More Complete Example: Resource Allocation & Constraint Management

- **Resource Allocation**: Allocating two resources to Task 2 can help meet project constraints, particularly when there's a fixed delivery date.
- **Problem of Over-allocation**: Task 1 and Task 3 both need the same resource, leading to overallocation.
- **Solutions**:
    - **Resource Leveling**: Adds soft constraints to avoid any resource working above 100% capacity.
    - **Compression Techniques**: Will be covered in detail in subsequent sessions.
- **Considerations**:
    - Resource 1 will be allocated full-time, while Resources 2 and 3 are needed only later in the project.

Goals of the Unit

1. **Techniques for Shortening a Plan**: Learning efficient methods to reduce project timelines.
2. **Risk Management**: Understanding and managing risks involved in reducing timelines.

Project Phases Overview

- **Initiate Plan**: Start with a structured project framework.
- **Execute & Monitor**: Track progress to ensure alignment with goals, costs, and schedules.
- **Close**: Conduct final assessments and approvals.
- **Key Areas**:
    - Change Control & Configuration Management
    - Quality Management
    - Human Resource Management
    - Risk Management

Preliminary Considerations for Feasibility

- **Initial Planning**: Initial versions may reveal challenges in meeting deadlines.
- **Options if Project Seems Unfeasible**:
    1. **Not Start**: If constraints prevent feasibility.
    2. **Shorten Timeline**: Using techniques such as project crashing.
    3. **Avoid Revising Estimations**: Adjusting estimations alone is risky without substantial changes.

Making the Plan Feasible

- **Adjusting Hypotheses**:
    1. **Reduce Scope**: Eliminates or shortens tasks.
    2. **Reduce Quality**: Reduces time requirements for specific activities.
    3. **Outsource**: Transfers tasks but may increase costs and risks.
- **Logical Adjustments**: 4. **Increase Resources**: Increases budget (related to project crashing). 5. **Alternative Approaches**: New methodologies can expedite but may require acclimatization. 6. **Activity Substitution**: Replaces tasks that might streamline the process. 7. **Break Rules**: Removes hard constraints (fast-tracking). 8. **Probability Management**: Uses critical chain management to focus on probable rather than pessimistic estimates.

Project Crashing

- **Definition**: Reduces project duration by decreasing the time of critical activities.
- **Objective**: Achieve reduced duration with minimized cost impact.
- **Cost Analysis**: Extra resources are added for key tasks, often incurring higher costs.

Fast Tracking

- **Definition**: A technique to expedite project completion by overlapping tasks that are normally sequential.
- **Benefits**: Reduces project duration without adding extra resources, as tasks are executed in parallel.
- **Risks**: Can lead to rework and quality issues if tasks that are dependent on each other are forced to overlap.

Fast Tracking vs. Resource Crashing

- **Resource Crashing**: Shortens project duration by adding extra resources to critical tasks, which increases costs.
- **Fast Tracking**: Shortens duration by running tasks concurrently, which can increase the risk of errors but does not necessarily increase costs.
- **Decision Criteria**: Project managers weigh the cost of additional resources in crashing against the risks of rework in fast-tracking.

Critical Chain Management (CCM)

- **Concept**: CCM bases its planning on average estimates for task durations, acknowledging that activities may sometimes take more or less time than anticipated.
- **Buffer Management**: Managers add buffer time to protect the project schedule from delays but aim to use only the necessary amount.

Reasons for CCM Effectiveness:

1. **Probable Estimates**:
    - Focuses on realistic ("most probable") task durations instead of overly cautious or pessimistic estimates.
    - **Contingency Calculation**: The buffer (contingency) is the difference between a 50% likely duration estimate and a 90% likely one.
2. **Activity Chains**:
    - Plans based on chains of activities rather than individual tasks, accounting for statistical dependencies.
    - **Statistical Insight**: The standard deviation of an activity chain is typically smaller than the sum of the individual standard deviations, optimizing overall schedule risk.

Example - CCM Estimation (Item 1):

- **Traditional Estimation**: Managers use "best guess" values but add pessimistic buffers.
- **CCM Estimation**: Uses contingency based on statistical variation, focusing on probable rather than worst-case scenarios.

Example - Sum of Variances (Item 2):

- **CCM Duration**: Adds individual task durations but applies a smaller cumulative buffer.
- **Outcome**: This approach yields a more precise contingency allocation, avoiding inflated buffers.

CCM Basic Principles

- **Explicit Contingency Buffers**: Each chain of tasks has a clear buffer, improving the efficiency of schedule protection.
- **Chain Monitoring**: During execution, managers monitor buffers rather than individual activities. If an activity overruns its time, the chain can overflow into the buffer, but only to a manageable extent.

CCM Execution Benefits

- **Shorter Plans**: Plans using CCM are often shorter than traditional methods due to efficient buffer usage.
- **Contingency Utilization**: By monitoring chains, CCM ensures only essential buffer time is used, keeping the project on track without unnecessary delays.

Project Costs and Structure

- **Cost Element Structure (CES)**: Breaks down project costs into hierarchies like personnel, hardware, and subcontracting to manage and allocate expenses systematically.

- **Work Breakdown Structure (WBS)**: A structured hierarchy of tasks (e.g., A1, A2, etc.) that aligns costs with project activities, aiding in tracking and managing project finances.

Example:

- **Quarterly Expenses and Income**:
    - Tracks income and expenditures, allowing managers to assess financial needs and shortfalls across quarters.
    - **Balance**: Calculates balance to show surplus or deficits, guiding financial adjustments if necessary.

Project Costs Over Time

- **Early vs. Late Start**: Schedules costs and labor based on project start times, illustrating how front-loaded or back-loaded scheduling affects cost flow.
- **Expenditure Profiles**:
    - **Uniform Distribution**: Assumes consistent work hours (e.g., 40 hours per week).
    - **Variations**: May include front-loaded, back-loaded, and linear distributions to reflect real-world variability in resource usage and expense timing.

Expense Authorization

- **Expense Authorization Process**: Manages who can approve and authorize project expenses based on funds availability, budget alignment, and threshold limits.
- **Workflow Example**:
    - **Project Manager** initiates purchases.
    - **Finance and Procurement** departments review and approve based on quotes and budget limits.
    - Higher expenses may need further approval from area heads or finance authorities.

End-of-Period Financial Reporting

- **Financial Status Report**: Produced periodically to track budgeted vs. actual expenditures.
- **Key Information**:
    - **Budgeted vs. Actual**: Compares planned expenses to what has been spent, identifying deviations.
    - **Projection Updates**: Adjusts future projections and evaluates project health based on current financial standing.

Financial Details and Terminology

- **Budget**: Initial planned amount for project costs.
- **Transfers**: Budget modifications.

- **Actual Expenses**: Amount spent so far.
- **Example Breakdown**:
    - **Personnel**: Budgeted €4000, increased by €2000, with €5000 spent, leaving €1000 available.
    - **Hardware**: Reduced budget, with available balance after spending adjusted to zero.