

Project Time Management

مقرر: إداره وقت المشروع

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PMG 212

Lecture 8



Agenda **Resource Management**

- Resource Management Overview
- Resource Allocation
- Resource Profile
- Resource Loading
- Modern Examples of Resource Loading in Global Companies
- What is Resource Loading in Projects
- Material Management
- Splitting Tasks
- Why use Resource Loading?
- Resource Loading Benefits
- Resource Loading Process
- Baseline, Current, and Forecast Schedule Discipline
- Schedule Analysis
- Resource Leveling versus Resource smoothing
- Estimate Cost Techniques

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Resource Management Overview

- Focuses on short-term execution planning
- Ensures correct resource availability
- Right resource at the right time
- Improves efficiency and productivity

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Resource Allocation

- Scheduling resources efficiently
- Avoid shortages and idle time
- Also called resource loading
- Supports smooth workflow

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Resource Profile

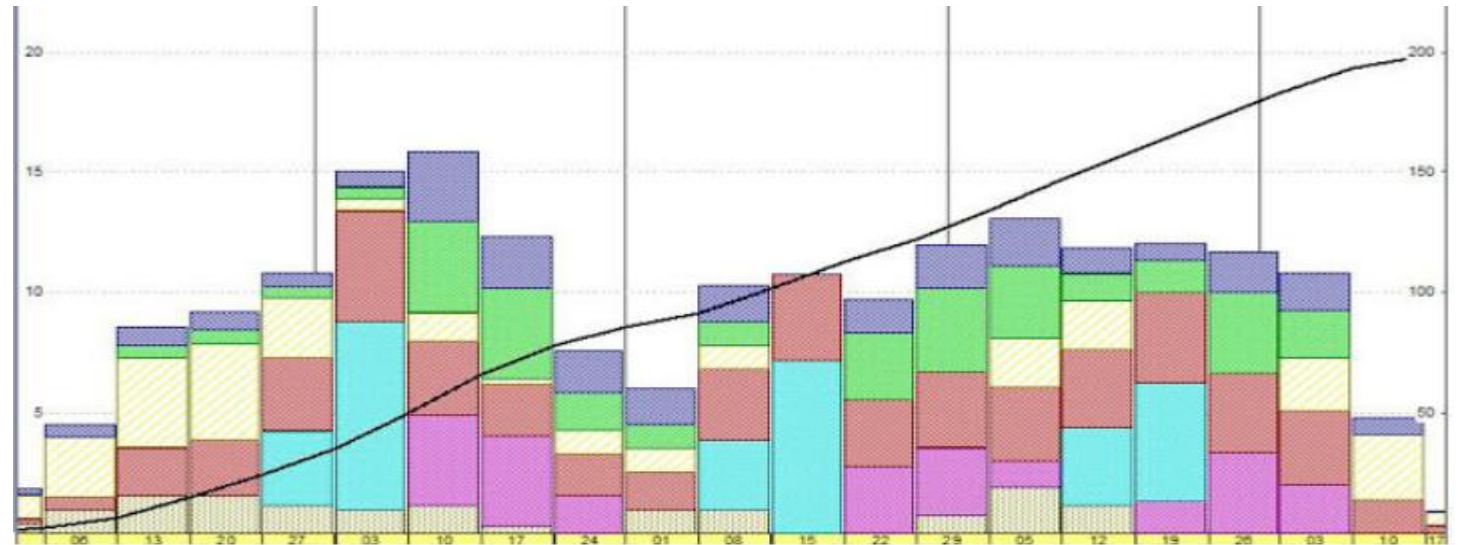
- Shows resource demand over time
- Starts low, peaks, then declines
- Visualized using histograms
- Supports planning decisions

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Resource Loading

Resource loading is the step in [resource planning](#) where you assign tasks to each person in a team throughout a workweek. This process considers everyone's [availability](#) and assigns tasks to each resource according to their available hours.



