WORK ORDER COSTING AND CLOSING VARIANCES

TRINAMIX WHITE PAPER,

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Trinamix

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Introduction

During regular shopfloor events like material issue, handling, assembly process, chemical process and transportation activities, etc., sometimes material losses as well as gains do happen. In a not-so-perfect world of manufacturing, these losses and/or gains in the process lead to a deviation called as '**Variance**'.

In a Standard Costing environment, each costed item generally gets a standard cost as part of the item definition and/or annual cost evaluation and update process. The difference between standard cost and actual incurred cost of the output is termed as 'Variance'. A variance may be favorable (or positive) or unfavorable (or negative) from the business point of view. If the actual incurred cost is less than the standard cost, the variance will be favorable and if the actual incurred cost is more than the standard cost, the variance will be considered unfavorable.

In case of assembly items that are manufactured in-house and have bills of material and routings, the cost is derived from cost roll-up process. On-hand stock is created through work order completion process for these items. This document will guide us in understanding the accounting of a work order or job close process.

This document has been prepared based on a hypothetical use case which covers most of the variances during a work order closing process. After the work order was closed, it was analyzed for variances for the following scenarios:

- There was difference in the component usage rates between work definition and rolled up structure.
- There was difference in the list of components between work definition and rolled up structure.
- Also, not all components used/issued on the work order were part of work definition and/or rolled up structure.
- The standard batch size was different from the work order start and completion quantities.

Assumption

The assembly might have gone through multiple updates in terms of components and resource usages over the course of the year. But, after each change in structure (in terms of items and usages), the cost roll-up was not performed as most of the organizations follow annual cost update process.

Variances

During work order or job close process, in an ideal scenario, system accounts entire work order variance into different heads of variances separately. In some cases, it is possible that after calculating all the specific variances, some amount is left out in WIP balance, this amount is flushed out using Job Close Variance. This is required so that no amount balance is left in WIP after job close.

The following are different WIP Variances booked in Cost accounting during job closing:

- Material Rate Variance
- Material Substitution Variance
- Material Usage Variance
- Resource Rate Variance
- Resource Substitution Variance
- Resource Efficiency Variance
- Batch Size Variance
- Usage Variance

Job close variance tries to accommodate any variances that the cost processor can't identify as one of the above Variances. Also, if the standard cost of the product is manually setup and not through the cost rollup process, then the entire cost of components and resources is marked as job close variance. Proper variance is only booked if the standard cost of the product is published using a roll-up with a proper work definition. Without this information system cannot calculate detailed variance.

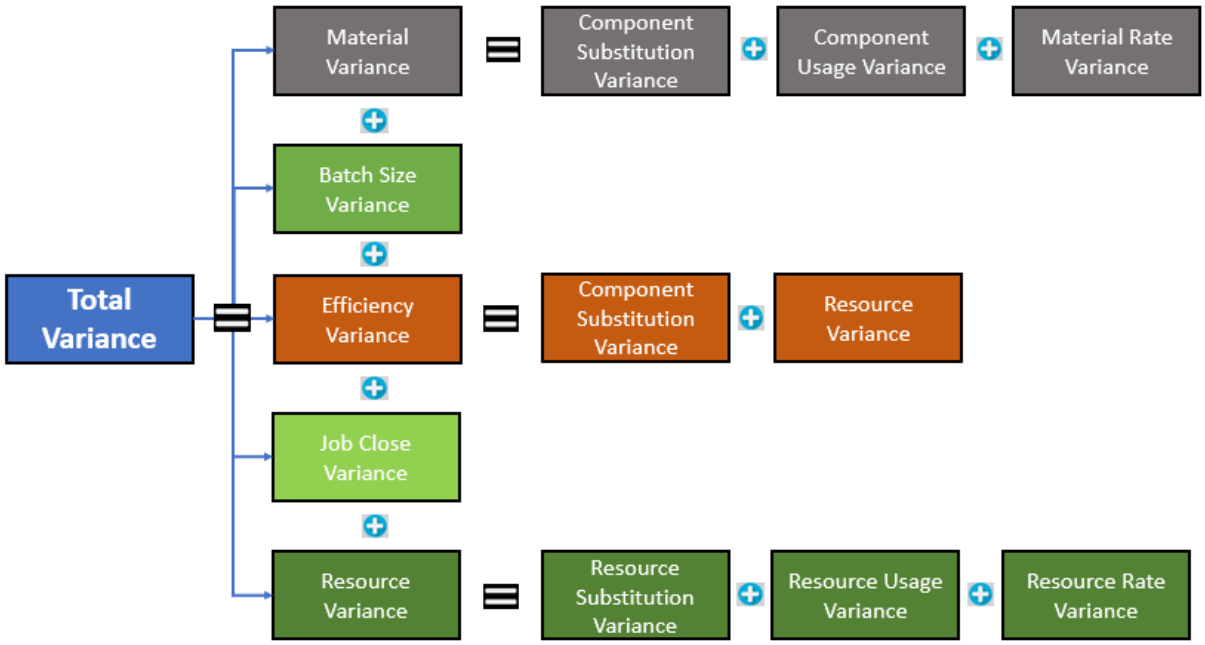
Work definition, work order details, assembly rolled up cost – these three entities are used to derive variance types and amounts.

