Effective Root Cause Analysis – A Process

Henry B. (Buddy) Everage
HBE Consulting Solutions, LLC
703-822-1201
beverage@hbeconsultingsolutions.com
Learning Objectives

- Improve the variance analysis process with a focus on identification of the true root cause
- Using customer’s data, learn how to apply the root cause analysis process to schedule variance
- Be adaptive and proactive. Consider a different process.
The Impetus behind a Rigorous Root Cause Analysis Approach

A central theme: the Root Cause of the VAR is not adequately or correctly identified
- Thus, the Corrective Action is inadequate
- Therefore, need a different approach to identify the Root Cause

EVMS Implementation & certification preparation support
- Documentation of processes
- Training, coaching, mentoring
- Several reviews/audits resulting in CARs
- A consistent problem – Quality of the VARs
The Objective of Writing Effective VARs

• Explain the variances, **identify the root cause**, assess the impacts, and state any corrective action plans in language which is easily understood by the people who review your VARs.

• If this objective is met, then:
  • Management and the customer has a better understanding of the VAR and the status of the project
  • Appropriate corrective action to correct the variance can be taken
A Disciplined Approach to Identifying the Root Cause

- Use multiple techniques collectively
  - The ‘5 Whys’ Technique
  - Uses an Ishikawa Diagram (aka, Fishbone, tree diagram, root cause tree)
  - Logic is validated using “If-Then” logic statements
  - Conducted in the context of a brainstorming session
Why this Approach?

• Good business practice
  • A disciplined, repeatable process
  • More reliable variance analysis
• Meets customer requirements
  • DOE EVMS and Project Analysis Standard Operating Procedure (SOP)
  • DOE EVMS Interpretation Handbook (EVMSIH v2.0)
  • DOE Corrective Action Standard Operating Procedure (SOP)
Root Cause Analysis Demonstration -
Determining the root cause for a VAR (schedule variance)

- (±) Sub-contractor work performed early or late
  - (±) Travel not performed as planned
  - (±) Material not delivered as planned
  - (-) Re-work or return defective material
  - (±) Incomplete re-plan
  - (±) BCWP assessed incorrectly

- MATERIAL

- PEOPLE
  - (±) Changed work priority
  - (-) Client driven delay
  - (-) Unexpected vacation or sick time
  - (-) Inexperienced personnel cannot complete work
  - (+) Over staffed. Able to work tasks ahead of plan
  - (-) Not fully staffed. Cannot complete work

- SCHEDULE VARIANCE

- PERFORMANCE
  - (-) Work not completed as planned
  - (-) Dependency: waiting on other work to be done
  - (±) Doing work out of sequence
  - (+) Caught up on past due work
  - (±) Client changed specifications

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Root Cause Analysis Demonstration -
Determining the root cause for a VAR (schedule variance)

BCWP_{CUM} < BCWS_{CUM}
- BCWP assessed incorrectly
- Travel not performed as planned
- Inexperienced personnel cannot complete work
- Material not delivered
- Not fully staffed. Cannot complete work
- Unexpected vacation or sick time
- Late delivery by sub-contractor
- Re-work or return defective material
- Client driven delay
- Dependency: waiting on other work to be done

BCWP_{CUM} > BCWS_{CUM}
- BCWP assessed incorrectly
- Early delivery by sub-contractor
- Over staffed. Able to work tasks ahead of plan.
- Material delivered early

BCWP_{MON} < BCWS_{MON}
- BCWP assessed incorrectly
- Travel not performed as planned
- Inexperienced personnel cannot complete work
- Material not delivered
- Not fully staffed. Cannot complete work
- Unexpected vacation or sick time
- Late delivery by sub-contractor
- Client driven delay
- Dependency: waiting on other work to be done

BCWP_{MON} > BCWS_{MON}
- BCWP assessed incorrectly
- Early delivery by sub-contractor
- Over staffed. Able to work tasks ahead of plan.
- Material delivered early

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Ground Rules for Root Cause Analysis

1. Use Ishikawa in the context of a brainstorming session.
2. Limit participants to SMEs who have insight (e.g., system engineers, technicians, coders, testers, installers, operators).
3. Be sure that everyone agrees on the problem and its effect.
4. For each node, identify causes and add them to the tree.
5. Be succinct. One thought per line on the diagram.
6. Consider splitting up overcrowded branches.
7. Consider grafting relatively empty branches onto others.
8. Consolidate and re-state continuously.
9. Avoid reaching a quick decision.
10. Pursue each line of causality back to its root cause. Seek to extend the branches.
11. Identify if the root cause is due to process or one-time error.
In addition to the schedule variance just discussed, this approach to root cause analysis can also be used for:

- Cost Variance
- Variance at Completion (VAC)
- TPCI$_{EAC}$
- Corrective Action Requests (CAR)

Let’s take a look
Variance at Completion (VAC)

