Project Controls Expo – 16th Nov 2016
Emirates Stadium, London

Introduction to Planning, Scheduling and Earned Value followed by Case Study on Data Analytics on improved Schedule Data Quality

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- **Consulting**
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About the Speaker

Tushar Tohan, CIPM

Associate Consultant, Projcon Group.

- Hold Bachelors of Engineering Degree in Mechanical Engineering
- Practising Project Controls in Oil and Gas sector and delivered innovative Project Controls solutions for fortune 500 companies.
- Worked in much diversified Oil and Gas projects involving 3G Modularization and setting up of Offsite and Utilities for Petrochemical Plant.
- Area of expertise is Project Planning and Scheduling, Earned Value Management System, Progress Monitoring and Control, Project Performance Reporting and Change Management.
- Presently Working with Projcon Group as an Associate Consultant and is supporting clients in setting-up of their Project Control processes and reporting framework.

About the Speaker

Ritesh Yadav

Associate Consultant, Projcon Group.

- Currently working for ProjCon Group; delivering & setting-up project controls processes and reporting framework for its clients.
- Previously worked as a Sr. Planning Engineer in Dedicated Freight corridor CTP 1 & 2 Railway Project (1200 kms. Track laying) worth 1.2 Billion Dollar.
- Holds Bachelors Degree in Civil Engineering; practicing application of Project Controls; expertise are in Earned Value Management, MI Reporting, Monitoring & Controls, and Schedule management.

Why we Plan for our work ?

A good PLAN is like a good map.

- It helps us PLAN where we want to go.
- Gets everyone going the same way with
  - the same philosophy
  - the same expectations
  - the same strategy
  - the same goals

“If you fail to plan, you are planning to fail”-Benjamin Franklin

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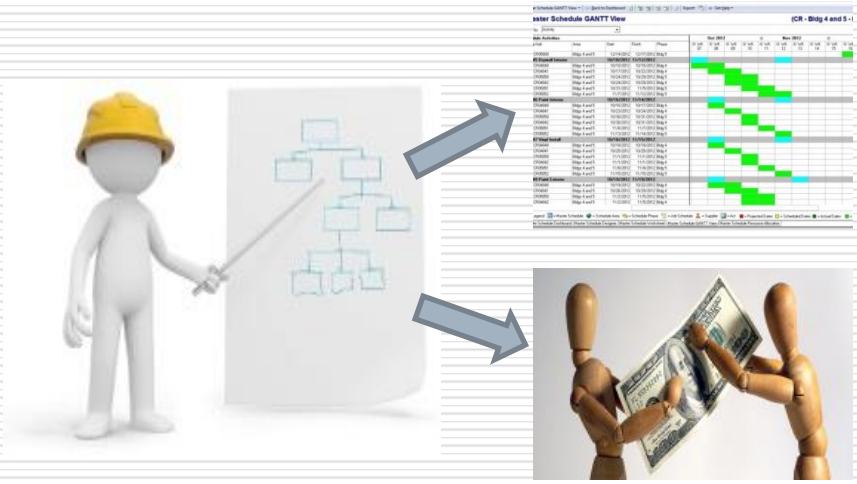
Project Execution Plan (PEP)

Guiding Document for Project team during execution.

- Maintains a adequate and timely flow of critical information.
- Describe general procedures to be adopted by the client and the team for the project.

What is Planning ?

- Planning is the devising of a workable scheme of operations designed to achieve an established objective when put into action.
- A rational approach to project execution.
- A method for translating scope into time (schedule) and money (budget).



Planning Process

In Planning you answer the following questions:

- **What** will be performed?
- **How** it will be performed?
- **Where** it will be performed?
- **Why** it will be performed?
- **Who** will perform the work?

In Scheduling you answer the **When**?

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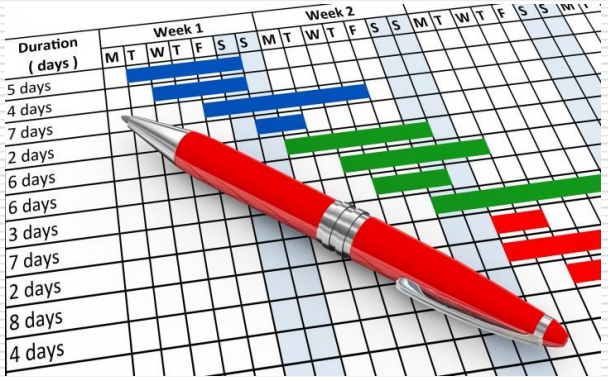
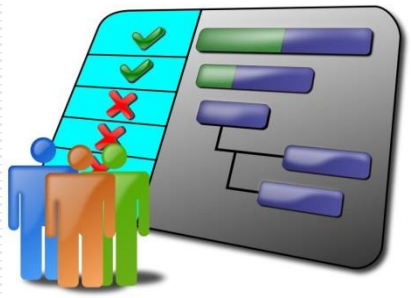
What is Scheduling?

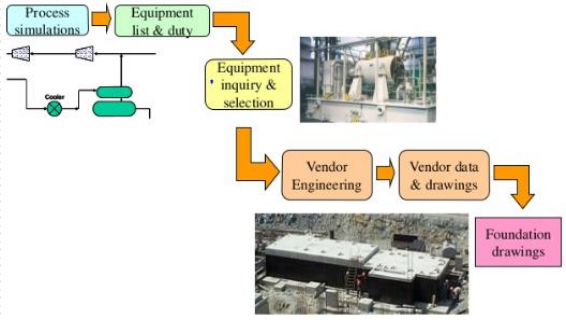
Scheduling is the preparation of a time table for implementation of an agreed plan.



Purpose of work scheduling:

- To reflect the project plan
- To sequence the work.
- To validate the time objectives





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Scheduling Process

- Develop the list of project activities.
- Sequence the list of project activities
- Determine the relationship between activities.
- Establish the duration for each activity
- Determine the project duration (start and completion dates)

Planning Vs Scheduling

Planning

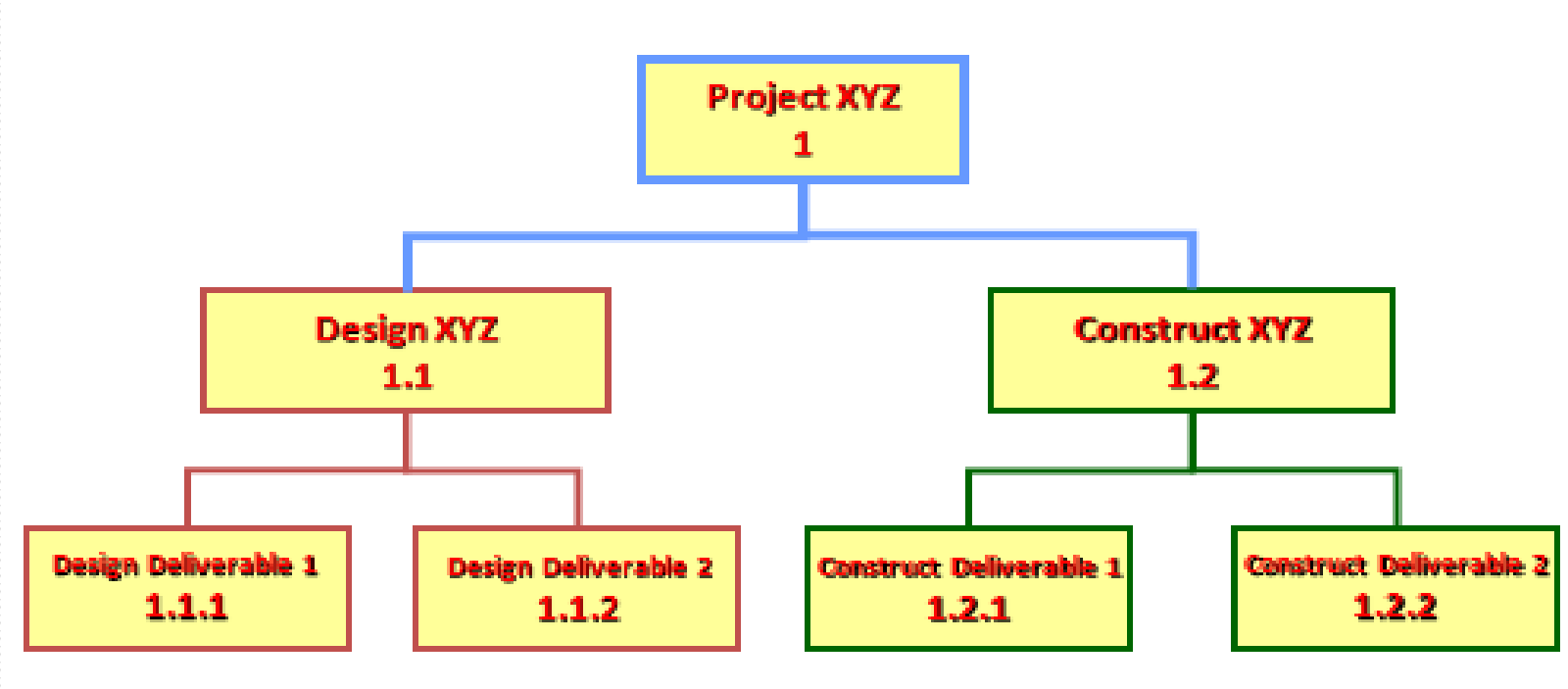
- Usually not scientific
- Involves more thinking
- Uses experience & history
- Reflects the Execution Strategy

Scheduling

- Scientific
- Task oriented
- Reflects the plan with durations and sequence of events.

Key terms in Planning and Scheduling: Work Breakdown Structure (WBS)

Breakdown of work into manageable parts arranged in a hierarchical order till the desired level is reached.



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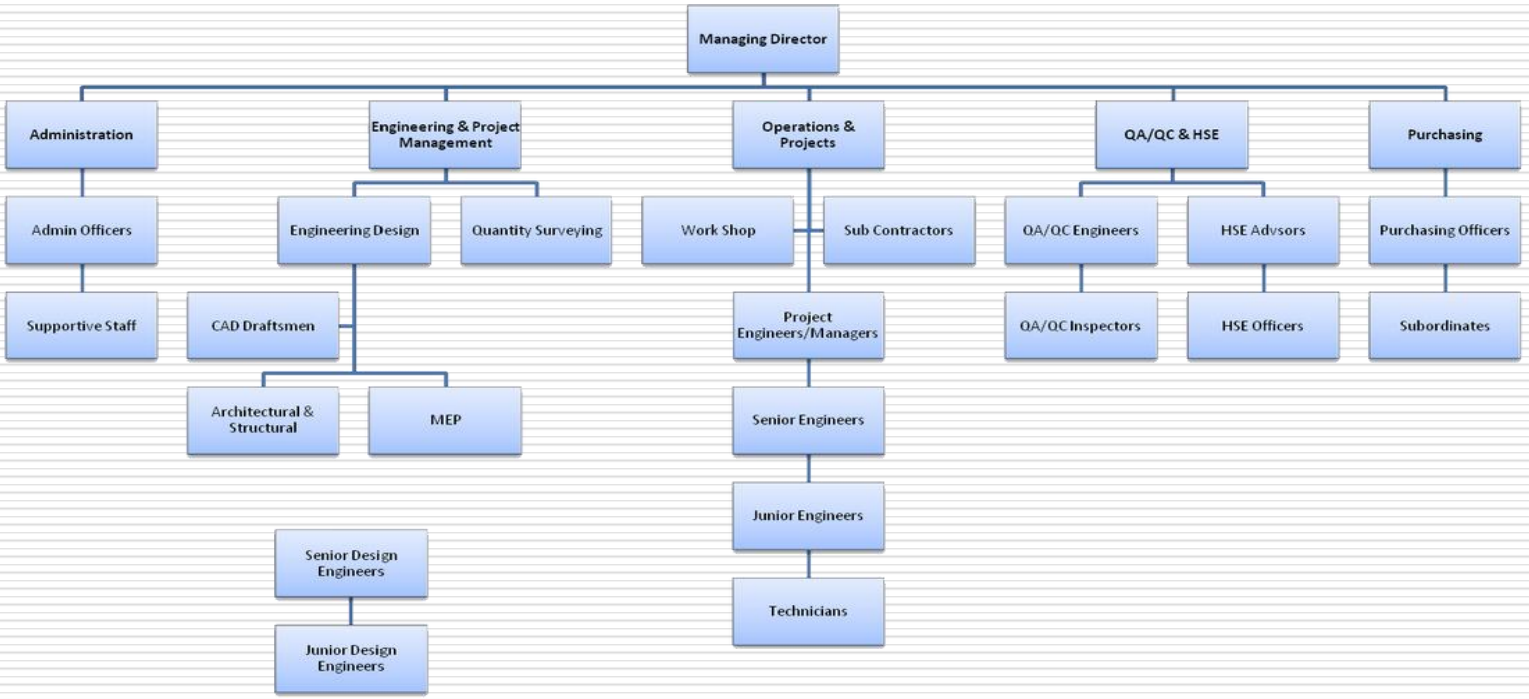
Organizational Breakdown Structure (OBS)

Decomposition of Human Resource pool needed to execute all the task



"The OBS is prepared with the idea that each task in the WBS must be assigned to a resource or a committee of resource"

