Grundlagen des Projektmanagement

Prof. Dr. Peter Müller

22./23. September 2005

Agenda for Today

9:15 – 10:00     Project Success
10:00 – 10:45    Project Lifecycles
10:45 – 11:00 Break
11:00 – 11:45    Scope Management
11:45 – 12:30    Time Management (1)
12:30 – 13:45 Lunch
13:45 – 14:30    Time Management (2)
14:30 – 15:15    Project Organization
15:15 – 15:30 Break
15:30 – 16:15    Project Change Management
16:15 – 16:45    Discussion
A Sad Story

- Standish Group Research Study “CHAOS” 1995
  - Fully successful (on-time, on-budget, with all features as initially specified)
  - Late, over-budget, or offered fewer features than originally specified
  - Cancelled prior to completion

- The average unsuccessful project (yellow and red)
  - Lasts 222% longer than it was planned to last
  - Goes over budget by 189% (4% by more than 400%)
  - Offers 61% of originally specified features (yellow)

Standish Group Research Study “CHAOS” 1995

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- Goes over budget by 189% (4% by more than 400%)
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Introduction

Why IT-Projects Fail

- Top 5 reasons measured by frequency of responses by IT executive management

  - Failure profiles of yellow projects
    1. Lack of User Input: 12,80%
    2. Incomplete Requirements: 12,30%
    3. Changing Requirements: 11,80%
    4. Lack of Executive Support: 7,50%
    5. Technology Incompetence: 7%

  - Failure profiles of red projects
    1. Incomplete Requirements: 13,10%
    2. Lack of User Involvement: 12,40%
    3. Lack of Resources: 10,60%
    4. Unrealistic Expectations: 9,90%
    5. Lack of Executive Support: 9%
How to Avoid Troubled Projects

- Apply proper engineering
  - Characteristics of IT-projects
  - Phases of IT-projects with their purpose, methods, and deliverables

- Apply proper project management
  - Main processes of project management with their inputs, techniques, tools, and outputs
  - Main areas of project management (scope, time, cost, quality, risk, etc.)

- Recognize the importance of non-technical aspects
  - Some basic rules of successful project management

PMI – Project Management Institute

- Non-profit project management professional association
- Develops and maintains a professional certification program to advance the PM profession
- A Guide to the Project Management Body of Knowledge (PMBOK® Guide) is a globally recognized standard for managing projects
- The general PM part of this course is based on PMI standards, terminology, and systematics
- www.pmi.org
1. Project Success

What is a Project?

- Definition:
  A project is a temporary endeavor undertaken to create a unique product or service

- In contrast: Operations are ongoing and repetitive

Every project has a definite beginning and a definite end

The product or service is different in some distinguishing way from all similar products and services
Examples for Projects and Operations

- **Projects**
  - Developing a new software application
  - Implementing a new business procedure
  - Adding functionality to an IT system
  - Doing a Diplomarbeit

- **Operations**
  - Bugfixing of an existing software application
  - Selling train tickets
  - Running a car factory

### From Projects to Operations

- Applications are neither projects nor operations, but products
Characteristics of Projects

- **Temporary** endeavor
- **Unique** product or service
- Performed by **people**
- **Constrained** by limited resources
  - Budget, time, staff
- **Planned, executed, and controlled**
- Have their own **organization**
Typical Core Activities in IT-Projects

- Design of a graphical user interface
- Installation of a local area network
- Integration test of all system components
- Training of users on a new application
- Implementation of a set of Java classes
- Documentation of design decisions and code

Typical Project Management Activities

- Communication with team, clients, management
- Effort estimations
- Planning activities and assigning resources
- Comparing actual performance to plan
- Risk analysis
- Negotiation with subcontractors
- Staff acquisition
PM Knowledge Areas

PM activities fall into nine Knowledge Areas

- Project Integration Management
- Project Scope Management
- Project Time Management
- Project Cost Management
- Project Quality Management
- Project Human Resource Management
- Project Communications Management
- Project Risk Management
- Project Procurement Management

The Triple Constraint

- Project objectives are **equally important**
- Actions in one project area usually affect other areas
1. Project Success

The Triple Constraint

- **Tradeoffs** among objectives must be **managed**
- **Priorities** are set by customers and management

More Competing Objectives

- **Scope**
- **Quality**
- **Risk**
- **Time**
- **Cost**
- **Customer Satisfaction**
Project Success

- Definition:
  A project is successful if the specified results are delivered in the required quality and within the predetermined time and resource limits.