The work order variances can be grouped further based on whether it is computed using quantity or rate or any other parameters, as follows:

1. When there is a component or resource quantity difference between Work order Input Quantity and Work definition Input Quantity then system derives the following variances:
    - Component Substitution variance
    - Resource Substitution variance
    - Usage Variance

- Efficiency Variance

2. When there is a component or resource usage unit rate difference between Work order and Work definition then system derives the following variances:
   - Material Rate Variance
   - Resource Rate Variance
3. Any residual variance left after computing the above variance should be classified as below:
   - Job Close Variance
4. Where the usage basis on the component or resource is fixed, and the costing batch size and total work order completion quantity is different then, the following variance is calculated:
   - Batch size Variance



Pictorial representation of variances

Use case

We will discuss each of the important variances with example in the following section of the document. Let's take the following example to discuss each of the variances.

Finished Good Assembly	AS-20000
Work Order	WO20000
Standard Batch Size	500
Work Order Start Quantity	1500
Work Order Completion Quantity	2106 (Over completion)
Components on the Work Order, Work Definition, Rolled up assembly	Shown below
Resource on the Work Order, Work Definition, Rolled up assembly	Shown below

Work Order Related information

The following table shows the list of components (for WO quantity = 2016) that are part of the work order WO20000.

Item	Standard Cost	Usage per Unit	Reqd. Qty	Issued Qty.	Reqd. Qty Cost	Actual Qty Cost
C10275	0.06291	0.00408	8.6	6.36	0.541026	0.4001076
C10364	698.60109	0.06908	145.5035	105.09	101648.9037	73415.98855
C20073	7.86229	0.00223	4.7	5	36.95276	39.31145
C20075	0.54962	0.02272	47.86	60	26.30481	32.9772
C20076	2.3326	0.00227	4.78206	5	11.15463	11.663
C20077	38.61279	0.00227	4.78206	5	184.64867	193.06395
C20091	23.56824	0.00227	4.78206	5	112.70473	117.8412
C20101	21.00647	0.00227	4.78206	5	100.45419	105.03235
C20102	1.22965	0.00227	4.78206	5	5.88026	6.14825
C20012	2213.5513	0.00091	1.9165	3	4242.27106	6640.6539
C20247	924.30035	0.00908	19.1435	16	17694.34376	14788.80561
C30369	46.42229	0.00363	7.665	8	355.82685	371.37832
C32043	6.87924	0.00728	15.35	13	105.59633	89.43012
C32086	27.32549	0.00273	5.75	6	157.12156	163.95294
C32020	7.10857	0	0	12	0	85.30284

The pink highlighted ones are not part of the rolled-up structure.

The blue highlighted one is added directly on the work order so it is not part of work definition and rolled-up structure.

Resource Information

The following table shows the resources used on the work order.

Resource	Basis	Rate (Work Definition)	Rate (Work Order)	Cost per Unit
Setup	Lot	7	7	753.76152
Runtime	Item	30	97.5	753.7615
Quality	Lot	2.5	4.5	615.84501
Test	Lot	0	0	610.85010

The highlighted resource was not part of work definition or rolled up structure. It was added as an ad-hoc resource on the work order.

Work Definition related information

The following table shows the components that are part of the latest work definition in the organization.

Item	Standard Cost	Usage per Unit	Reqd. Qty Cost
C10275	0.06291	0.00408	0.54102
C10364	698.60109	0.06908	101648.9037
C20073	7.86229	0.00223	36.95276
C20075	0.54962	0.02272	26.30481
C20076	2.3326	0.00227	11.15463
C20077	38.61279	0.00227	184.64867
C20091	23.56824	0.00227	112.70473
C20101	21.00647	0.00227	100.45419
C20102	1.22965	0.00227	5.88026
C20012	2213.5513	0.00091	4242.27106
C20247	924.30035	0.00908	17694.34376
C30369	46.42229	0.00363	355.82685
C32043	6.87924	0.00728	105.59633
C32086	27.32549	0.00273	157.12156

The pink highlighted ones are not part of the rolled-up structure, but part of the latest work definition.