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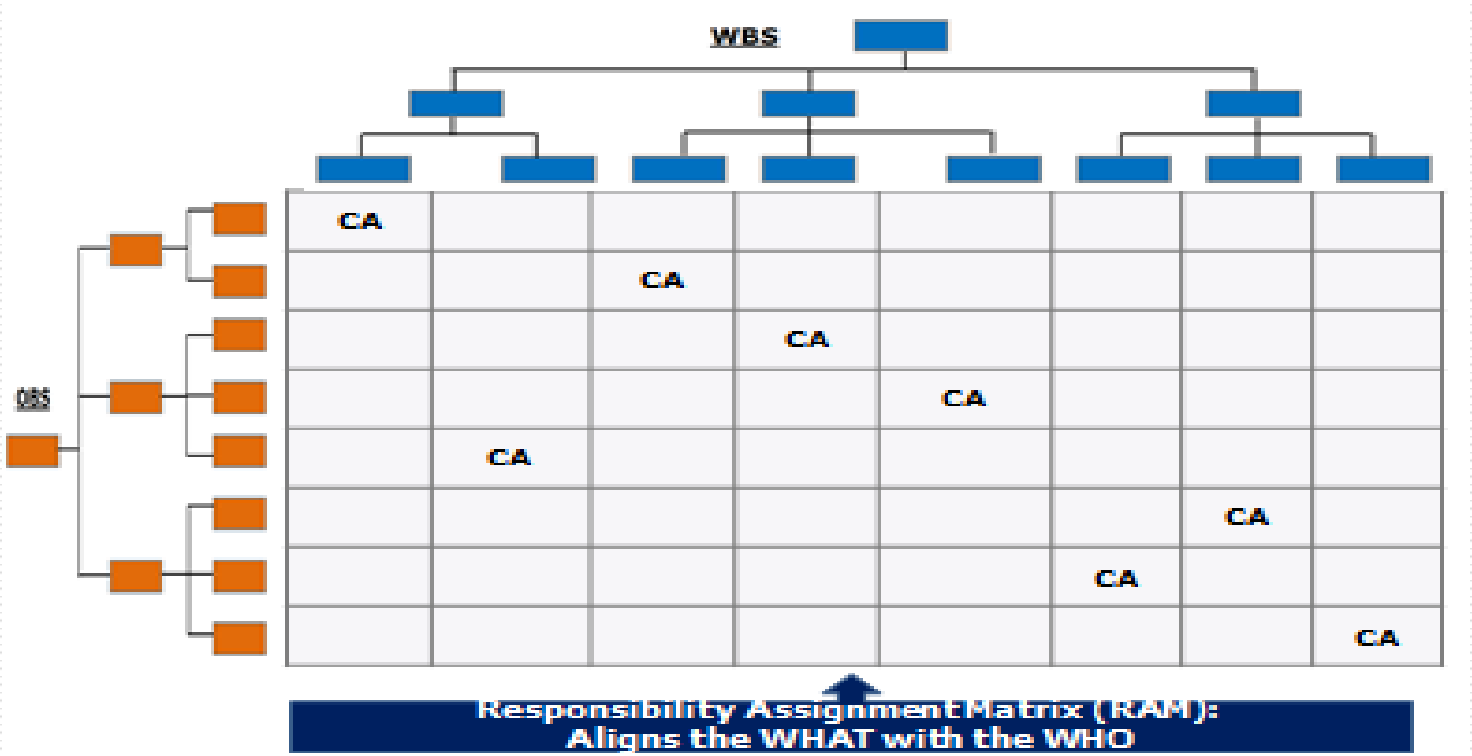
Responsibility Assignment Matrix (RAM)

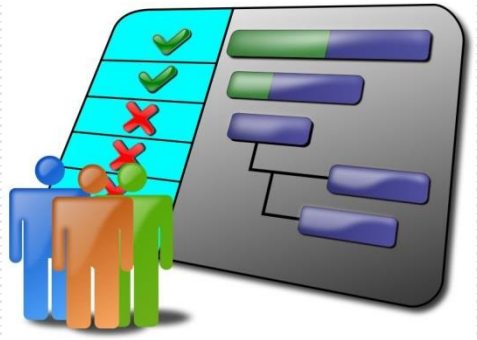
This actually integrates WBS and OBS into a matrix format to clearly state specific responsibility for specific project tasks.

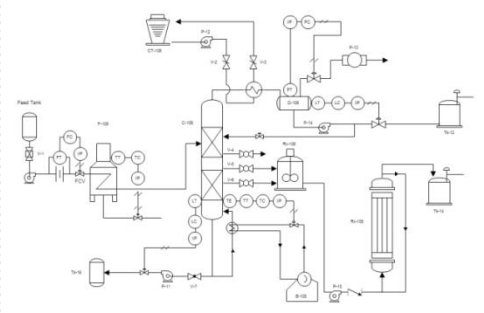


Activity

The Basic element into which a Project is subdivided for scheduling a network.

- Has a definable start and finish
- Consumes time (Exclusion are milestones)
- Consumes resources
- Is measurable

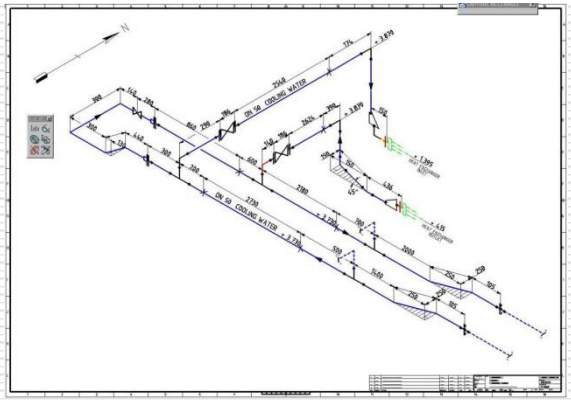




Milestone

“A zero duration activity or event which is used to denote a particular point in time for reference or measurement. ”

- Can be either a Start or Finish Achievement
- Has no duration
- Has no resources



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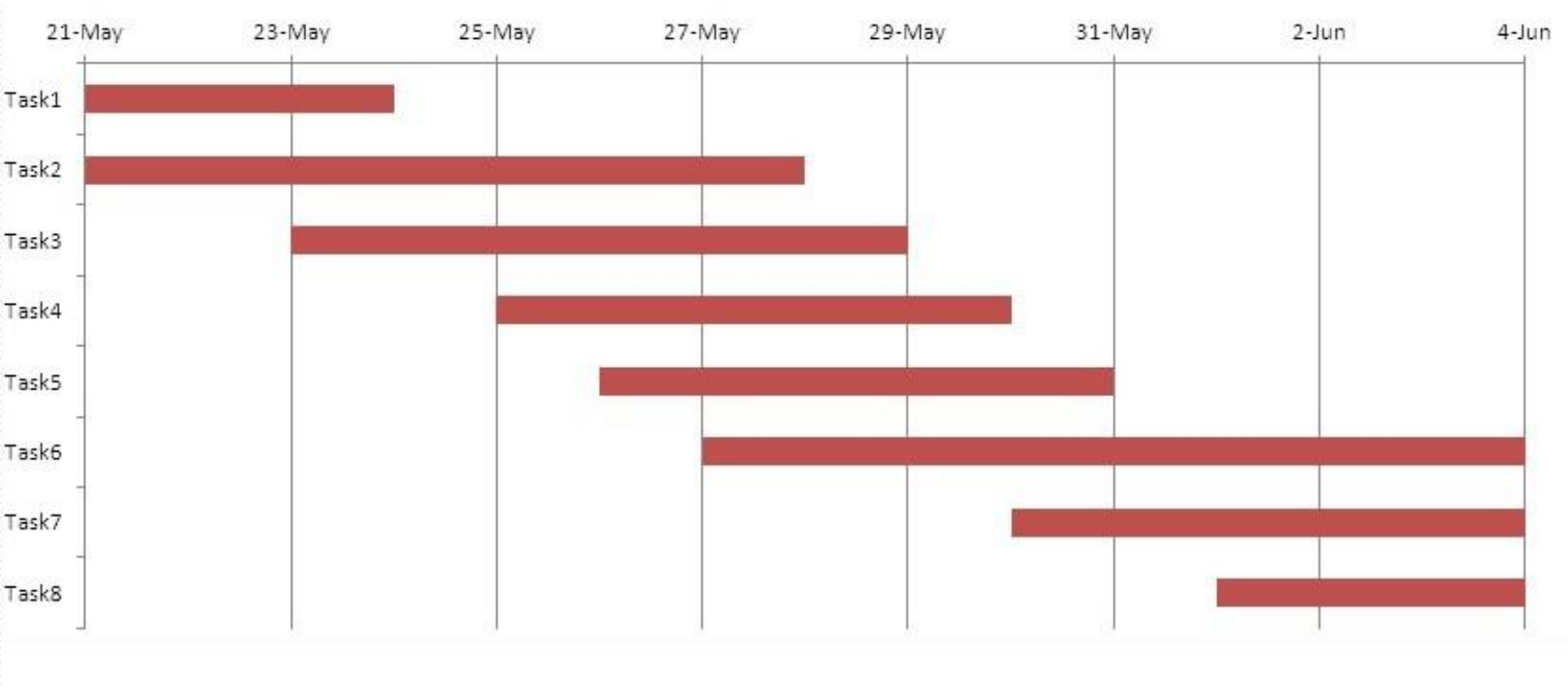
Gantt Chart



“Bar chart showing activities against time”

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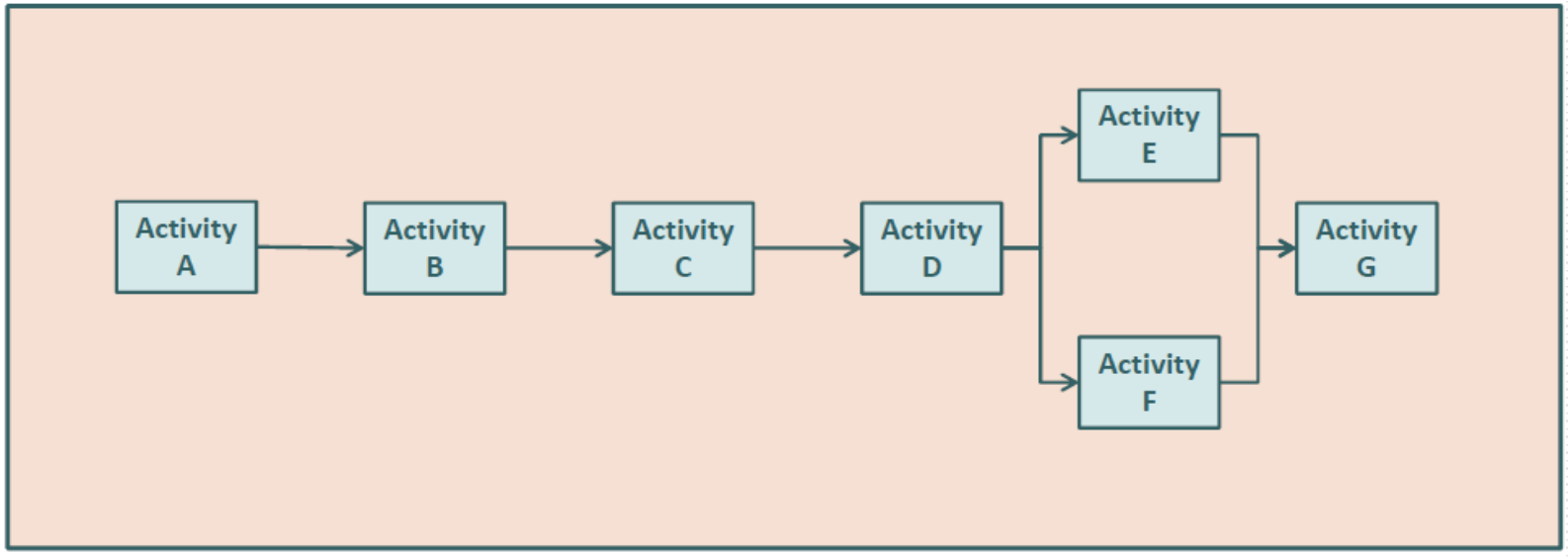
Network Diagram

A graphic display of schedule activities and predecessors which aid Project Planning by showing the logical relationships of activities, one to another.



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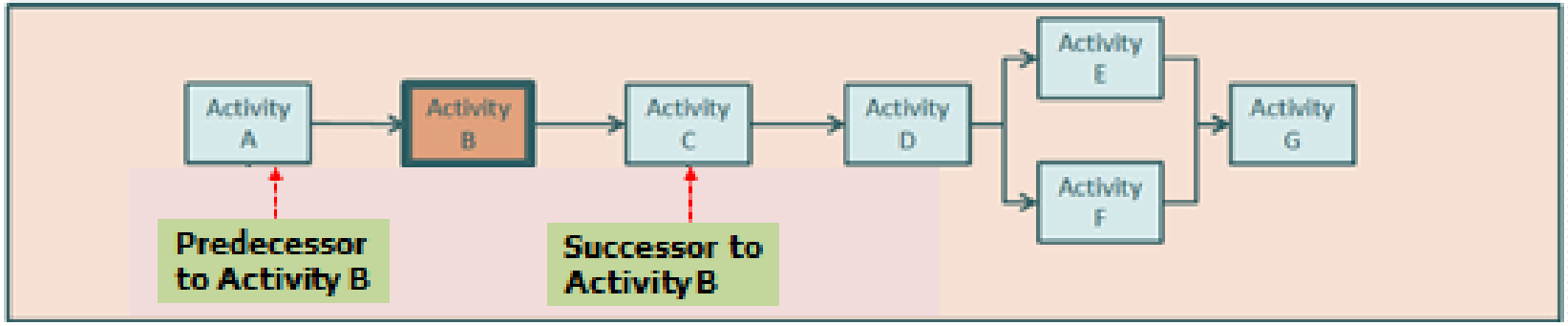
Type of Activity

Predecessor :

- An activity that must occur before another activity.
- A predecessor activity controls the start or finish date of its successor(s).
- An activity can have multiple predecessors, each with a different relationship to it.

