhead we do not know the exact amount, but then we determinate using a predetermined rate. So, we will have something called the predetermined overhead rate. Now to calculate this predetermined overhead rate we need to know 2 things one is the estimated production activity level. In this case we will call it as the standard volume, so we will use the term standard volume.

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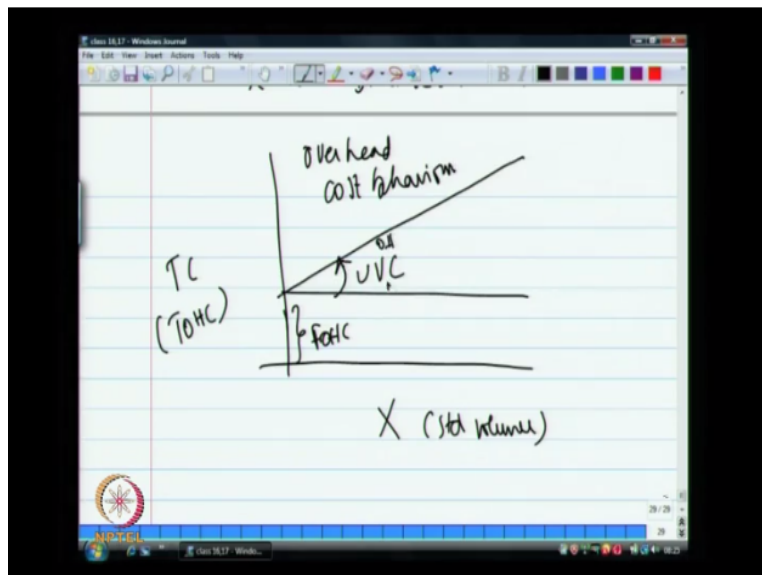
And at this estimated production volume the total overhead cost, so we need to know 2 things what is the standard volume or what is the production level that we anticipate and for that particular standard volume what will be the total overhead cost that we would estimating that we would be incurring. Now if you recall this same behaviour we also studied when we understood the cost volume relationship with regard to fixed cost.

And then we calculated what is the total you know unit fixed cost when we calculate the unit fixed cost we were able to appreciate the cost volume relationship. Likewise the same analogy the same concept in this analogy of overhead cost can also be used to calculate this predetermined overhead rate. So, what is the difference in this case the fixed cost that we saw earlier is nothing but the overhead cost here, the overhead cost is the fixed cost here.

So, I will just give you a small example to understand this. The total cost that we use to calculate in the introductory session on fixed cost variable cost is the total fixed cost+the total variable cost in this case the total cost is the total overhead cost, the total fixed cost will be the total fixed overhead cost per unit of total fixed overhead cost is the same expect that the relevant cost here is the overhead cost.

Now the unit variable cost is the variable overhead cost per unit and of course the standard volume or the production level.

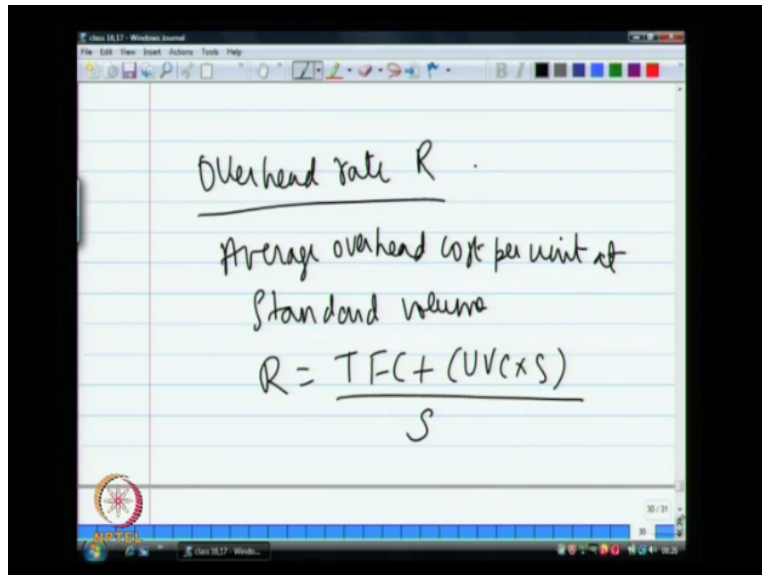
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So, if you look at the graph here I will have the production volume let us say X this is the standard volume and the total cost. In this case the total overhead cost this is the behaviour remains the same, this is the fixed overhead cost and then this becomes the, the behaviour of the

overhead cost with volume. The rate at which this behaves depends on what the unit variable overhead cost is.