Resource Loading

There are various ways that project tasks can be assigned within a team. Often each team member will be assigned a percentage of a task or activity until 100% of their work capacity for the week is filled. This way, project managers can divide project tasks efficiently, so that their resources are neither over-utilized or under-utilized.

In other cases, project managers may choose not to fill up 100% of each team member's available hours with critical tasks. Instead, they assign up to 75 - 80% to specific tasks. The remaining hours can be used for responsive activities such as checking and responding to email, bathroom breaks and other tasks. This way, team members can ensure the quality of their output by having manageable workloads.

Resource Loading

Why is resource loading essential in project management?

Project managers struggle to maximize the use of project resources while keeping the workload healthy. That's where tracking your project's resource load can help.

The benefits of resource loading are:

- 1) Accurately calculate (or visualize using a resource loading chart) resource availability to decide if you want to take up more work.
 - 2) Visualize resource workload to spot under or over-allocation. Adjust to maximize utilization without burning out your team.
- 

Resource Loading

Why is resource loading essential in project management?

The benefits of resource loading are:

- 3) Use team resources to their full potential and avoid disengaged workers by preventing under-allocation.
 - 4) Keep stakeholders informed and happy by setting realistic expectations of project success.
 - 5) Consider employee availability to accommodate changes and stick to the project schedule.
 - 6) Stay on top of your team's workload to identify and plan for resource risks beforehand.
-

Resource Loading

Resource loading vs. resource leveling

Resource loading and resource leveling are different resource management techniques applied in different situations. Both resource planning techniques, although different, help a project manager keep the project team's workload healthy and deliver projects on time.



Resource Loading

Resource loading vs. resource leveling

Here's a table that summarizes the key differences between the two techniques.

	Resource loading	Resource leveling
Why?	Optimize assignments based on available resources	Optimize project timeline to prevent over/under allocation
What?	Assign work based on available capacity	Adjust resource allocation based on project priorities
When	During the initial project planning phase	After you allocate resources to the project

Resource Loading

- What is resource scheduling?
- Why do we use it?
- How does it work?



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Modern Examples of Resource Loading in Global Companies

1. Google – Software Development Teams

Google uses detailed **resource loading dashboards** to assign tasks across engineers in Search, Maps, and AI teams.

Each engineer is typically loaded to **70–80% capacity** for coding and core tasks, leaving the remaining time for code reviews, innovation time, and problem-solving.

This prevents burnout and ensures high-quality outputs in fast-paced product cycles.



Modern Examples of Resource Loading in Global Companies

2- Amazon – Fulfillment & Logistics Projects

Amazon's operations managers use resource loading to balance engineers and analysts working on warehouse automation projects.

For example, robotics engineers may be assigned **60% to system updates, 20% to testing, and 20% to urgent operational incidents.**

This structured load prevents delays in massive supply chain networks.



Modern Examples of Resource Loading in Global Companies

3- Tesla – Manufacturing Line Optimization

Tesla uses resource loading when planning upgrades to production lines. Mechanical engineers are allocated tasks based on **shift availability** and **specialization** (e.g., battery, motors, or final assembly).

If a specialist is overloaded, the project manager delays tasks or reallocates work to other factory locations.



Modern Examples of Resource Loading in Global Companies

4- Apple – Product Design & Engineering

Apple uses resource loading across industrial designers, software engineers, and supply chain planners.

Teams are assigned tasks in phases (design, prototyping, testing), and load charts help determine whether additional contractors are needed during peak development periods.



Modern Examples of Resource Loading in Global Companies

5- Meta (Facebook) – AI Research Projects

Meta's AI research teams schedule experiments, model training, and data annotation using resource loading tools.

For instance, data scientists may be assigned **50% to a new model, 30% to maintenance, and 20% to cross-team reviews.**

This allows flexibility while keeping innovation active.