Rolled up Structure related information

The following table shows the list of components that are part of the rolled-up structure.

Item	Standard Cost	Usage per Unit	Usage * Cost
C10275	0.06291	0.01	0.00062
C10364	698.60109	0.09	62.87409
C20073	7.86229	0.01	0.07862
C20075	0.54962	0.1	0.05496
C20076	2.3326	0.01	0.02332
C20077	38.61279	0.01	0.38612
C20091	23.56824	0.01	0.23568
C20101	21.00647	0.01	0.21006
C20102	1.22965	0.01	0.01229
C20012	2213.5513	0.002	4.42710
C20017	953.72183	0.003	2.86116

The highlighted item was not part of the work order or work definition, but was involved in rollup process. This item was part of the work definition during the annual cost rollup process but later was removed from the item structure and work definition.

Variances Amount

The following table shows the work order variance amounts under different variance categories:

In the coming section of the document, we will discuss about each of these variances.

Work Order Number	Batch Size Variance	Component Substitute Variance	Efficiency Variance	Job Close Variance	Material Rate Variance	Usage Variance	Grand Total
WO20000	21892.81	4586.51	20521.87	0.00	0.00	69964.55	116965.74

Component Substitution variance

Component Substitution variance is computed if the input component on the work order does not match the components on the work definition. All of the variance between WIP cost and standard cost for the component can be termed as substitution variance in this case.

- *Component part of work order but not present on work definition*
- *Component part of work definition but not present on work order*

In our example, the following components will contribute to Substitution Variance:

C20247, C30369, C32043, C32086, C32020

The first four items were part of work definition but not part of rolled up structure.

The last item C32020 was not part of work definition nor the rolled-up structure.

There was another item C20017 which was part of the rolled-up structure but not part of the work definition or work order will contribute to this variance.

Variance calculation: {For items (C20247, C30369, C32043, C32086), (C32020), (C20017)}

Formula:

Components Substitution variance = Actual Issued quantity * Standard Cost of the item

For item C20247,

Standard Cost = 924.30035

Usage = 0.00909

WO Quantity = 2106

Components Substitution variance = 924.30035 * 0.00909 * 2106 = 17694.38

Similar calculations have to be done for all other above-mentioned items.

Components Substitution variance = Actual Issued quantity * Standard Cost of the item

Resource Substitution variance

Resource Substitution variance is computed if the input resource on the work order does not match with the work definition. The entire variance amount between WIP cost and standard cost for the resource can be termed as substitution variance in this case.

The resource 'Test' was not part of work definition, hence will contribute to the resource substitution variance.

Another possible scenario may be,

If any of the resources (Setup, Runtime, Quality) that are part of work definition is missing on the work order that will contribute to resource substitution variance.

Resource Substitution variance = Actual Issued quantity * Standard Cost of the Resource

Usage Variance

If the input quantity for the component on the work order is greater or lesser than the input quantity on the work definition, there will be an unfavorable or favorable usage variance.

This variance is derived using the following formula:

(Scaled Input Quantity – Actual Input Quantity) X WD Component Unit Rate (cost element)

We will take one example of one item to explain this variance.

Let's take example of Item C10364.

Usage variance = (Usage per assembly * WO Completion quantity – Actual issued quantity) X Unit Standard Cost

WD Usage (on rolled up usage): 0.09

WO Completion quantity = 2106

Actual issued quantity = 105.09

Unit Standard Cost = 698.60109

Hence, Usage variance = (0.09 * 2106 - 105.09) * 698.60109 = 58996.86189

Similarly, all other items (which are not part of substitution variance) have to be computed like the above calculation.

Usage variance = (Usage per assembly * WO Completion quantity – Actual issued quantity) X Unit Standard Cost

Efficiency Variance

Where the input quantity for the resource on the work order is greater or lesser than the input quantity on the work definition, there will be an unfavorable or favorable usage variance. This variance is derived using the following formula:

(Scaled Input Quantity – Actual Input Quantity) * WD Resource Unit Rate (cost element)

In our example,

Work Order quantity = 2106 which is (2000/500=4) + (106/500=0.212)

Resource	Basis	Rate (Work Definition)	Rate (Work Order)	Cost per Unit
Setup	Lot	7	7	753.76152
Runtime	Item	0.06	97.5	753.7615
Quality	Lot	2.5	4.5	615.84501
Test	Lot	0	0	610.85101

Setup and Quality have Basis = Lot.