Successor :

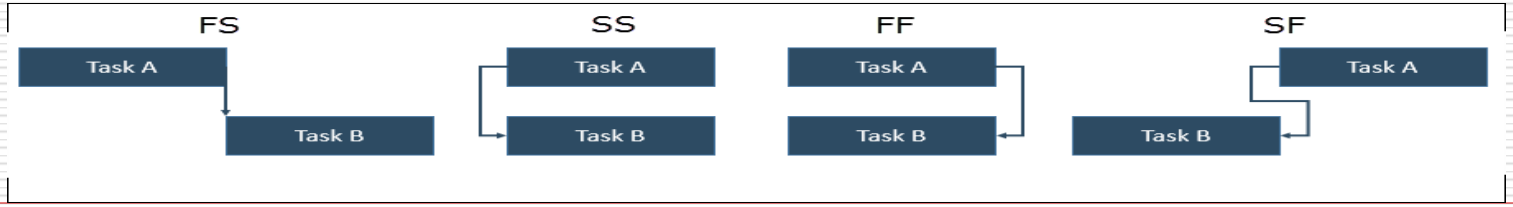
- An activity that must occur after the start or finish of predecessor activity.
- An activity can have multiple successors, each with a different relationship to it.



Activity Dependencies

There are four types of Dependencies:

- **Finish to Start - FS** - A relationship in which the predecessor activity must Finish before its successor activity can Start.
- **Start to Start - SS** - A relationship in which the Start of the predecessor activity controls the Start of a successor activity.
- **Finish to Finish - FF** - A relationship in which the Finish of a successor activity depends on the Finish of its predecessor activity.
- **Start to Finish - SF** - A relationship in which the Start of the predecessor activity controls the Finish of a successor activity.



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Activity Duration

“Needs Experience”

- The project manager and team member(s) must decide which work period is right for the project.
- Two major duration estimating tool: PERT & CPM.

PERT uses the distribution’s mean to determine individual activity duration. Specifically, the PERT formula is

$$(P + 4M + O) / 6$$

Critical Path Method (CPM) requires only a one time estimate per activity. This method uses only a Most Likely time estimate.

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Determining Project Duration
Critical Path Method (CPM)

"Software do it in seconds but there is a science behind its process"

CPM Science:

- Forward Pass (FP)
- Backward Pass (BP)

The **Forward Pass** determines the early start (ES) and the early finish (EF) of each activity.

Project Duration

Project Start and finish date

The **Backward Pass** determines the late start (LS) and late finish (LF) of each activity.

Float

Critical Path

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Critical Path Method (CPM) Output

Output:

- **Early Start (ES):** The earliest date or time an activity may start
- **Early Finish (EF):** The earliest date or time an activity may finish
- **Late Start (LS):** The latest date or time an activity may start so the project may be completed on time
- **Late Finish (LF):** The latest date or time an activity may finish
- **Lag:** An offset or delay from an activity to its successor. Lag can be positive or negative.
- **Total Float:** The amount of time the start or finish of an activity can be delayed without affecting the project finish date.
- **Free Float:** The amount of time than that the early start/finish of an activity can be delayed without delaying the early start/finish of a successor activity.
- **Critical Path:** Series of consecutive activities that represent the longest path through the project.

Schedule Failure

- Lack of buy-in by all project team members
- Lack of Planning
- Inadequate or inappropriate logic ties
- Poor duration estimating
- Lack of information
- Lack of adequate consideration of resources, and work conditions

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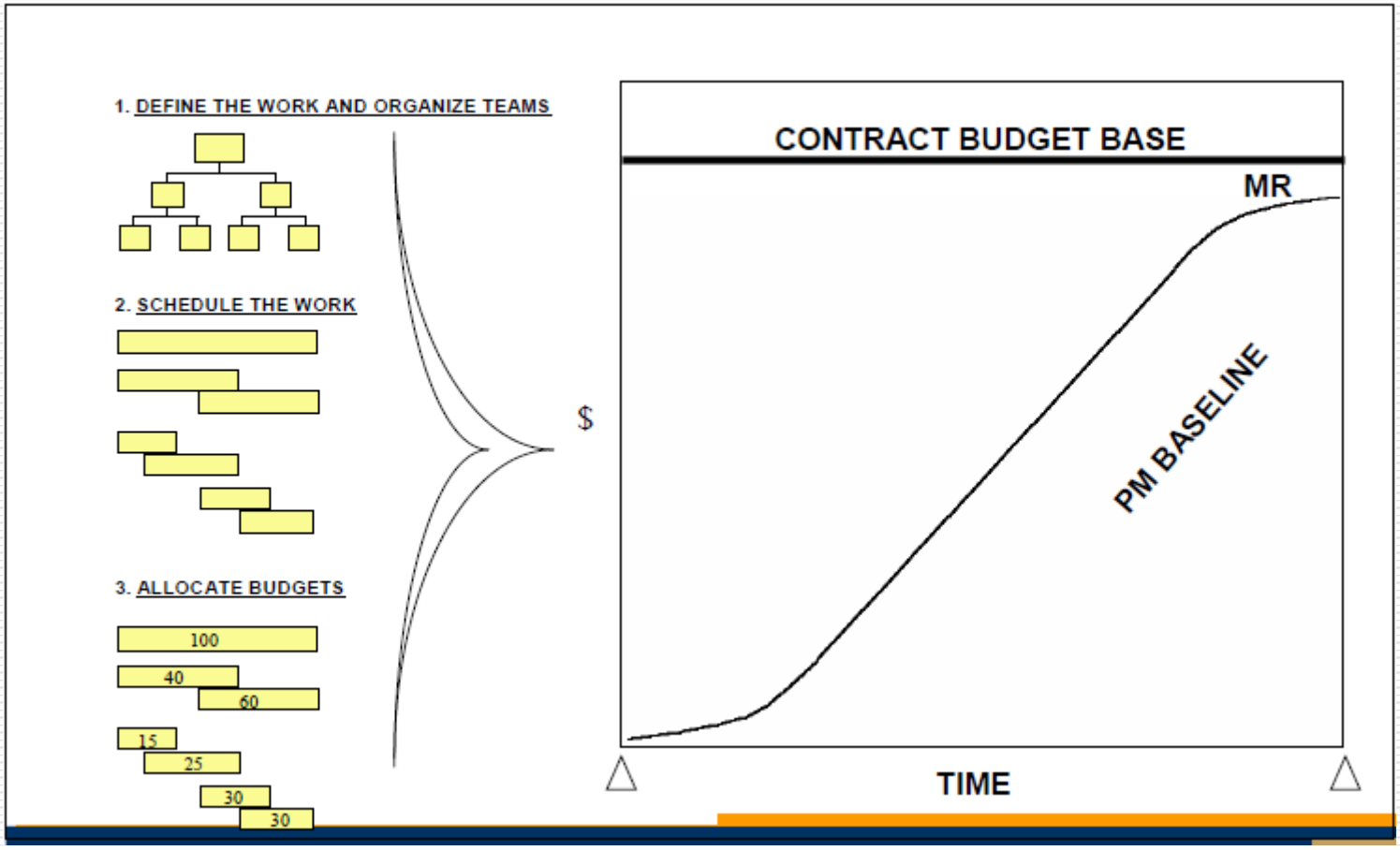
DCMA 14 Point Schedule Assessment

1. Checking the Logic.
2. Looking for Leads.
3. Looking for Lags.
4. The Right Relationship Types.
5. How about those Hard Constraints.
6. Rein-in your Total Float.
7. Negative Float is Never Good.
8. Break Down those Long Durations.
9. Check for Invalid Dates.
10. Load it up with Resources and Cost.
11. Subvert Activity Slippage.
12. Critical Path Integrity
13. Critical Path Length Index (CPLI)
14. Baseline Execution Index (BEI)

Earned Value Management System (EVMS)

- EVMS is a rational method for measuring productivity that can help the project teams manage their work more effectively by:
  - Anticipating problems before they become acute.
  - Recognizing trends and correcting them.
  - Applying lesson learned to improve future performance.

Earned Value Management System Performance Baseline formation



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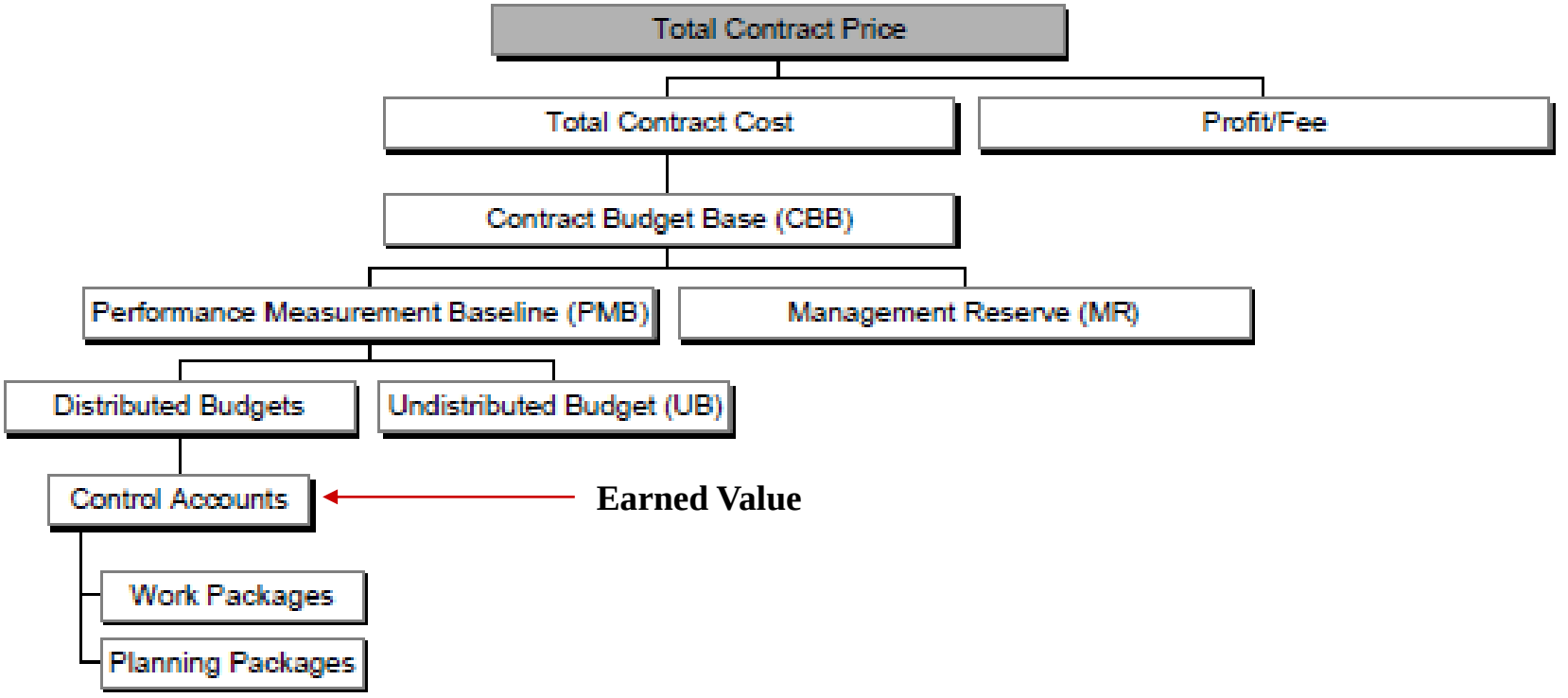
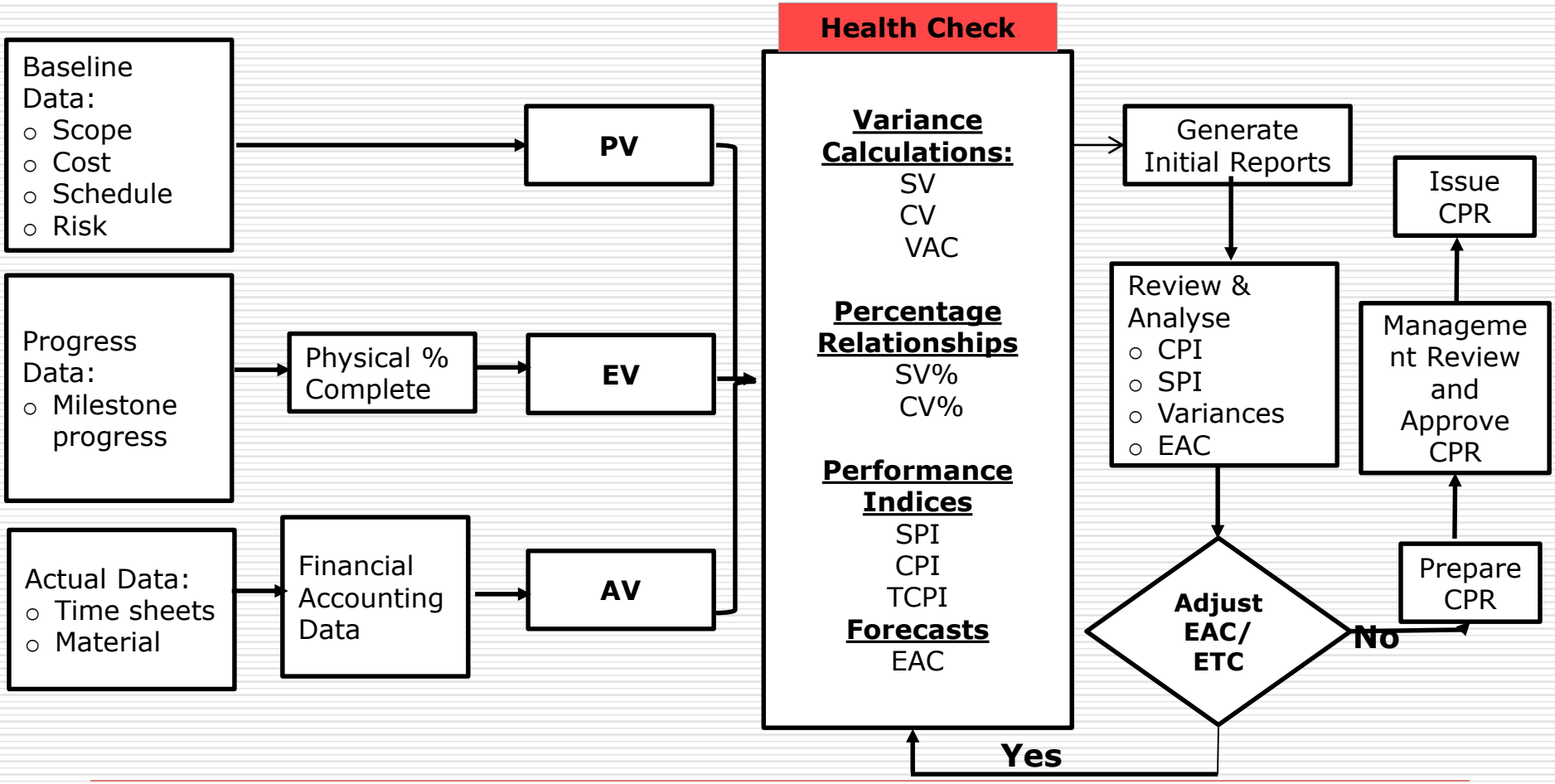
EVMS Contract Baseline