- Computer scientists tend to focus on scope and quality only
  - The development of a technically perfect application is not a success if the cost exceeds the price clients are willing to pay
  - Excellent project results often are worthless if they come too late (temporary market windows, external deadlines)

Project Integration Management

- Ensure that various elements of the project are properly coordinated
  - Estimate cost of staffing alternatives
  - Determine effects of a scope change on schedule

- Make tradeoffs among competing objectives and alternatives

- Primarily task of project manager since he / she is responsible for seeing the overall “big picture”
Integration Management Processes

- Project plan development
  - Integrates various planning outputs (time, cost, risk, etc.)
  - Produces a formal, consistent document to manage project execution
- Project plan execution
  - Produces actual work results
- Integrated change control
  - Determines that a change has occurred
  - Manages the changes as they occur
  - Results in corrective actions and project plan updates

2. Project Lifecycles
Projects are Complex

- At project start, only broad information about characteristics of product are available
- Average size of IT projects is 500-2000 person days
- Different tasks have to be performed such as designing a GUI, testing a module, installing hardware, training users, or negotiating with customers

⇒ How can we handle this complexity?

Decomposition According to Product

Requirements → Subproject → Subproject → Subproject → Unique Product or Service
Subprojects

- Decomposition usually follows structure of product
- Subprojects are easier to manage
- Subprojects enable one to use specialized staff
- Remaining and new problems
  - Only broad information about product characteristics
  - Managing the interfaces between subprojects
  - Integrating the results of the subprojects
  - Increased need for communication
- Subprojects are still complex

Progressive Elaboration

Characteristics of a unique product or service must be progressively elaborated

- During the project, characteristics are defined in more detail as the project team develops a better and more complete understanding of the product
2. Project Lifecycles

Project Phases

- Definition:
  
  A collection of logically related project activities, usually culminating in the completion of a major deliverable
Project Phases

- **Definition:**
  
  A collection of logically related project activities, usually culminating in the completion of a major deliverable

---

Waterfall Model of Project Life Cycle

- Analysis Phase
- Design Phase
- Implementation Phase
- Test Phase
- Deployment Phase

---

Time
Properties of the Project Life Cycle

- Stakeholders’ influence on product characteristics and final cost is highest at project start and decreases progressively
- Cost of changes and error correction increases during the project life cycle

From Projects to Operations

- Project phases are surrounded by related activities that are not part of the project
2. Project Lifecycles

Product Life Cycle

Business Requirements

- Market Demand
- Business Need
- Customer Request
- Technological Advance
- Legal Requirement

Operation

Project

Product

Core and Project Management Processes

- Grouped into phases
- Grouped into process groups
2. Project Lifecycles

Project Management Life Cycle

- Initiating Processes
- Planning Processes
- Controlling Processes
- Executing Processes
- Closing Processes

Example: Time Management

- Schedule Development
  - Schedule Updates
  - Task List for Each Team Member
- Schedule Control
  - Status Reports
- Project Plan Execution
  - Corrective Actions
Process Groups

- Project groups are not discrete one-time events
- They overlap and occur at varying levels of intensity within each phase of the project

Interaction between Phases

- Input and output of the processes depend on the phase in which they are carried out
- But processes are not limited to one phase (overlaps)
3. Scope Management

Why Do We Need a Project Plan?

- Unique product or service
- Guide project execution
- Document project planning assumptions
- Document planning decisions regarding alternatives chosen
- Facilitate communication among stakeholders
- Provide baseline for progress measurement and project control
Aspects of Project Planning

**Project Management**
- Project Integration Management
- Project Cost Management
- Project Communications Management
- Project Scope Management
- Project Quality Management
- Project Risk Management
- Project Time Management
- Project Human Resource Management
- Project Procurement Management

Planning Iterations

- Scope Planning
- Time Planning
- Cost Planning
- ... Planning
- Project Plan Development
Assumptions

- Definition:
  *Assumptions are factors that, for planning purposes, are considered to be true, real, or certain*
- Assumptions affect all aspects of project planning, and are part of the progressive elaboration of the project
- Project teams frequently identify, document, and validate assumptions as part of their planning process
- Assumptions generally involve a degree of risk

Constraints

- Definition:
  *Constraints are factors that limit the project team’s options*
- A single project may contain cost, time, human resource, technical, and other constraints
- Examples
  - External deadlines (e.g., Y2K, Euro)
  - Fixed upper limits for budget
  - Dependencies on other projects, etc.
Project Plan Document

- A formal, approved document
- A project plan is not just a schedule!
- Contains
  - Project management approach
  - Scope, schedule, cost estimates, resources, responsibilities
  - Subsidiary management plans for scope, schedule, cost, quality, etc.
  - Performance measurement baselines for scope, schedule, and cost
  - Open issues and pending decisions

Baseline

- Definition: 
  *The originally approved plan plus or minus approved changes.*

- Baselines are used to compare the actual performance and forecasts of the project with the original plan
Decomposition of Deliverables

Identify the major deliverables of the project, including project management.