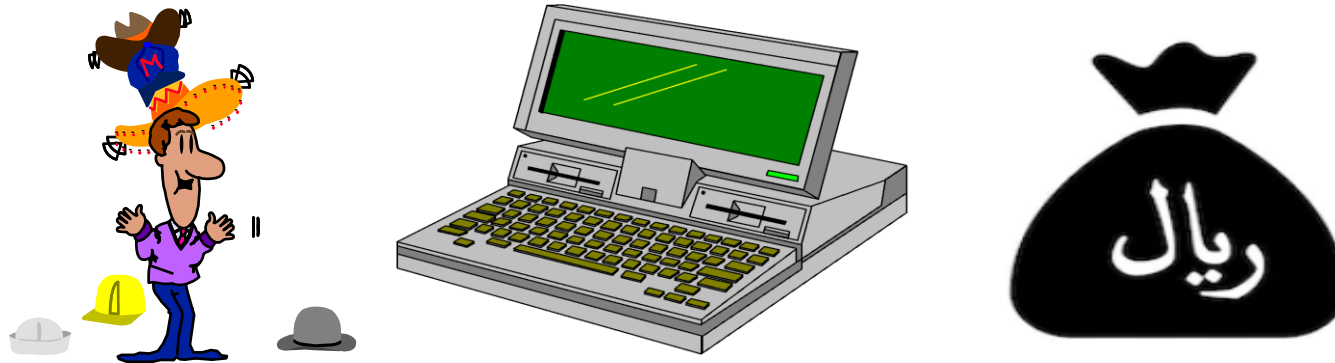


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What is Resource Loading in Projects

- People, equipment, money, space, bulks...



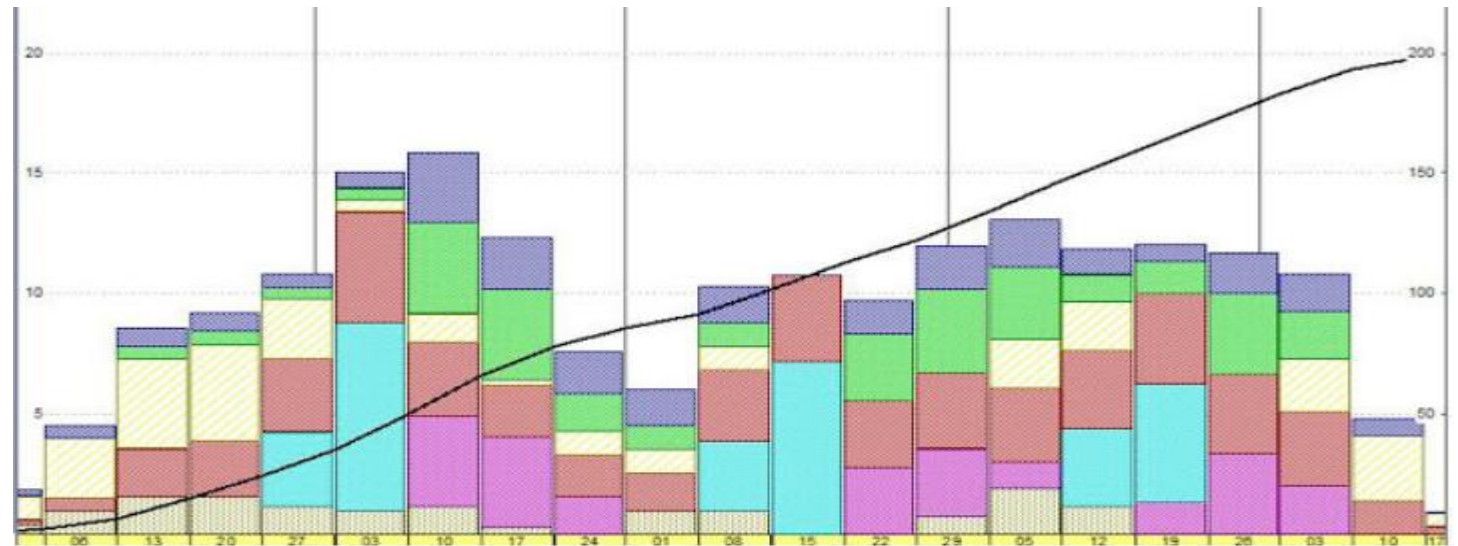
- It defines which resources should be utilized on specific tasks - between which dates.