EVMS Important Terms

- How much work **should** be done? – BCWS or Planned Value (PV)
- How much **physical work is** done? – BCWP or Earned Value (EV)
- How much did the **is done** work cost? – ACWP or Actual Value (AV)
- What was the total job **supposed** to cost? – Budget At Completion (BAC)
- What do we **now expect** the job to cost? – Estimate At Completion (EAC)
- What will be the estimate cost **to complete** the job? – Estimate To Complete (ETC)
- How is our **Schedule Performance**? – Schedule Performance Index (SPI)
- How is our **Cost Performance**? – Cost Performance Index (CPI)
- Project **on Schedule or Behind Schedule**? – Schedule Variance (SV)
- Project **Cost underrun or overrun**? – Cost Variance (CV)

EVMS Implementation



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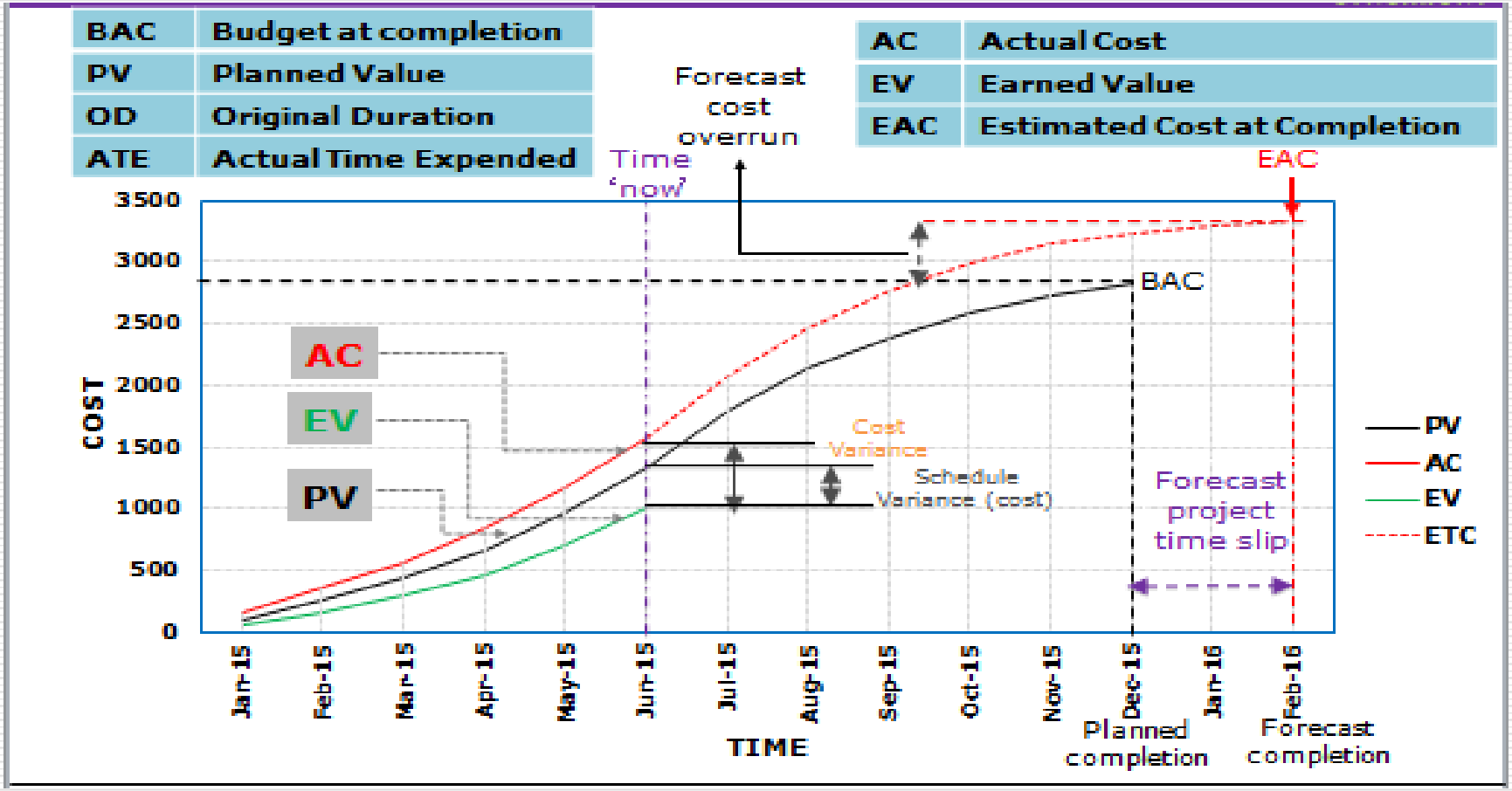
EVMS Indices

- Schedule Performance Index (SPI) = EV/PV
- Cost Performance Index (CPI) = EV/AV
- Schedule Variance (SV) = EV-PV
- Cost Variance (CV) = EV-AV
- Estimate To Complete (ETC) = (BAC-EV)/(SPI*CPI)
- Estimate At Completion (EAC) = AV+ETC
- Variance At Completion (VAC) = BAC-EAC
- To Complete Performance Index (TCPI) = (BAC-EV)/(BAC-AV)
- Schedule Variance % (SV%) = (SV/PV)*100
- Cost Variance % (CV%) = (CV/EV)*100

EVMS Curve



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EVMS : A Health Check Tool

SPI = EV/PV

- **SPI < 1:** This is behind schedule situation where EV<PV
- **SPI = 1:** This is the ideal condition, where EV=PV
- **SPI > 1:** This is ahead of schedule situation, where EV>PV

CPI = EV/AV

- **CPI < 1:** This is overrun situation where EV<AV
- **CPI = 1:** This is the ideal condition, where EV=AV
- **CPI > 1:** This situation is called under run, where EV>AV

EVMS : A Health Check Tool

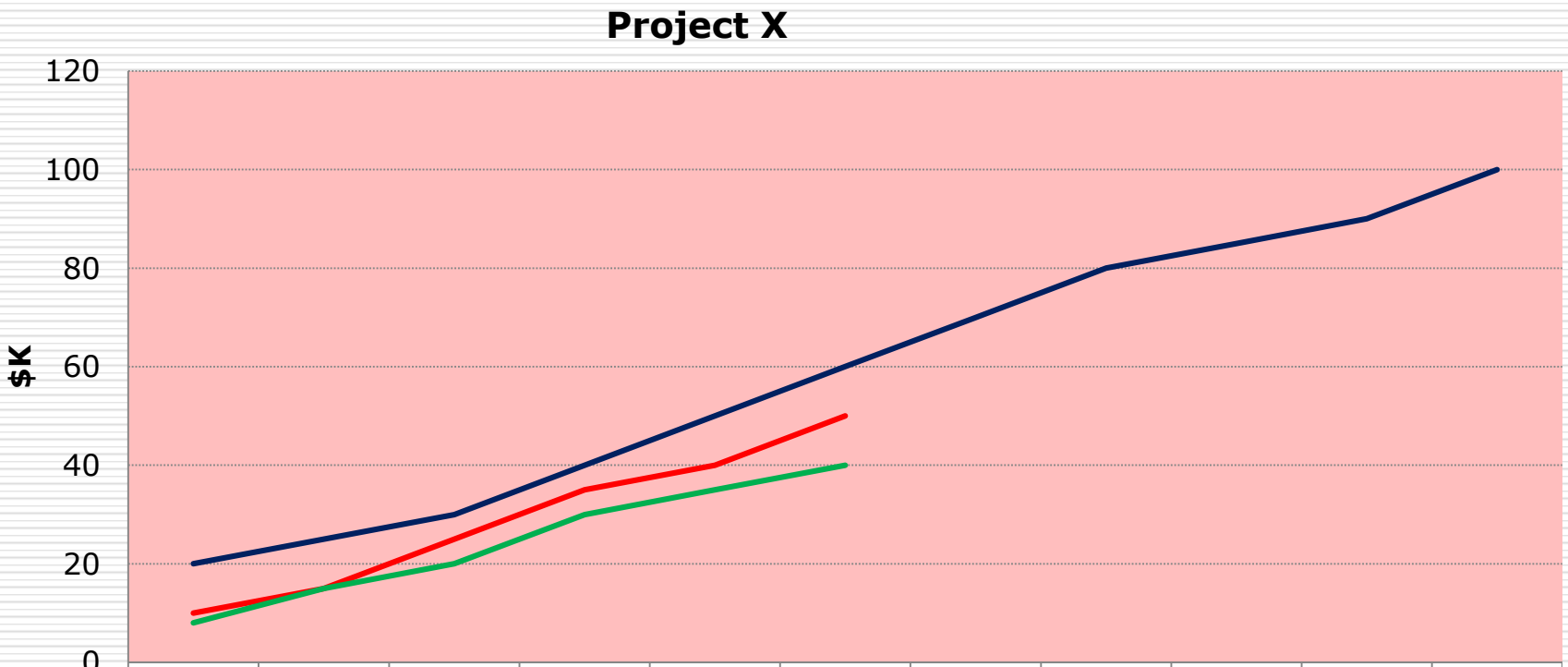
SV = EV-PV

- **SV < 0:** A negative SV means the project is behind the schedule.
- **SV = 0:** Ideal condition, this means you are on schedule.
- **SV > 0:** A positive SV simply means that the project is ahead of the work that it initially planned to do.

CV = EV-AV

- **CV < 0:** Overrun condition. Project spends more funds to perform the physical work performed.
- **CV = 0:** Ideal condition. Project spends funds as per physical work performed.
- **CV > 0:** Under run Condition. Project spends lesser funds to perform the physical work performed.

EVMS Sample Exercise



	J	F	M	A	J	J	A	S	O	N	D
PV	20	25	30	40	50	60	70	80	85	90	100
AC	10	15	25	35	40	50					
EV	8	15	20	30	35	40					

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EVMS Sample Exercise

SV = EV – PV

= 40 – 60

= -20

CV = EV– AC

= 40 – 50

= -10

TCPI (BAC) =

[BAC - EV (cum)/ BAC – AC (cum)]

= (100 - 40)/(100 – 50)

= 60/50

= 1.20

SV% = (SV/PV) x 100

= (-20/60) x 100

= -33%

CV% = (CV/EV) x 100

= (-10/40) x 100

= -25%

SPI = EV/PV

= 40/60

= .67

CPI = EV/AC

= 40/50

= .80

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EVMS Reporting

- CPR (Cost Performance Report) enables the top management to exercise an effective control over the project.
  - It provides overview of the project status.
  - Outlines the present performance and the future targets.