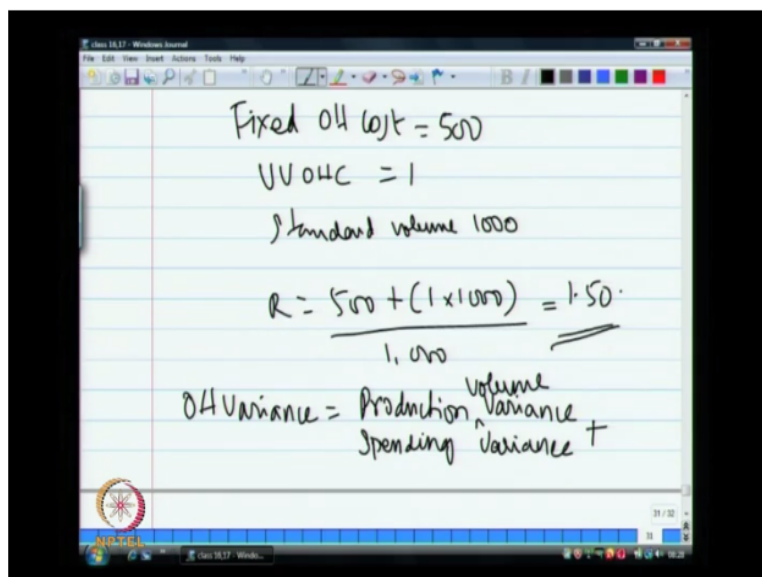
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Overhead rate R .
Average overhead cost per unit at
Standard volume
$$R = \frac{TFC + (UVC \times S)}{S}$$

Now with this how do we calculate the overhead rate R, the predetermined overhead R it is the average overhead cost per unit at standard volume. So, how do we calculate this average cost the simple calculation is we just divide the total overhead cost at standard volume by the number of units represented by that volume or to put in a mathematical expression this R will be the total fixed cost+the unit variable cost times the volume which is the standard volume/S.

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Fixed OH cost = 500
UV OHC = 1
Standard volume 1000
$$R = \frac{500 + (1 \times 1000)}{1,000} = 1.50$$

OH Variance = Production Spending Variance + Volume Variance

Let us assume an example the budgeted fixed overhead cost is 500 then the variable unit variable overhead is 1 and the standard volume is 1000, sorry terms technology gets little inconvenient also 1 minute, unit variable overhead cost is 1 and this standard volume is 1000. So, the predetermined overhead rate in this case will be $500 + 1 * 1000 / 1000$ which is 1.50. So the overhead variance is the difference between the overhead cost that is actually incurred.

And the overhead cost that is absorbed by the production volume, now there can be just as we had usage variance and price variance, efficiency variance and rate variance in labour. The overhead variance will have 2 components to with namely the production variance and the spending variance or the production volume variance and the spending variance. The reason that the overhead variance arises is because the production volume variance arises.

When the actual production volume is different from the standard volume that is being use to calculate the predetermined overhead rate. So, that is the reason why we have a production volume variance and the spending variance is the estimated overhead cost itself for a standard volume. The actual overhead cost is not equal to this estimate you have to very carefully understand this the concept of overhead variance itself is based on an assumption.

And the closest or the exact parallel that we saw to understand this is the behaviour of cost when we understood the cost volume behaviour, fixed cost variable cost. And in this case the cost is qualified to be the overhead cost except for that the behaviour remains the same, while in material variance and labour variance we are able to quantify exactly the extent of resources that gets consumed. In this case we are not able to exactly quantify.

But at the same time we know that certain portion of the overhead cost can be directly traceable to a particular cost object expect that we need some basis on which this overhead cost needs to be allocated. And we calculated that basis by estimating the predetermined overhead rate, now that predetermined overhead rate holds good for a particular standard volume and for that particular standard volume an estimated total overhead cost.

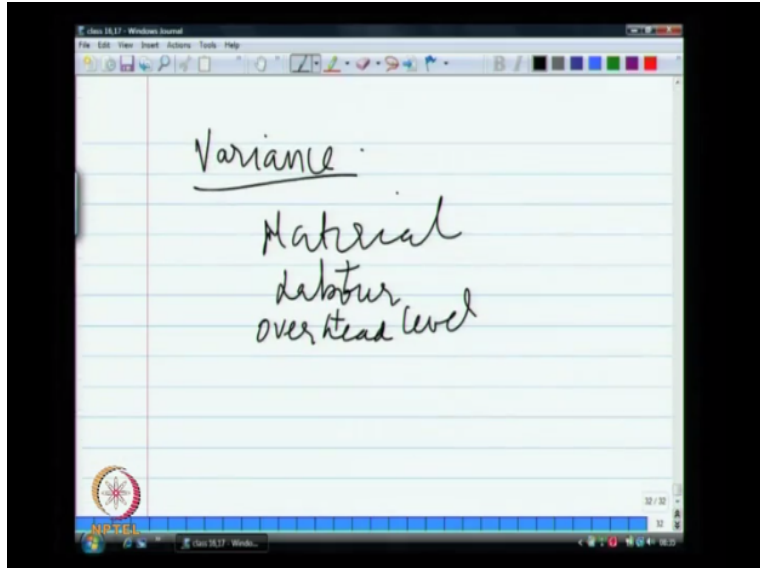
Now with this understanding at the backdrop now see how can an overhead variance arise 2 things. The production volume that is the actual production that we do if that is more or less than the standard volume. Then there is a difference in the overheads and that is called the production volume variance or the actual overhead cost that is being incurred can be more or less than what it was estimated to be at the standard volume, that is the spending variance.