Adequate cost and duration estimates possible at this level?

Yes

Validate decomposition:
• Are items necessary and sufficient?
• Is each item clearly and completely defined?
• Can each item be scheduled and budgeted?

No

Identify constituent components of the deliverable.

Decomposition Example 1

Product ABC

Analysis

... Product definition

Functional design

Non-functional req.

Status quo

Approval

Deployment

Software

Hardware

Handbook

Project Management

Project definition

Project plan

Status reports

Project definition
3. Scope Management

Decomposition Example 2

- Product ABC
  - Software
    - Database
    - User interface
    - Business logic
  - Hardware
    - Computers
    - Network
    - Installation
  - Training
    - Materials
    - Training environment
  - Project Management
    - Project definition
    - Project plan
    - Status reports

3. Scope Management

Work Breakdown Structure (WBS)

- Definition:
  A deliverable-oriented, hierarchical grouping of project elements that organizes and defines the total work scope of the project. Each descending level represents an increasingly detailed definition of the project.
3. Scope Management

WBS Relationships

- Make-or-Buy Decisions
- System Solution
- Change Management
- Status Reporting
- Project Organization
- Estimations

4. Time Management (1)
### Purpose of Scheduling

- Track the progress of the project
- Determine how possible changes might affect the project
- Communication
  - Will the activities be completed in time?
  - When are which resources needed?
  - When will major milestones be reached?

### Activities

- Kitchen
  - Remove carpeting
  - Serve food
  - Remove furniture

- Bathroom
  - Clean room
  - Refurnish

- Workroom
  - Paint
  - Paint walls (1)
  - Paint walls (2)
  - Paint ceiling

- Sleeping room
  - Lay parquet

- Rule of thumb: 40 to 80 person hours per activity
Milestones

- Definition: 
  *A significant event in the project, usually completion of a major deliverable*

- Milestones have no effort or duration
- Milestones do not have resources

- Example: Painting completed

Dependencies

- Logical relationships among activities
  - Finish-to-Start (FS)
  - Start-to-Start (SS)
  - Finish-to-Finish (FF)
  - Start-to-Finish (SF)

- Dependencies can be mandatory (hard logic), discretionary (soft logic), or external
4. Time Management (1)

Lag and Lead

- Modify a logical relationship to direct a delay or acceleration of the successor task
- No modifier

- Lag (+3 units)

- Lead (-2 units)

Network Diagrams

- Precedence Diagramming Method
  - Show all activities (depicted by boxes)
  - Show the logical flow (depicted by arrows)
  - Clearly illustrate dependencies

- Rules
  - Each activity has at least one predecessor and successor (start and end as milestones)
  - No loops, no dangling arrows

- Other network diagramming methods
  - Arrow diagramming method (activity-on-arrow)
  - Conditional diagramming methods
Network Example

START

Serve food

Remove furniture

Remove carpet

Clean room

Refurnish

Lay parquet

Paint walls (1)

Paint walls (2)

Paint ceiling

Painting completed

END

4. Time Management (1)

Computing a Schedule

- A schedule consists of the planned dates for all activities and milestones
- Notation

![Diagram showing Activity network with ES, EF, LS, LS, and Duration labels]
Forward Pass

- Determines overall project duration
- First activity starts on time unit 0
- Calculation of the early start and early finish dates
- For Activity A:
  \[ ES(A) = \max_{P \in \text{predecessors}(A)} ES_P(A) \]
  \[ EF(A) = ES(A) + \text{Duration}(A) \]

Calculating Early Start

**FS-relation:**
\[ ES' := EF + L \]

**FF-relation:**
\[ ES' := EF + L - D' \]

**SS-relation:**
\[ ES' := ES + L \]

**SF-relation:**
\[ ES' := ES + L - D' \]
Backward Pass

- Determines latest possible dates for each activity that do not delay the overall project
- Last activity ends at time unit of project duration
- Calculation of the late start and late finish dates
- For Activity A:
  \[ LF(A) = \min_{P \in \text{successors}(A)} LF_P(A) \]
  \[ LS(A) = LF(A) - \text{Duration}(A) \]
- The logic is “inverted”
  - early ↔ late, start ↔ finish, + ↔ -, primed ↔ unprimed
### Calculating Late Finish