EVM Reporting

Data

Processes

People

Systems

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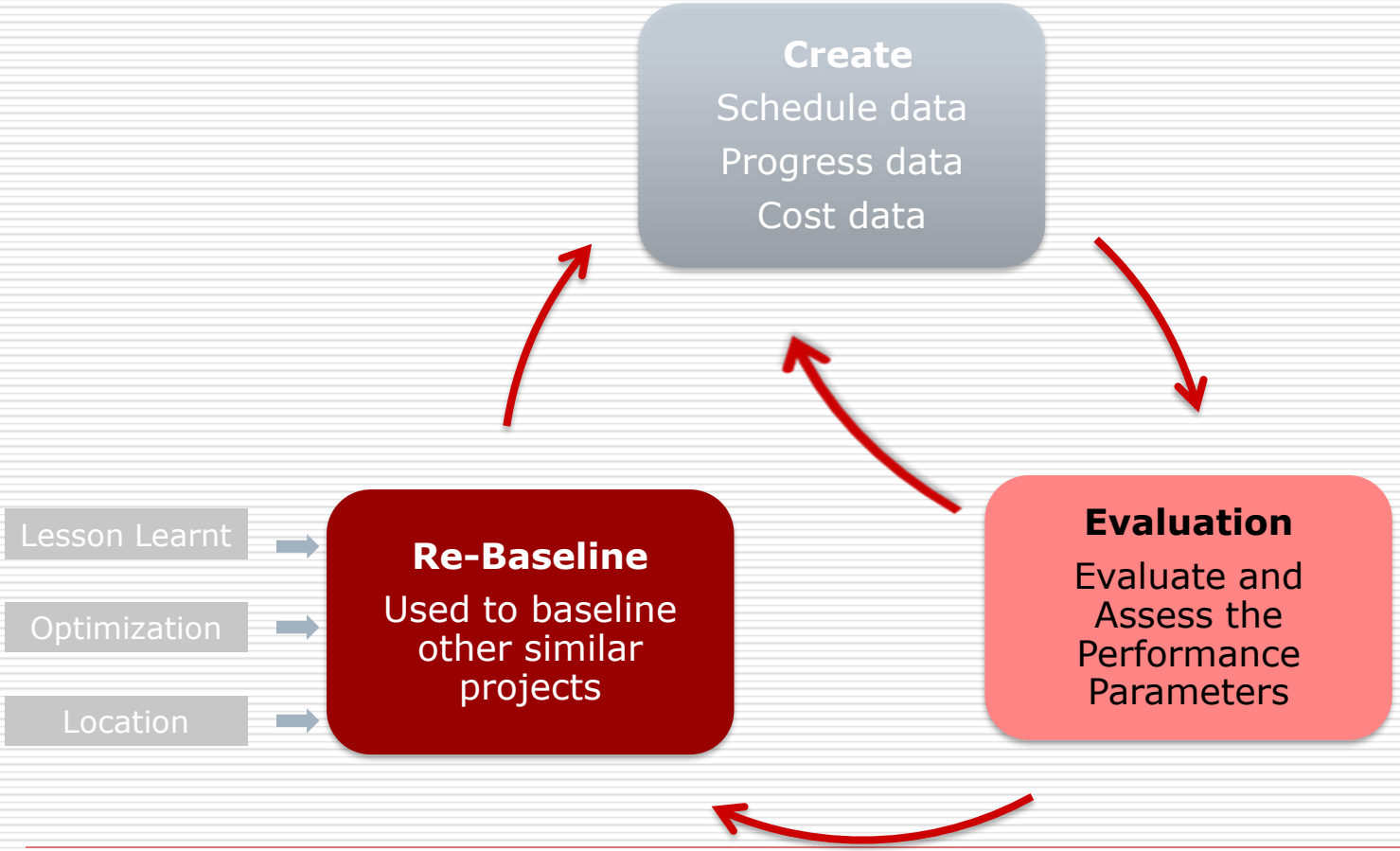
Data Cycle



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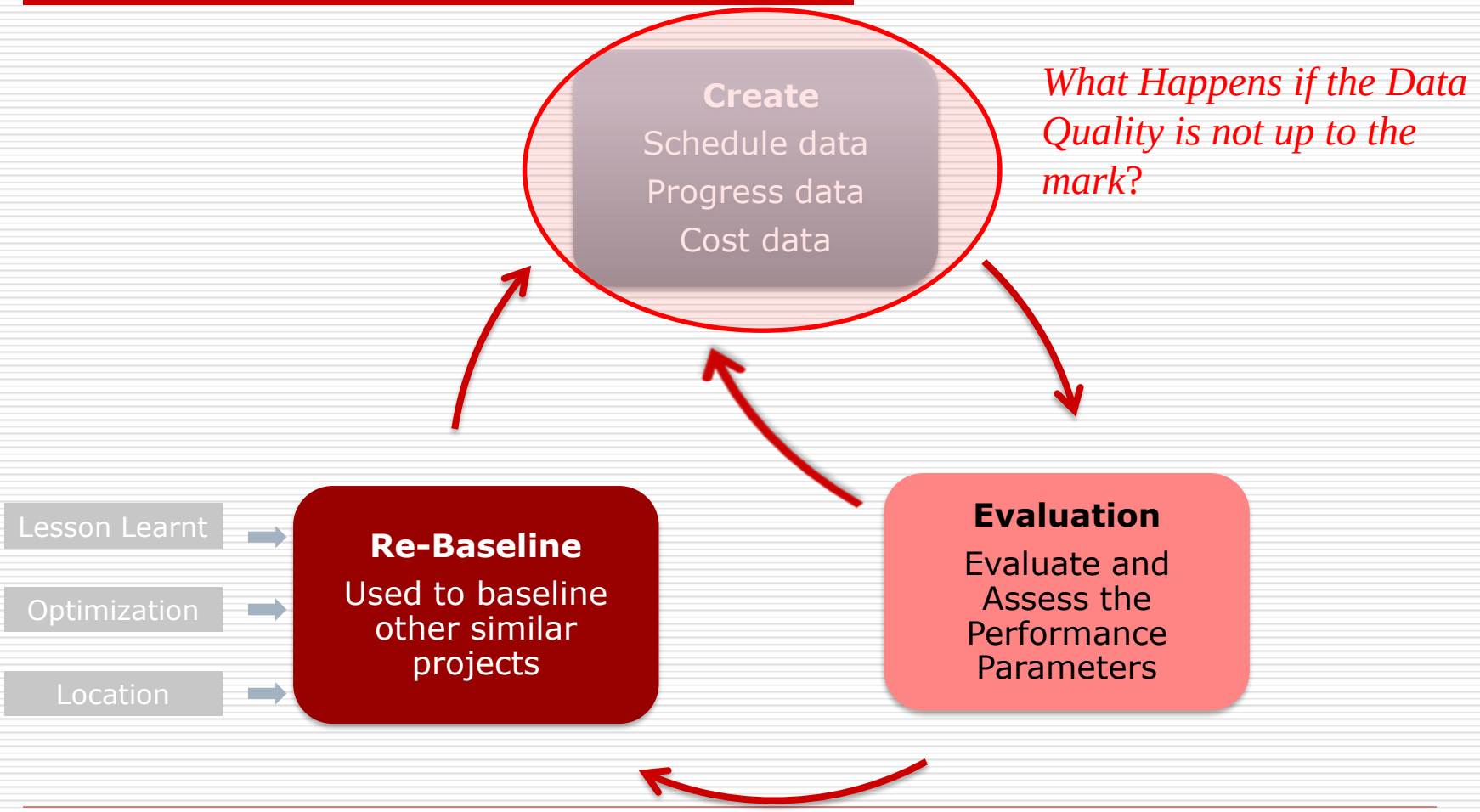
Data Cycle

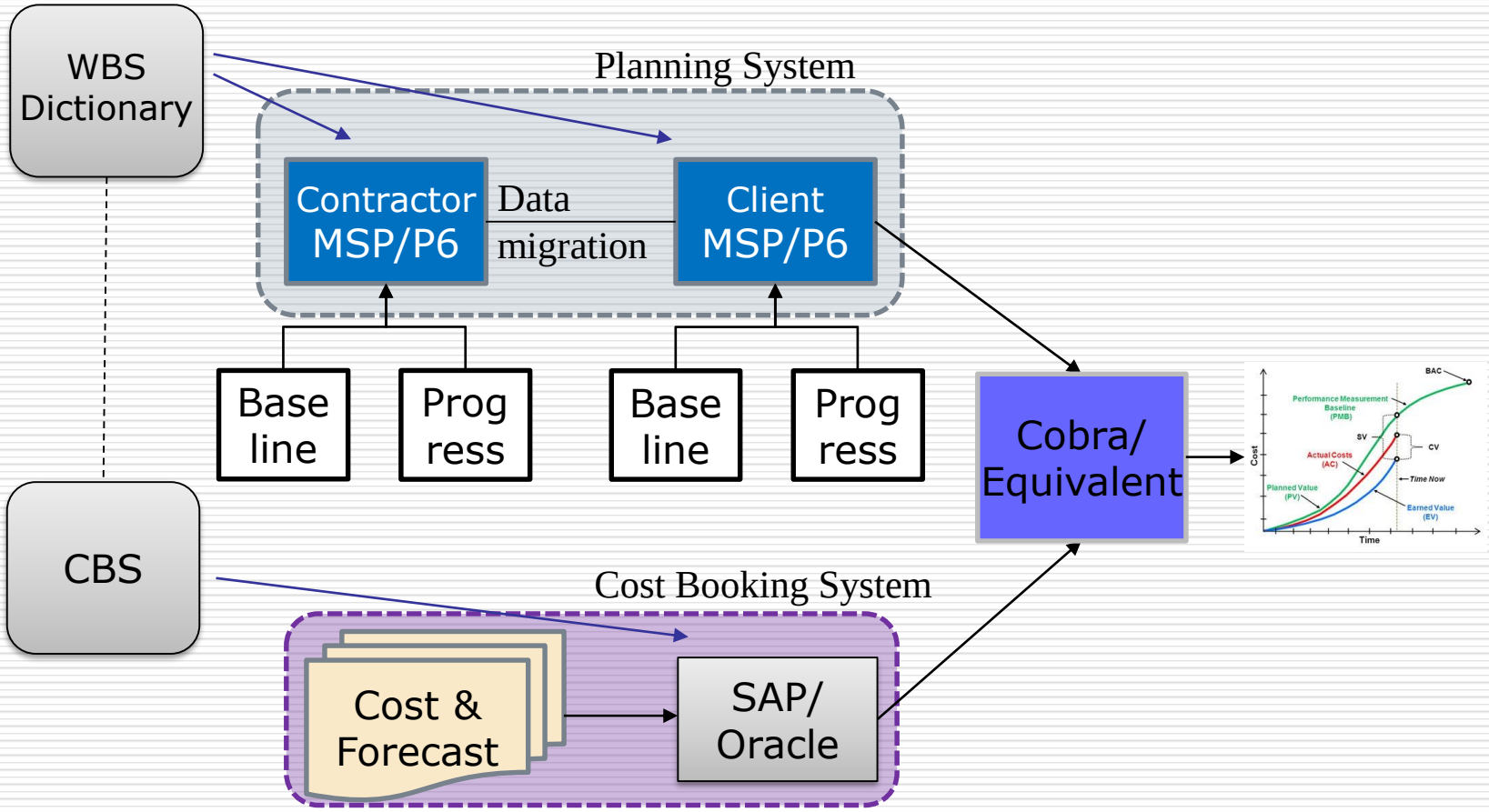


Effects of Poor Data Quality

- Risk of Delays and Cost over-run increases
- Affects Progress Parameters (Reporting failure)
- Reserve adequacy risk (Cash flow)
- Material/Resource/Manpower forecasting
- Optimization failure
- Difficulty to Baseline similar projects
- Data driven decisions impacted