Positive Price or Usage Variance

Performance overstated

G and A Costs lower than planned

Used fewer people than expected

Used lower priced personnel

Unexpected Tax relief

Material costs lower than expected

Hours not charged to correct charge number

Cost of Money lower than forecast

Planned Travel not needed

Sub-contractor/vendor costs lower than expected

Failed to accrue estimated actuals

Performance understated

Overtime required

G and A Costs higher than planned

Cost of Money higher than forecast

Sub-contractor/vendor costs higher than expected

Material costs higher than expected

Hours not charged to correct charge number

Actuals incorrect

Over-staffed. Charging too many hours

Used higher priced personnel

Used more people than expected

Unexpected Tax burden

Negative Price or Usage Variance

BAC > EAC

VARIANCE AT COMPLETE

BAC < EAC
**TCPI\textsubscript{EAC}**

More people will be needed to complete the work

- Inexperienced personnel cannot complete work
- Higher rate for personnel
- Overtime will be required
- Client driven delay
- Expect more technical challenge in later phases
  - Defective Material requires return or re-work
  - Over-staffed. Charging too many hours
  - BCWP assessed incorrectly
  - ETC hasn’t been updated properly

More than 10% between TCPI\textsubscript{EAC} and CPI\textsubscript{CUM}

ETC hasn’t been updated properly
- BCWP assessed incorrectly
- Not fully staffed. Not charging enough hours
- Technical issues are low risk in later phases
- Travel not required as planned
- Material not required as planned
- Lower rate for personnel

Less people will be needed to complete the work

TCPI\textsubscript{EAC} < CPI\textsubscript{CUM}
Corrective Action Request (CAR)

Processes not followed: rare or one-time instance

Processes not followed on a consistent basis

Artifacts missing

Data elements on artifacts are not complete

Data elements do not correspond on multiple artifacts

System Description or work instructions not consistent with EIA-748 Guidelines

System Description or work instructions have internal contradiction

System Description or work instructions lack detail

Excessive number of Implementation CARs

Corrective Action Report
Root Cause Analysis Demonstrations –

A VAR Sample (Schedule Variance)
Root Cause Analysis Demonstration - Determining the root cause for a Schedule Variance

Jan 2016 Control Account Situation: Significant negative cumulative schedule variance (SV) has grown over the last 20 months. Recently, the negative SV has started to improve. Approval to proceed with the sampling plan as received in Sep 2015.
**Root Cause Analysis Demonstration - Determining the root cause for a Schedule Variance**

- **BCWP\textsubscript{CUM} < BCWS\textsubscript{CUM}**
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  - Travel not performed as planned
  - Late delivery by sub-contractor
  - Re-work or return defective material
  - Client driven delay
  - Dependency: waiting on other work to be done

**Why?** Delays in the client and regulatory agency reviews and approvals of sampling plan

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Root Cause Analysis Demonstration -
Determining the root cause for a Schedule Variance

Why?

“Bring me another rock syndrome” - delays occurred over a 20 month period due to changes in permit procedures

Why?

Delays in the client and regulatory agency reviews and approvals of sampling plan

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**Root Cause Analysis Demonstration - Determining the root cause for a Schedule Variance**

- **Reasons for Schedule Variance**
  - BCWP assessed incorrectly
  - Travel not performed as planned
  - Inexperienced personnel cannot complete work
  - Material not delivered
  - Not fully staffed. Cannot complete work
  - Unexpected vacation or sick time
  - Late delivery by sub-contractor
  - Re-work or return defective material

- **Dependency:** waiting on other work to be done

**Jan 2016 Control Account Situation:** Significant negative cumulative schedule variance (SV) has grown over the last 20 months. Recently, the negative SV has started to improve. Approval to proceed with the sampling plan as received in Sep 2015.

**Why?**
- Client and regulatory agency driven delays; issue out of the control of the contractor
- "Bring me another rock syndrome" - delays occurred over a 20 month period due to changes in permit procedures
- Delays in client and regulatory agency reviews and approvals of sampling plan
- X-114A sampling scheduled to occur concurrently with soil excavation will now occur after excavation is completed
- Why was the schedule changed? Who made that decision?
Root Cause Analysis Demonstration - Determining the root cause for a Schedule Variance

- Client and regulatory driven delays; issue out of the control of the contractor
- “Bring me another rock syndrome” - delays occurred over a 20 month period due to changes in permit procedures
- Delays in the client and regulatory agency reviews and approvals of sampling plan
- X-114A sampling scheduled to occur concurrently with soil excavation will now occur after excavation is completed

Why was the schedule changed? Who made that decision?
A clear reason for the schedule change was not identified

Why?

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  - Late delivery by sub-contractor
  - Re-work or return defective material
  - **Client driven delay**

**Dependency:** waiting on other work to be done

Why? 
Client and regulatory agency driven delays; issue out of the control of the contractor

Why? 
“Bring me another rock syndrome” - delays occurred over a 20 month period due to changes in permit procedures

Why? 
Delays in the client and regulatory agency reviews and approvals of sampling plan

Why? 
X-114A sampling scheduled to occur concurrently with soil excavation will now occur after excavation is completed

Why? 
X-114A sampling also delayed due to lack of progress of soil remediation being performed in another CA

Why? 
A clear reason for the schedule change was not identified

Why? 
Reason for remediation delay was not identified

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Key Takeaways

• Best Practices
  • Combining a variety of analysis techniques into a single process produces a disciplined, repeatable process
  • Root cause templates eases the burden of the CAM

• Tips & Tricks
  • Develop and use the root cause templates for your project(s)
    • Modify the ones presented today
Questions?