### **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.