Runtime has basis = Item

Scaled quantity for Runtime will be 30 * 4.212 = 126.36 ------- (where 30 = 0.06*500)

Hence, efficiency variance for Runtime = (126.36-97.5) * 753.7615 = 21753.557. This is a negative variance.

For Setup, there is no variance.

For Quality, (4.5-2.5) * 615.84501 = 1231.69

Total efficiency variance = (-21753.557) + 1231.69 = -20512.87

Efficiency variance = (Scaled Input Quantity – Actual Input Quantity) * WD Resource Unit Rate (cost element)

Batch Size Variance

Batch size variance happens when components have fixed usage and work order completion quantity is different from the work definition "Costing Batch Size".

Costing batch size is 1 if costing batch size is not provided.

Where the usage basis on the component or resource is fixed, a Batch size variance will need to be computed if the costing batch size and total product completion quantity on the work order is different.

Use the following formula:

((Total Amount as per WD/Costing Batch size) – (Total Amount as per WD/Total Product completion qty.)) X Total Product Completion Quantity

Resource	Basis	Rate (Work Definition)	Rate (Work Order)	Cost per Unit
Setup	Lot	7	7	753.76152
Runtime	Item	0.06	97.5	753.7615
Quality	Lot	2.5	4.5	615.84501

The resources Setup and Quality having Lot as Basis are applicable here.

Total Amount as per WD = Resource Rate * Cost per unit

Costing Batch size = 500

Total Product completion qty. = 2106

For Resource: Setup

Batch Size variance = (7 * 753.76152 / 500 - 7 * 753.76152 / 2106) / 2106 = 16947.57402

For Resource: Quality:

Batch Size variance = (2.5 * 615.84501 / 500 – 2.5 * 615.84501 / 2106) / 2106 = 4945.23543

Total Batch Size variance = 16947.57402 + 4945.23543 = 21892.80945

Compare the unit rate on the work order with the unit rate on the work definition to derive the following variances:

Batch Size variance = ((Total Amount as per WD/Costing Batch size) – (Total Amount as per WD/Total Product completion qty.)) X Total Product Completion Quantity

Material Rate Variance

This variance is the difference in per unit rate for a component used on a work order vs. a work definition. The rate could be different for the following reasons:

- The input item has a cost method of 'actual' or 'average'
- Where the input item has a cost method of standard and the new component standard cost is published to cost accounting, however the end item cost is not published.
- Where the input item has a cost method of standard and the new component standard cost derived is different due to a later cost date being used when a new standard is effective

This variance will be calculated using the following formula:

(WD Input Unit Rate – WO Input Unit Rate) X WO Input Quantity (costing UOM)

Material Rate variance = (WD Input Unit Rate – WO Input Unit Rate) X WO Input Quantity (costing UOM)

Resource Rate Variance

This is the difference between the resource rate used in work order vs. the resource rate used to roll up standard costs. This could be different due to the following reasons:

- The cost date derived on the resource transactions is advanced and a new standard is effective.
- The modified resource rate plan is published to cost accounting without publishing the end item cost.

Resource Rate variance = (WD Input Unit Rate – WO Input Unit Rate) X WO Input Quantity (costing UOM)

Job Close Variance

Any residual variance left after computing the above variance should be classified as 'Job Close Variance'

Job Close Variance = Residual Unaccounted Variance

Variance on a reopened Work Order

If a work order is re-opened after it was closed, the whole variance processing will be executed again for the work order.

The delta between the old and new variance will be accounted for under appropriate categories.

Conclusion

As compared to On-prem, Oracle Fusion has come up with more exhaustive work order closing accounting functionality which encompasses all possible variance sources and categories. This helps to provide businesses a 360-degree visibility of their process anomalies in the manufacturing sphere. This in-turn helps a more efficient way of plugging the holes.

About the Author

Diptikanta is an experienced ERP professional in the area of Manufacturing and Supply Chain. He has more than 15 years of experience in Steel Manufacturing, Supply Chain and ERP consulting domain. He holds a Master's degree in Business Administration in Finance and Marketing and a Bachelor's degree in Metallurgical engineering. He is a PMP certified professional and a Black Belt in Six Sigma.

Reference: Oracle support documents, user guides

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