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Material Management

- Planning and procurement
- Submittals and approvals
- Lead time identification
- Schedule coordination



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Splitting Tasks

- Scheduling technique to improve resource utilization
- Resources are shifted temporarily between tasks
- Avoids delays on critical path activities
- Effective when mobilization costs are low
- Suitable when learning curve is maintained

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Why use Resource Loading?

- Analytically **manage** and use schedule **float**
 - Analyze **staffing requirements**
 - Evaluate **effects of limited staffing**
 - **Avoid wide fluctuations** in daily need for various resources (leveling)
- Produce more realistic schedules
 - Produce progress & resource curves
 - Comply with client requirements

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Resource Loading Benefits

- Helps maximize utilization of resources
- Produces realistic start/finish dates
- Avoids peaks and valleys in staff
- Helps in scheduling constrained resources

Good resource scheduling is the basis for maximizing the productivity of people and equipment while minimizing their cost.

Resource Loading

ACTIVITY
A

TF = 0

ACTIVITY
B

TF = 45

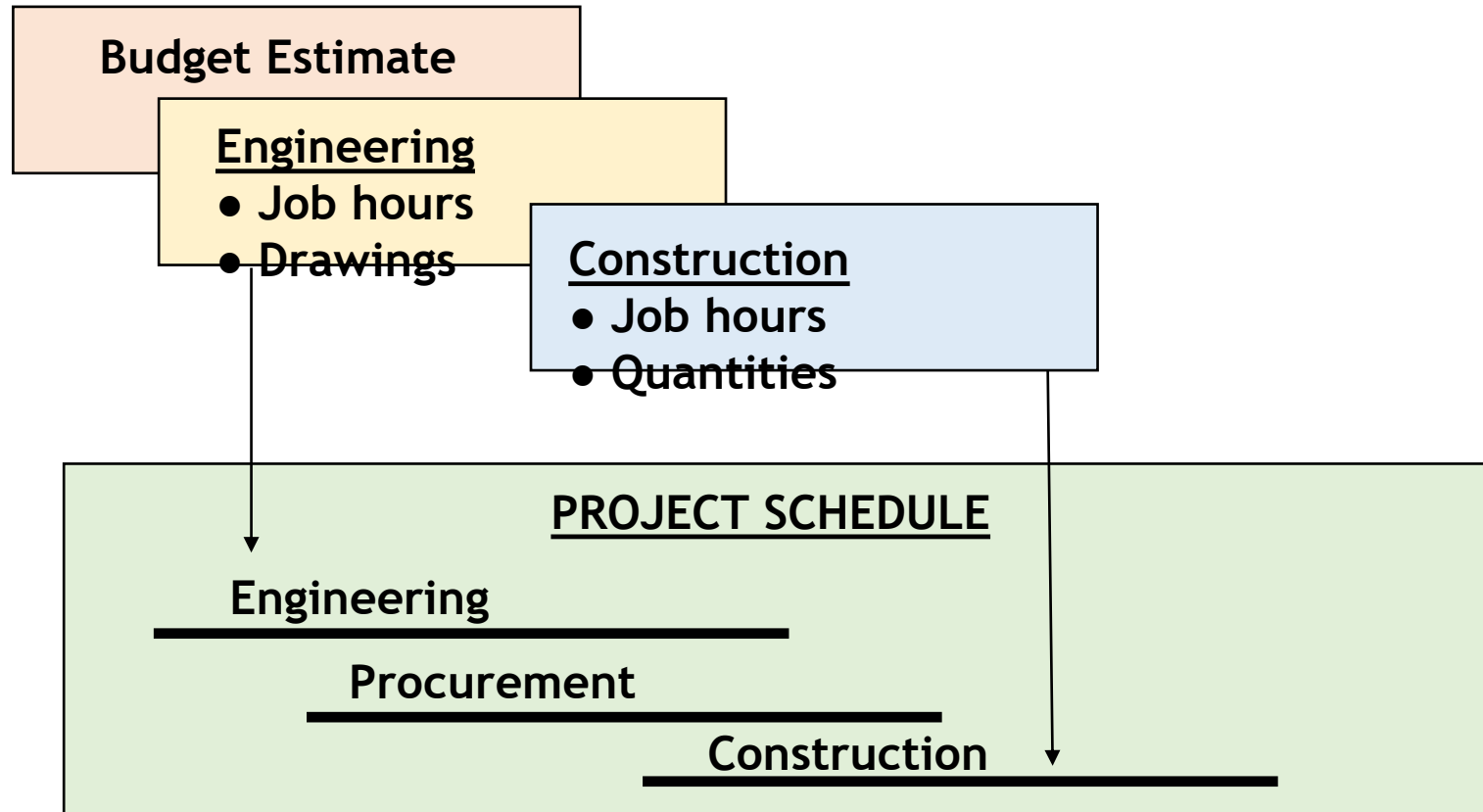


- **Competing** for the **same resource** at the same time.
- Activity with the **least TF** is scheduled **first**

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Resource Loading Process



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Baseline, Current, and Forecast Schedule Discipline

- **Baseline Schedule**
 - Represents the approved project plan
 - Contains project execution activities, logic, and budget resources
 - Provides the means for measuring actual project progress against the plan
- **Revised Baseline Schedule**
 - The Baseline Schedule with updates for Schedule Change Notices (approved scope changes and Project Manager approved changes in the execution plan)

Baseline, Current, and Forecast Schedule Discipline

- **Current/Forecast Schedule**
 - Presents the actual progress of the project
 - Includes projections

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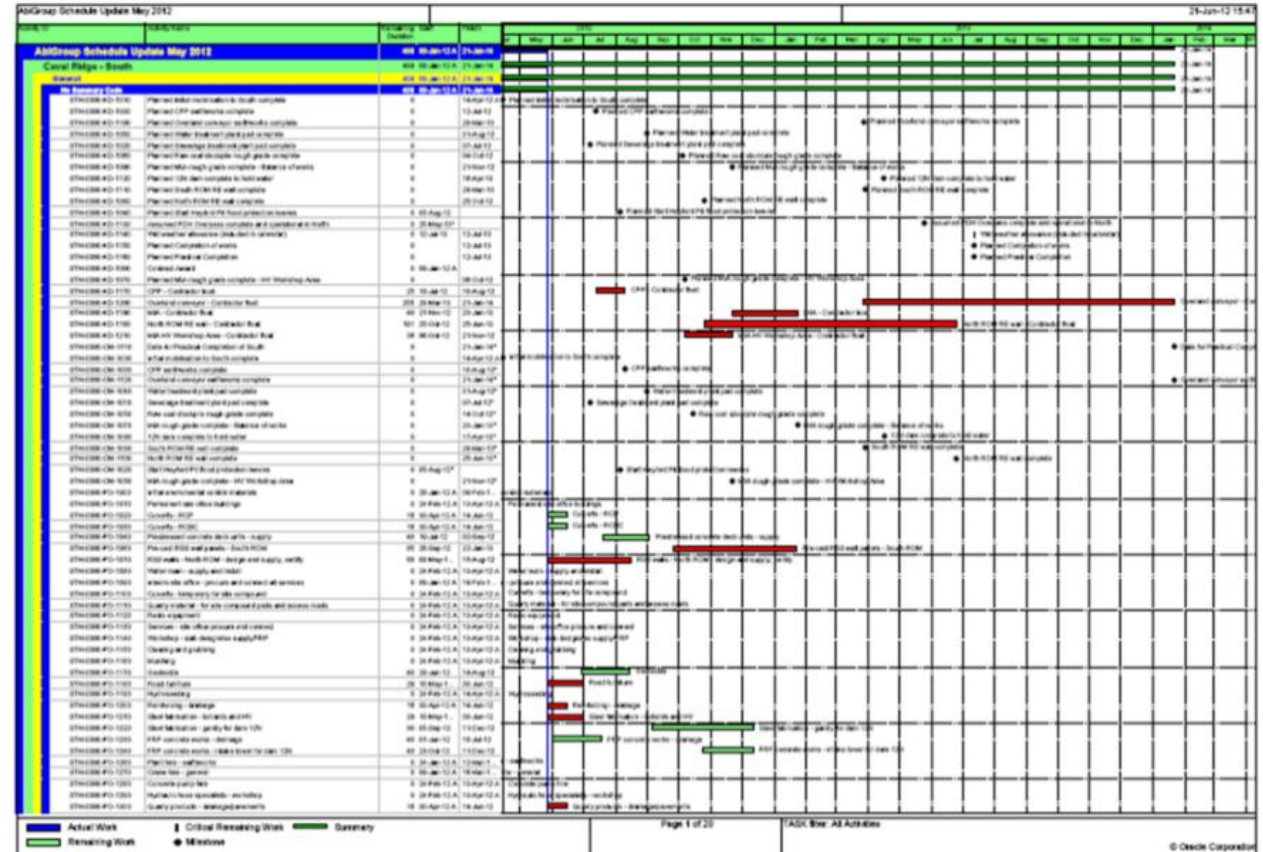
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Schedule Analysis