Image Source : Google

EVM Reporting



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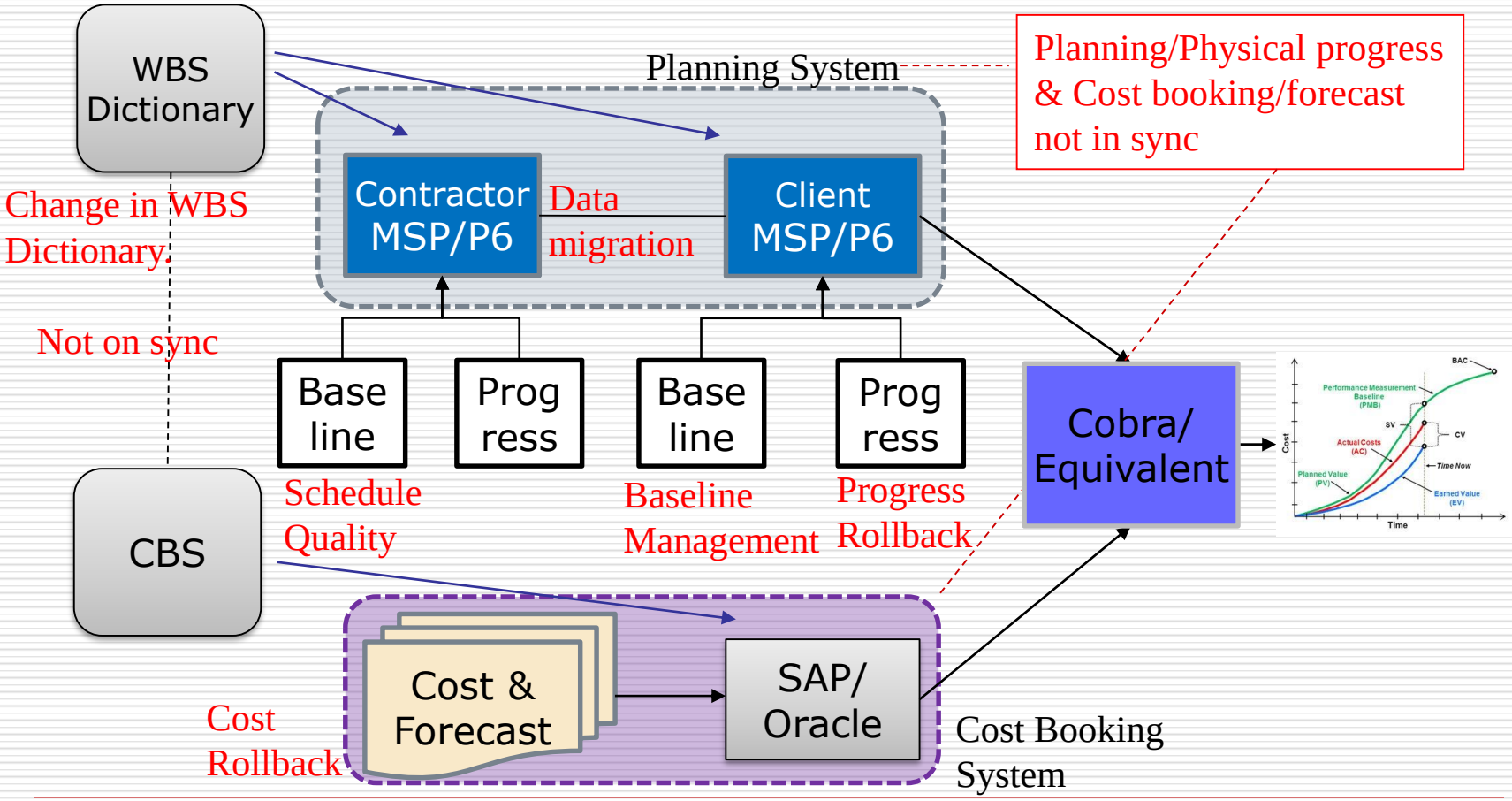
EVM Reporting – Data Quality Issues



Data Quality Assessment

- Schedule Data (Planned / Baseline data)
  - Schedule quality metrics (Schedule Auditor)
  - Baseline management
- Reporting Challenges & Limitations
  - Cost booked in invalid CBS (WBS – CBS integration)
  - Change in WBS Dictionary
  - Systems/Software induced issues
- Cost & Progress Data
  - Cost Rollback (negative cost booking)
  - Progress Rollback
- Co-relation between Cost & Progress booked

Schedule Auditor

PROJECT SUMMARY

Project ID			Project Dates	
			Forecast	Baseline
Project Name		Start		
		Finish		
Schedule Quality Score	Average 71%	F/B Cost(M)	[illegible]	[illegible]
Data Date		Type of Activities		
Performance % Complete	15%	Task Dependent	58	
Schedule % Complete	17%	Milestones	13	
Total No of Activities	71	Level Of Effort	0	
Activities Completed	13	Resource Dependent	0	
Activity % Complete	18%	WBS Summary	0	

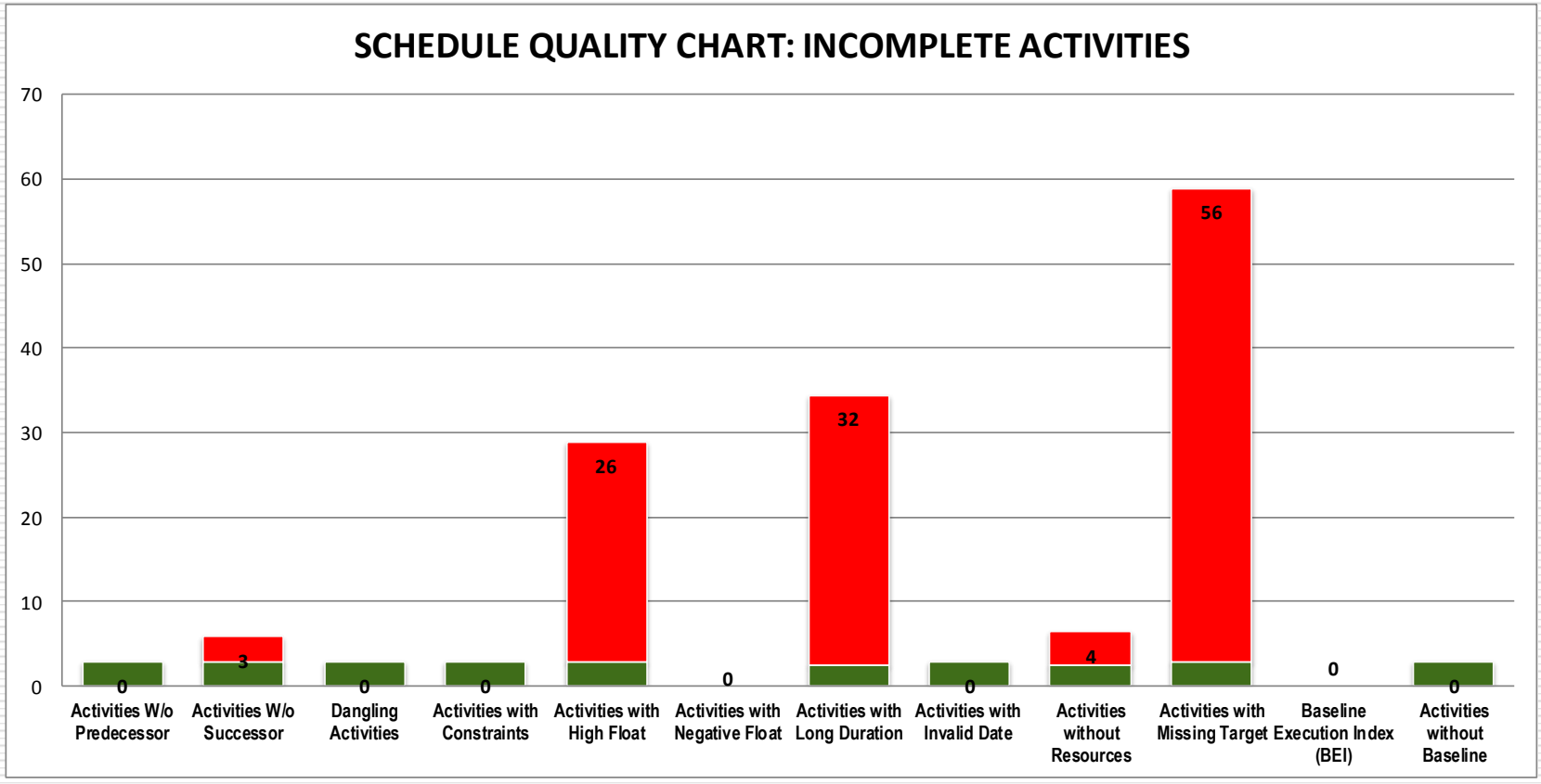
S.No	Schedule Quality Checks	Result					
		Incomplete Activities			All Activities		
		Percentage		Nos	Percentage		Nos
1	Activities W/o Predecessor	0%	PASS	0 of 58	1%	PASS	1 of 71
2	Activities W/o Successor	5%	FAIL	3 of 58	4%	PASS	3 of 71
3	Dangling Activities	0%	PASS	0 of 58	0%	PASS	0 of 71
4	Activities with Constraints	0%	PASS	0 of 58	0%	PASS	0 of 71
5	Activities with High Float	45%	FAIL	26 of 58	37%	FAIL	26 of 71
6	Activities with Negative Float	0%	PASS	0 of 58	0%	PASS	0 of 71
7	Activities with Long Duration	65%	FAIL	32 of 49	71%	FAIL	41 of 58
8	Activities with Invalid Date	0%	PASS	0 of 58	0%	PASS	0 of 71
9	Activities without Resources	8%	FAIL	4 of 49	7%	FAIL	4 of 58
10	Activities with Missing Target	97%	FAIL	56 of 58	94%	FAIL	67 of 71
11	Baseline Execution Index (BEI)				87%	FAIL	13 of 15
12	Activities without Baseline	0%	PASS	0 of 58	0%	PASS	0 of 71

DASH BOARD

Process All

Schedule Auditor

SCHEDULE QUALITY REPORT - INCOMPLETE ACTIVITIES



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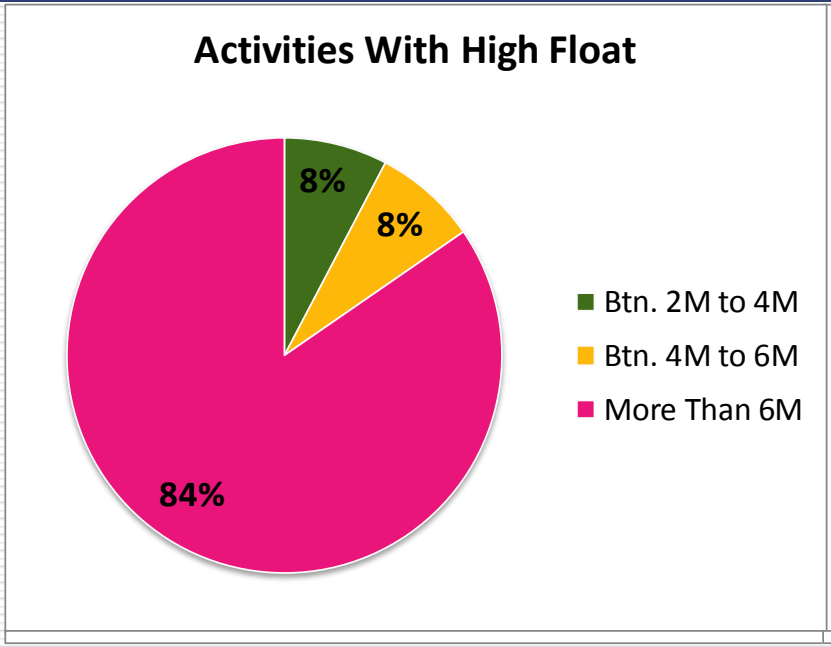
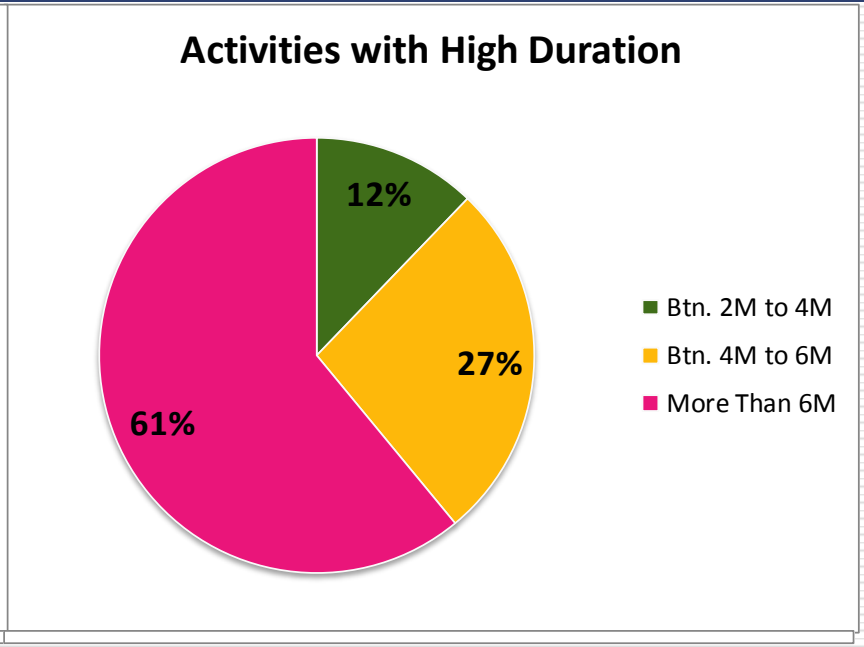
Schedule Auditor