#### FS-relation:
\[ LF := LS' - L \]

#### SS-relation:
\[ LF := LS' - L + D \]

#### FF-relation:
\[ LF := LF' - L \]

#### SF-relation:
\[ LF := LF' - L + D \]

### Backward Pass Example

```
<table>
<thead>
<tr>
<th>Activity</th>
<th>ES</th>
<th>EF</th>
<th>Activity'</th>
<th>LS</th>
<th>D</th>
<th>LF</th>
<th>Activity'</th>
<th>LS'</th>
<th>D'</th>
<th>LF'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint ceiling</td>
<td>43</td>
<td>8</td>
<td></td>
<td>51</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Paint walls (1)</td>
<td>3</td>
<td>12</td>
<td></td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove furniture</td>
<td>0</td>
<td>4</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paint walls (2)</td>
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<td>12</td>
<td></td>
<td>51</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean room</td>
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<td></td>
<td>75</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Serve food</td>
<td>0</td>
<td>40</td>
<td></td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lay parquet</td>
<td>51</td>
<td>16</td>
<td></td>
<td>67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Refurbish</td>
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<td>8</td>
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<td>75</td>
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<tr>
<td>Painting completed</td>
<td>51</td>
<td>0</td>
<td></td>
<td>51</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Painting completed</td>
<td>51</td>
<td>0</td>
<td></td>
<td>51</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Refurbish</td>
<td>67</td>
<td>8</td>
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<td>75</td>
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</tr>
</tbody>
</table>
```

```
START -- 0
-0
-0

END -- 75
75 0 --
```

Timeline:
- `Paint ceiling` starts at 43 and ends at 51.
- `Paint walls (1)` starts at 3 and ends at 15.
- `Paint walls (2)` starts at 39 and ends at 51.
- `Clean room` starts at 67 and ends at 75.
- `Serve food` starts at 0 and ends at 40.
- `Remove furniture` starts at 0 and ends at 4.
- `Remove carpet` starts at 4 and ends at 12.
- `Lay parquet` starts at 51 and ends at 67.
- `Refurbish` starts at 67 and ends at 75.
- `Painting completed` starts at 51 and ends at 51.
5. Time Management (2)

Network Diagrams with Dates

[Diagram showing network with dates and activities such as paint walls, lay parquet, serve food, etc.]

Peter Müller – Grundlagen des Projektmanagement, September 22/23, 2005
5. Time Management (2)

Bar (Gantt) Charts

- Serve food
- Rem. Furn.
- Rem. Carpet
- Wall 1
- Ceiling
- Paint
- Wall 2
- Parquet
- Refurnish
- Clean room

- 17.11. 19.11. 21.11. 23.11. 25.11. 27.11.

5. Time Management (2)

Milestone Charts

<table>
<thead>
<tr>
<th>Milestone</th>
<th>17.11.</th>
<th>18.11.</th>
<th>19.11.</th>
<th>20.11.</th>
<th>21.11.</th>
<th>22.11.</th>
<th>23.11.</th>
<th>24.11.</th>
<th>25.11.</th>
<th>26.11.</th>
<th>27.11.</th>
<th>28.11.</th>
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<td>START</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Painting completed</td>
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<tr>
<td>END</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

Current Date

Planned ▲ Actual ▼
Diagramming Methods

- Network diagrams
  - Show dependencies and workflow
  - Purpose: planning

- Gantt charts
  - Show dates and durations
  - Purpose: reporting and progress tracking

- Milestone charts
  - Show major events
  - Purpose: reporting to management and customer

Analyzing a Schedule

- Identify schedule risks
- Determine if deliverables will be made on time
- Check resource usage
- Find potentials for compressing the schedule
- Consistency
Float

- Definition:
The amount of time that an activity may be delayed from its early start without delaying the project finish date

- Float = LF – EF = LS – ES

- Interpretation
  - Float > 0: Time is available
  - Float = 0: Situation is critical
  - Float < 0: Project is behind

- Sometimes called Total Float, Slack, or Total Slack

Float Example

<table>
<thead>
<tr>
<th>Activity</th>
<th>Start</th>
<th>Duration</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serve food</td>
<td>0</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Remove furniture</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Lay parquet</td>
<td>51</td>
<td>12</td>
<td>63</td>
</tr>
<tr>
<td>Painting completed</td>
<td>51</td>
<td>0</td>
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<td>Painting</td>
<td>0</td>
<td>15</td>
<td>15</td>
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<tr>
<td>Remove carpet</td>
<td>4</td>
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</tr>
<tr>
<td>Clean room</td>
<td>67</td>
<td>0</td>
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<tr>
<td>Refurnish</td>
<td>67</td>
<td>12</td>
<td>79</td>
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<tr>
<td>Paint walls (1)</td>
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<td>15</td>
</tr>
<tr>
<td>Paint walls (2)</td>
<td>39</td>
<td>12</td>
<td>51</td>
</tr>
<tr>
<td>Paint ceiling</td>
<td>43</td>
<td>8</td>
<td>51</td>
</tr>
</tbody>
</table>