The effect of both the production volume variance and the spending variance will be the overhead variance. The overhead variance is a little tricky subject to understand the concept to understand. But then very simple for the purpose of this discussion it is enough if you understand that. Apart from the general overhead, the selling general, administrative expenses which are indirect in nature.

And cannot traced to a particular cost object there are some specific overheads that can be traced to a particular cost object which is determined by calculating a predetermined overhead rate which is linked to an estimated overhead cost at a standard volume. And if the actual production differs from the standard volume then there is a production volume variance and if the actual overhead cost differs from the estimated overhead cost at standard volume then there is a spending variance.

It is little complicated to it looks complicated when I say this, but then when I just split overhead variances is production spending and production volume variance and spending variance it is easy to understand.

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So, from the overall variance aspect let us see when we started this concept of variance we set to assets at the very purpose of doing this is to go into the integrities of a cost analysis to see why we have done better or why we have not done better. And this we can do only if we are able to quantify the cost elements with reference to a cost object and this quantification we can do it at 3 broad levels.

At the material level, at the labour level and at the overheads level and to do this we need to first understand what would be the estimated material conception what would be the estimated labour conception what would be the estimated overhead cost. And then we split the material into usage and price and remember we are talking here about direct cost only we are talking about indirect cost, because they are not directly traceable to the cost object.

And when it comes to material I am just trying to sum up what we did in the last 3, 4 classes. So, when it is comes to material we would like to understand to produce 1 unit of a cost object how many of the different material inputs that we need and at what rates to we get them. That times the total number of units of the cost object will give you the total material usage and total material price variance.

At a unit level to produce 1 unit of the cost object how much material I need and at what price I am going to buy this particular material this is at the material level. Likewise at the labour level

to produce 1 unit of a cost object how much of labour hours do I need and how much am I going to pay for this labour hours that I need to pay for 1 unit of the cost object. And again for overhead what is the predetermined overhead rate that I will be using to allocate the overhead cost to a particular cost object.

And all these 3 put together will give you the detailed variance. So, material+labour+overhead level is the variance. Now at the beginning of this concept of variance analysis I said we do this, because management accounting as a subject by itself is something that is got to do with looking inside the organisation to see what is happening at the various cost breakdown elements. And to see whether there is a scope to improve and increase efficiency and productivity.

And that we can do only if we are able to breakdown this cost elements into finer elements and then look at it from a monetary perspective, because we are talking about finance and everything is monetized. So, we need to look at it from monetary perspective and hence this variance analysis is done to fix or identify the reasons why material is being excessively consumed or why material is not being competitively sourced why excess labour is being consumed, why we are overpaying or underpaying not underpaying.

But optimally economically paying, so these are reasons that we will find and if there are best practices that are being followed how can this best practice be replicated across the organisations, that is also one of reasons why we do this management accounting as an exercise. So, it revolves around this slippery term called cost and I told you when you hear the word cost a lot of things get associated with it, it is as good as saying cost is the amount of money that I spend to buy a particular resource.

But it is beyond that and that how we saw how cost is being split into various different elements and what we have seen till now is not the overall perspective of cost, because there is still more to this we have something called activity based costing, we have something called joint costing, we have something called differential costing all these I am not going to get into, because we are just going to cover only the basics of management accounting.

And I feel that this is enough to understand the cost volume behaviour and what fixed cost unit variable cost is how the total cost varies how to calculate the economic the break event point, then how to do this variance analysis to ensure that there is improvement in process efficiency. And with that we will kind of stop not venturing into differential costing, joint costing, product costing and all that.

Because all that again activity based costing these are all against bigger subjects by itself, but then one thing that I want to also teach the classes one particular model that emerges from this cost study. And this is something that you will often do let us say you are engineers. So, this you will encounter when you are working in a manufacturing organisation or any production any organisation that engages in production or manufacturing.

We handle inventory and you know how critical inventory is for an organisation and what I will be trying to do is we had a little bit orientation in accounting. So we are going to see how cash is impart to and an organisation and how we need to increase the time that is taken to optimally utilise cash. We are just going to see the cash conversion cycle increase or decrease as the case maybe to make sure that we efficiently manage cash.

And how inventory planning is an important tool that contributes to an efficient cash conversion cycle and for that inventory planning how the cost elements involved in the inventory planning play a very critical role. So, next class we will just try to see a cash conversion cycle and inventory planning mechanisms and how cost elements influence inventory planning as a result of which cash conversion cycle also gets positively or negatively impacted, thank you.