- Is the **project on schedule**?
 - What activities are ahead or behind schedule?
 - What impact will to-date poor or good productivity have on the to-go portion of schedule?
 - Has the execution plan or work process changed?

Schedule Analysis

- What is the **critical path**?
 - Has it changed from the baseline?
- What are the means to **recover the schedule**?
 - What are the resource requirements?
 - What will it cost?



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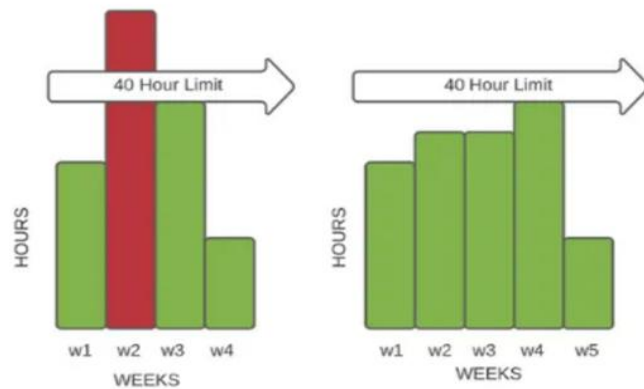
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Resource Leveling versus Resource smoothing

- Resource leveling – This is used when scheduling the production of available resources is limited and needs to be used optimally.
- Resource smoothing – This is used when time constraints are the biggest factor blocking production.

Resource Loading

Resource Leveling



Resource leveling can be used when shared or critically required resources are available only at certain times or in limited quantities, or are over-allocated, or there is a need to keep resource usage at a constant level.

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Estimate Cost Techniques

- **Three-Point Estimates**

- Triangular Distribution.

$$✓ cE = (cO + cM + cP) / 3$$

- Beta Distribution (from a traditional PERT analysis).

$$✓ cE = (cO + 4cM + cP) / 6$$

- Standard Deviation = **(Pessimistic-optimistic) / 6**

Estimate Cost Techniques

- **Earned Value Management (EVM)** is a methodology that combines scope, schedule, and resource measurements to assess project performance and progress.
- EVM can be used for analysis of cost and schedule baselines
- Earned Value Management is carried out using the three main inputs:
 - Planned Value (**PV**)
 - Earned Value (**EV**)
 - Actual Cost (**AC**)

Earned Value Analysis

- The earned value (EV), is a measure widely used in construction,
- Earned Value Management (EVM) is a technique for calculating the 'percent complete' of a control account.