ANALYSIS OF ACTIVITIES WITH HIGH DURATION ,FLOAT, CONSTAINTS, INVALID DATES





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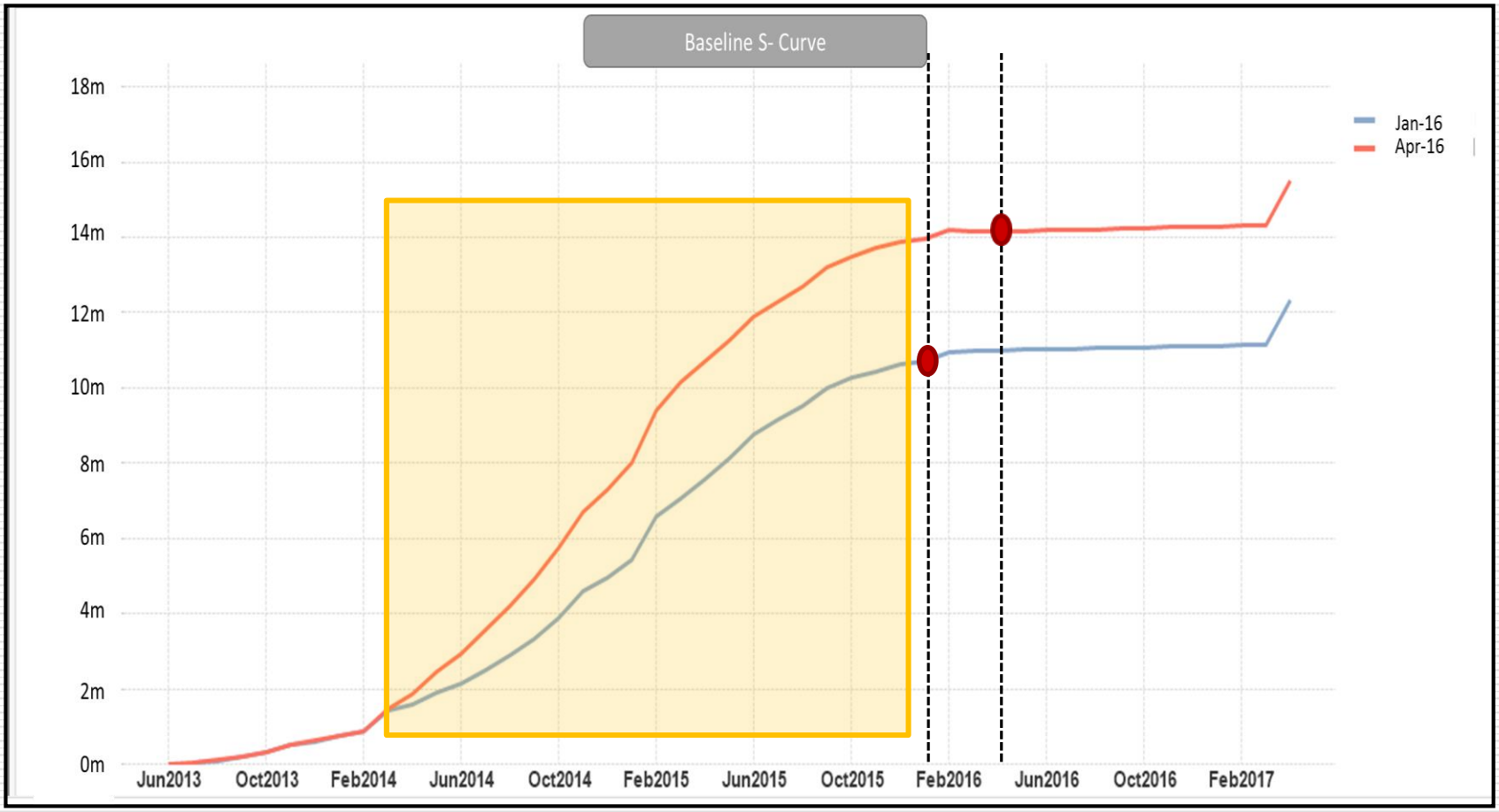
Change in Baseline Historical Cost Profile



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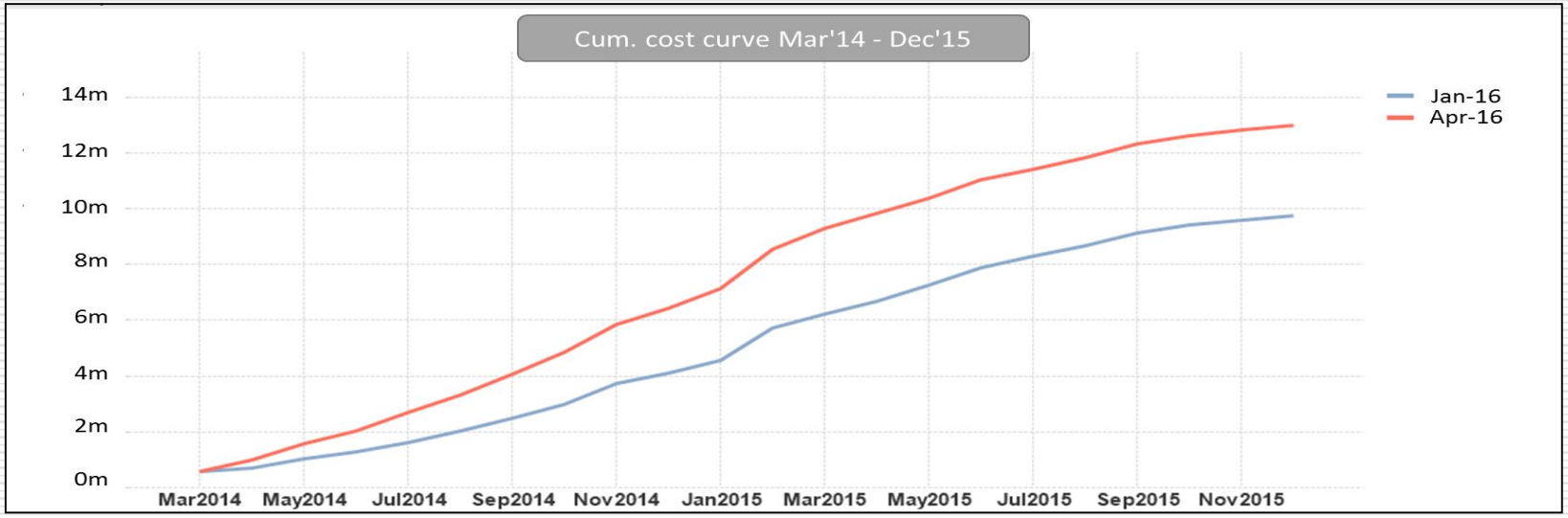

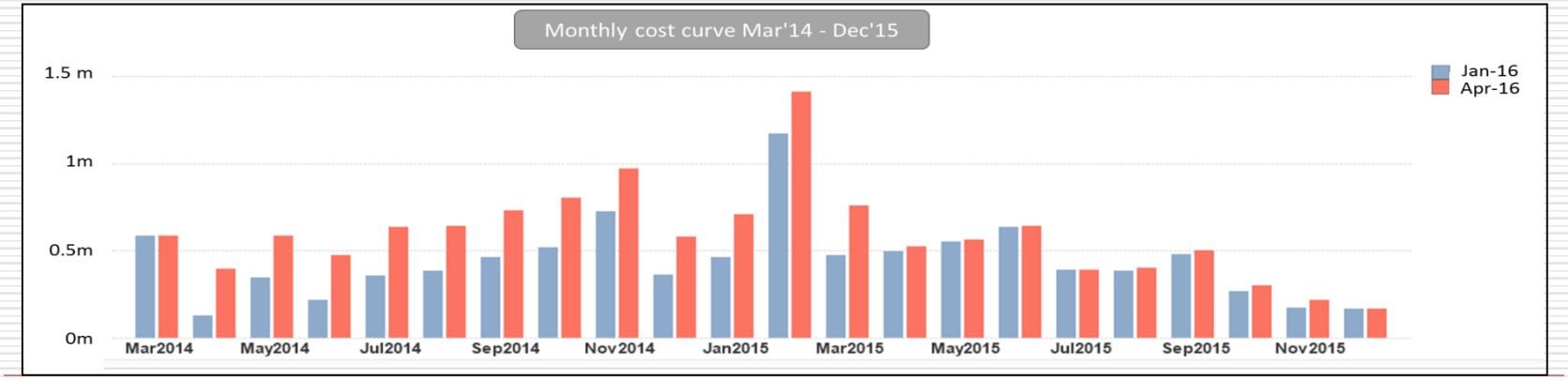

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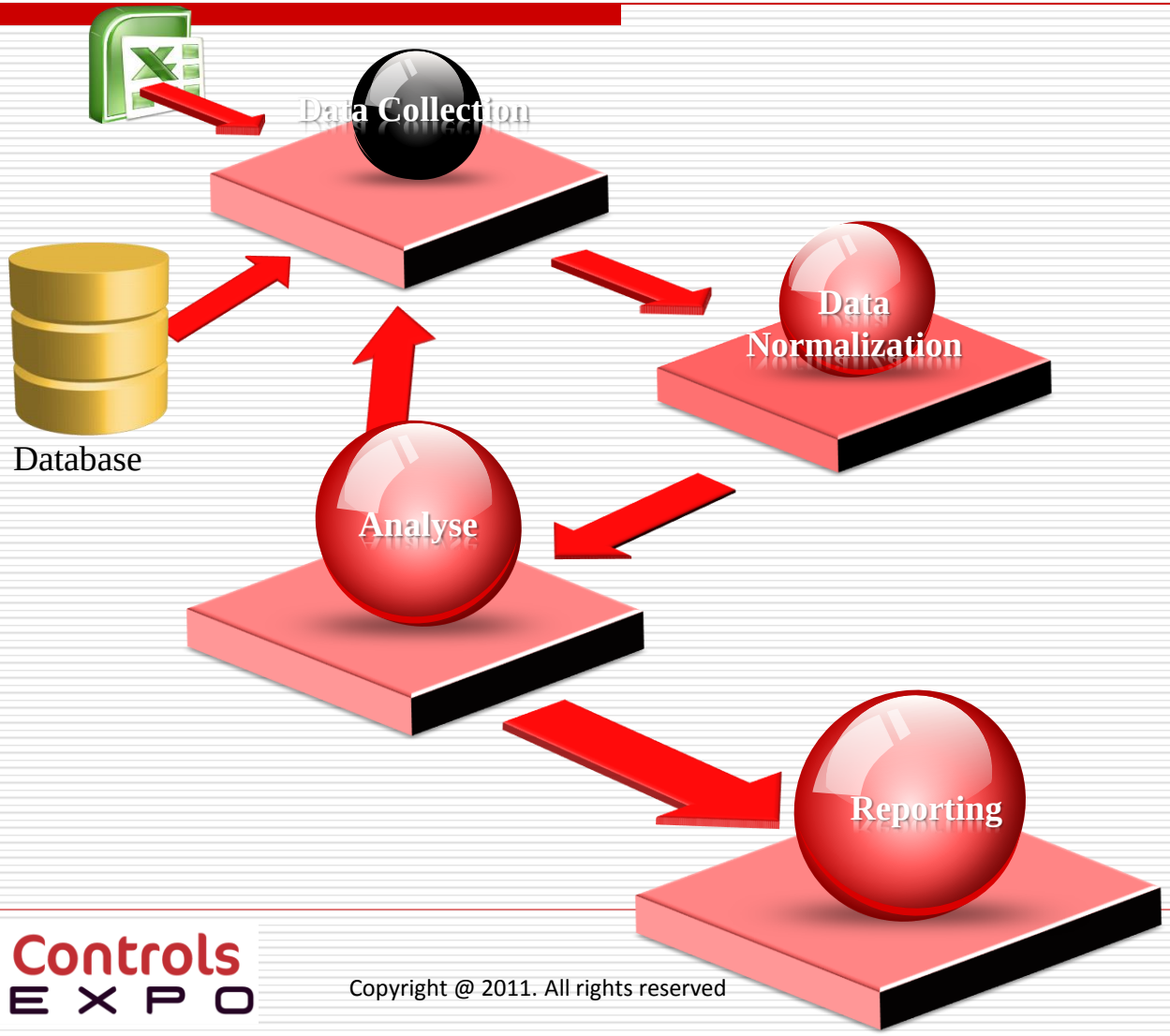

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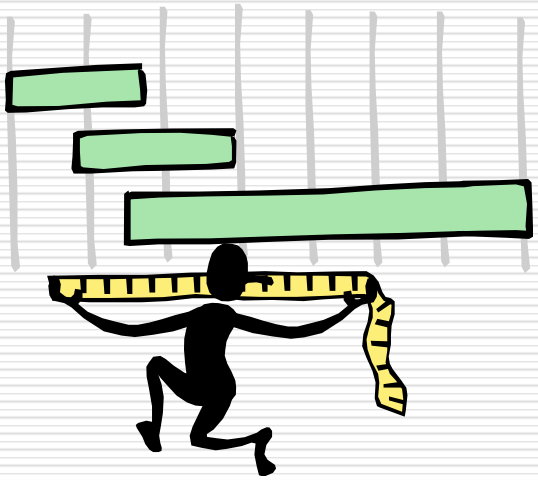
Reporting Challenges & Limitations

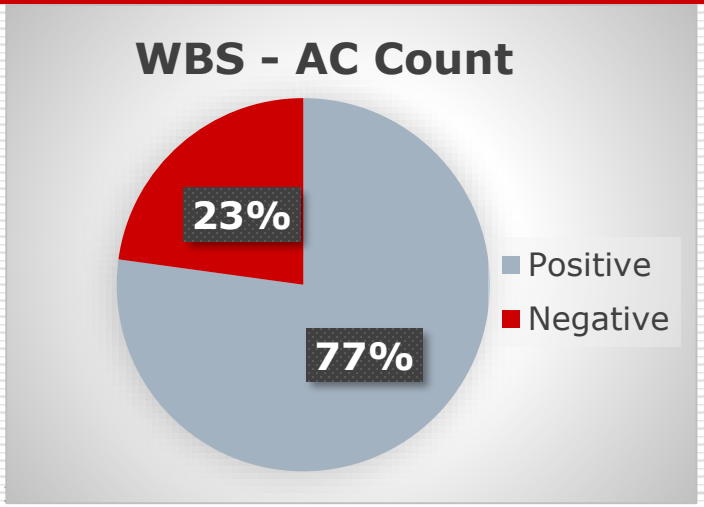
- Alignment between the Core systems(Planning & cost control)
  - Dates
  - Forecast(cost & resource)
- WBS – CBS integration
  - Invalid codes present systems
  - Old WBS codes remaining in the system;
- Change in WBS dictionary
  - Transfer of Cost & Budget.
- Systems/Software induced issues
  - Resource loading activity Start & Finish
  - % complete out of range
  - Invalid dates
  - Incomplete data transfer

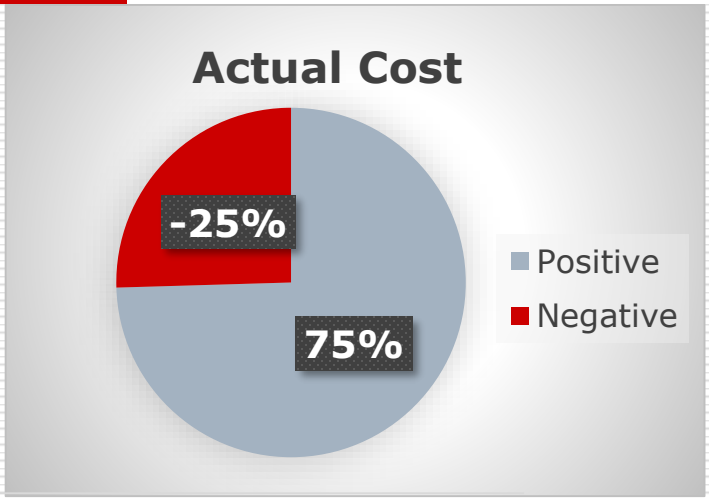
Cost & Progress Related Data Quality Issues

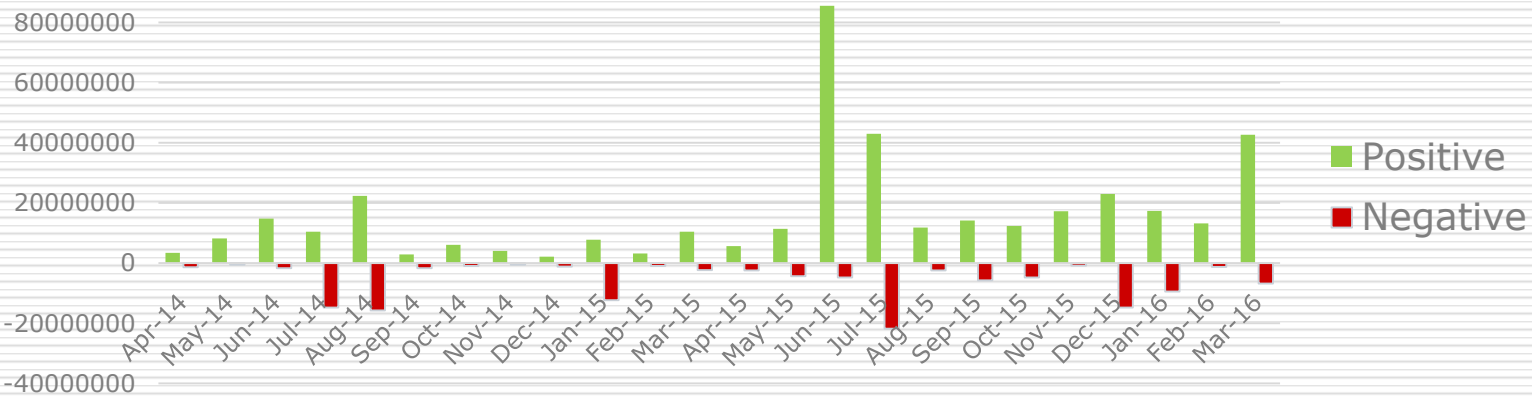


Project Controls EXPO

Cost Rollback

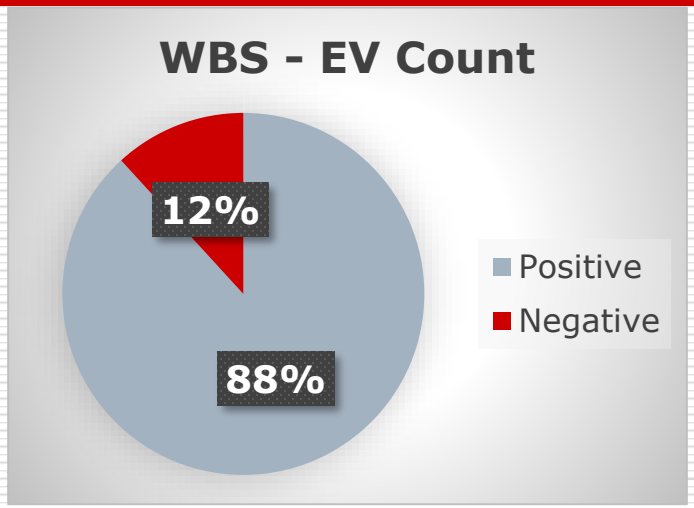


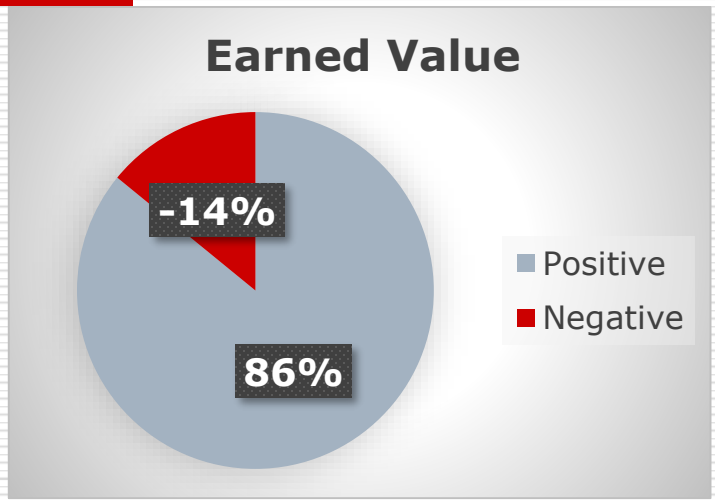


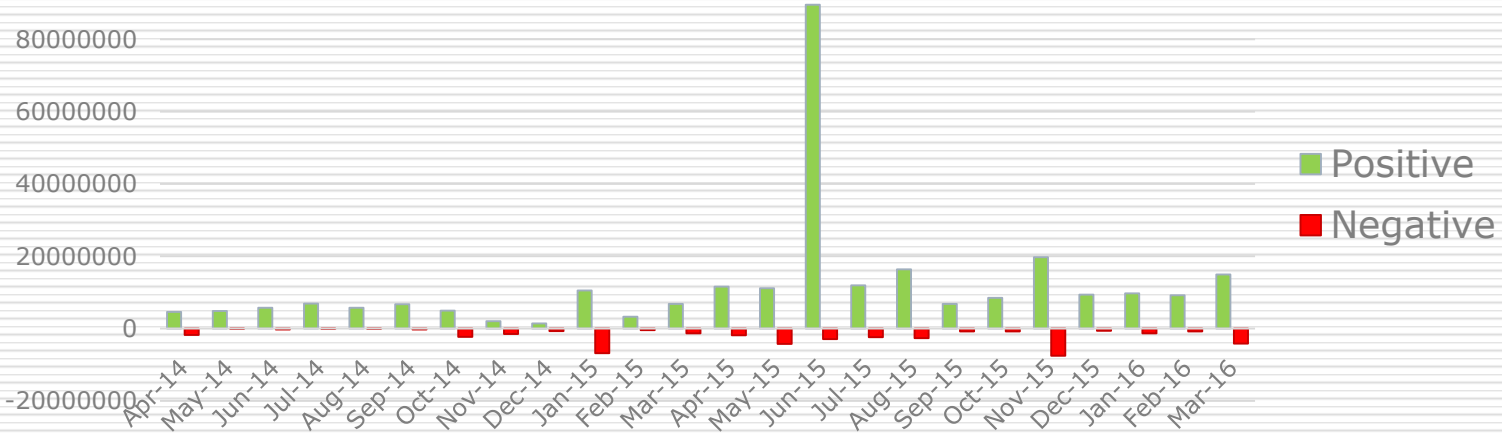


Project Controls EXPO

Progress Rollback

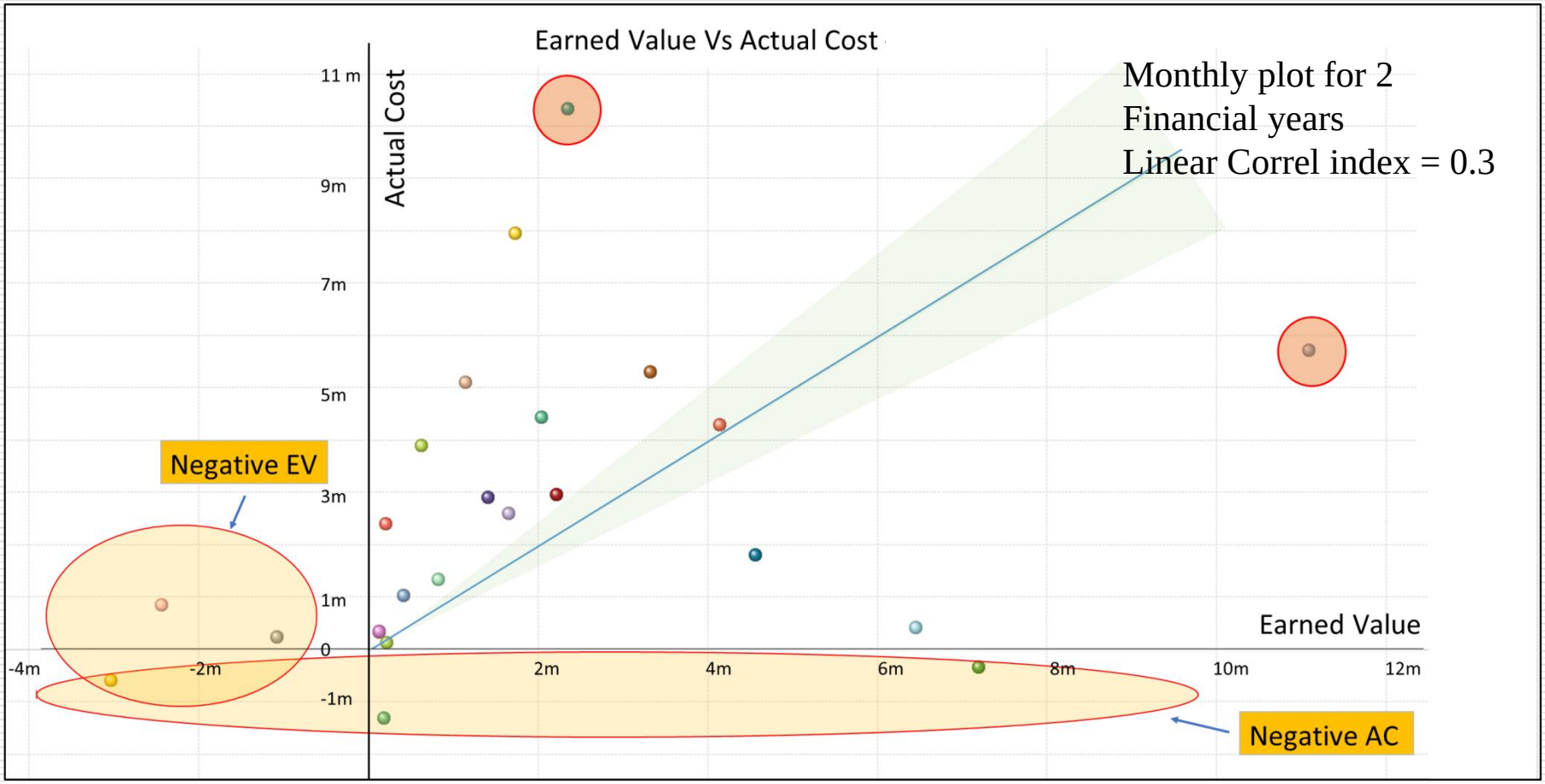






Project Controls EXPO

Earned Value vs Actual Cost



Conclusion

- Data Quality Assessment is an important aspect of progress reporting, it helps in
  - understanding the reporting gaps
  - Cleaning the data & make it reliable
  - Identifies the degree of variance in progress parameters
  - Creates a dependable back-up data for business decisions
- Effective data quality management should be considered a basic requirement for modern-day project management.
- Create business rules for sustainable data quality improvement
- Quality of data is a risk and should be monitored with other project/portfolio risks.

Project Controls EXPO