"Earned Value Analysis" is an industry standard way to:

- measure a project's progress,
 - forecast its completion date and final cost,
 - provide schedule and budget variances.
-

EVM Three Main Measurements

By integrating three measurements, it provides consistent, numerical indicators with which you can evaluate and compare projects.

- **Planned Value (PV)** = Hourly Rate × Total Hours Planned
- **Actual Cost (AC)** = Paid Hourly Rate × Actual Hours
- **Earned Value (EV)** = Total value of work done = (Project value) × (% Completed)

EVM can measure **VARIANCE** and **PERFORMANCE INDEX**

Basic EVM Formulas

EVM is based on monitoring three aspects along the project in order to reveal the health of the project with the following indices:

(example of building 10 houses each has a value of US\$10,000 expected to be completed in 10 Months in proportion):

- **Planned Value (PV)** — The **budgeted value** of the work completed so far at a specific date
example: at end of Month 4, altogether 4 houses should be completed, the PV is US\$40,000
- **Earned Value (EV)** — The **achieved value** of the work completed so far at a specific date
example: by end of Month 4, only 3 houses are completed, the EV is US\$30,000
- **Actual Cost (AC)** — The total expenditure for the work so far at a specific date
example: by end of Month 4, \$35,000 was spent, the AC is \$35,000

Schedule and Cost Variance

- **Schedule Variance (SV)** — difference between PV and EV, to tell whether the project work is ahead of / on / behind **schedule**
- **SV = EV – PV**
 - If the project is behind schedule the SV will be negative (i.e. achieved less than what planned)
 - If the project is on schedule the $SV = 0$
 - If the project is ahead of schedule the SV will be positive (i.e. achieved more than what planned)
- **example:** by end of Month 4, the $SV = EV - PV = \text{US\$}30,000 - \text{US\$}40,000 = -\text{US\$}10,000$ (behind schedule)

Schedule and Cost Variance

- **Cost Variance (CV)** — difference between PV and AC, to tell whether the project work is
 - under / on / over **budget**
 -
- **CV = EV – AC**
 - If the project is over budget the CV will be negative (i.e. achieved less than spent)
 - If the project is on budget the CV = 0
 - If the project is under budget the CV will be positive (i.e. achieved more than spent)
- **example:** by end of Month 4, the CV = EV – AC = \$30,000 – \$35,000 = - \$5000 (over budget)

Schedule and Cost Performance Index

- **Schedule Performance Index (SPI)** — ratio between EV and PV, to reflect whether the project work is ahead of / on / behind **schedule in relative terms**

SPI = EV/PV

If the project is behind schedule the SPI < 1 (i.e. achieved less than what planned)

If the project is on schedule the SPI = 1

If the project is ahead of schedule the SPI > 1 (i.e. achieved more than what planned)

example: by end of week 4, the SPI = EV/PV = US\$30,000/US\$40,000 = 0.75 (behind schedule)

Schedule and Cost Performance Index

- **Cost Performance Index (CPI)** — ratio between EV and AC, to reflect whether the project work is under / on / over **budget in relative terms**

CPI = EV/AC

If the project is over budget the $CPI < 1$ (i.e. achieved less than spent)

If the project is on budget the $CPI = 1$

If the project is under budget the $CPI > 1$ (i.e. achieved more than spent)

example: by end of week 4, the $CPI = EV/AC = \$30,000 / \$35,000 = 0.86$ (over budget)

- **Note both SV and SPI / CV and CPI give similar information on schedule / budget but the indices will give more insights into the actual performance with a meaning comparison.**



Thank You