Float Example Diagram
Critical Path

- **Definition:**
  
  *The series of activities that determines the duration of the project (the longest path through the network)*

- Sum of float on critical path is zero (or negative)
- Critical path is important
  - To shorten project duration
  - To focus progress control
  - To identify schedule risks
- There can be several critical paths in a project

---

Critical Path Example

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5. Time Management (2)
Free Float

- Definition: 
  *The amount of time that an activity can be delayed without delaying the early start of any immediately following activity*

- Free Float = ES' – EF – L

Schedule Compression

- Fast tracking to shorten critical path
  - Do activities in parallel instead of in sequence
  - Problem: increases risk

- Crashing the network
  - Add resources to the critical path (e.g., from non-critical activities)
  - Problem: Law of diminishing returns

- Increasing productivity by different technology

- Extended hours and weekends should not be considered during planning
  - You will need them during project execution anyway
Resource Leveling

- Common results of critical path method
  - More resources required than available
  - Changes of resource levels are not manageable
- Analysis: Resource histograms
- Heuristic: Resource-based method
  - Allocate scarce resources to critical path first
- Resource leveling usually leads to longer project duration

Consistency

- Required roles for task
- Staff skills
- Staff availability
- Network diagram
- Task estimates
Main Planning Processes

5. Time Management (2)

6. Project Organization
6. Project Organization

Functional Organization

- Staff members are grouped by specialty 
  - Production, marketing, accounting, etc.
- Scope of projects is limited to the boundaries of the function

Projectized Organization

- Most resources are involved in project work
- Project managers have great deal of independence and authority
Matrix Organization

- A blend of functional and projectized organizations

Comparison (to Functional Organization)

- Projectized organization
  - Efficient project organization: No "home" when project is completed
  - Loyalty to the project: Lack of professionalism in disciplines
  - More effective communication: Duplication of facilities and job functions

- Matrix organization
  - Highly visible project objectives: More than one boss for project teams
  - Maximum utilization of scarce resources: Tougher problems with resource allocation
  - Better horizontal and vertical dissemination of information: Functional managers may have different priorities than project mngrs
  - Team members maintain "a home": Higher potential for conflict
Stakeholders

- Definition
  Individuals and organizations that are actively involved in the project, or whose interests may be positively or negatively affected as a result of project execution or project completion; they may also exert influence over the project and its results.

- Key stakeholders
  - Project manager
  - Customer
  - Performing organization
  - Project team members
  - Sponsor

Stakeholder Analysis

1. Find all stakeholders
2. Determine essential stakeholders
3. Evaluate how to approach essential stakeholders
4. Plan
6. Project Organization

Determining Essential Stakeholders

<table>
<thead>
<tr>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your power relative to the stakeholder's power</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Your dependence on the stakeholder</td>
<td></td>
</tr>
</tbody>
</table>

- Accommodate them
- Work with them
- Work around them
- Ignore them, with caution

Evaluating Essential Stakeholders

<table>
<thead>
<tr>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship quality</td>
<td></td>
</tr>
<tr>
<td>Agreement with Project goals</td>
<td></td>
</tr>
</tbody>
</table>

- Yes men
- Allies
- Adversaries
- Challengers

- Acknowledge the caution that exists
- Be clear about what you want from them
- State your vision
- Acknowledge their position in a neutral way
- Bring them into your team
- Ask for advice and support
- Be grateful for their challenges
- Follow their suggestions
Example: Project Organisation

- Project Manager
- Test Coordination
- Deployment Coord.
- Cluster 1
  - Subproject
  - Subproject
  - Subproject
  - ...
- Cluster 2
  - Subproject
  - Subproject
  - ...
- Cluster 3
  - Subproject
  - Subproject
  - ...

6. Project Organization

Example: Responsibility Assignment Matrix

- Should be linked to WBS closely

Legend
- R - Approval
- P - Responsible
- I - Participation (mandatory)
- A - Information
Organizational Planning: Summary

- Purpose
  - To identify, document, and assign project roles, responsibilities, and reporting relationships

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Tools &amp; Techniques</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Project interfaces</td>
<td>1. Organizational theory</td>
<td>1. Roles and responsibility assignments</td>
</tr>
<tr>
<td></td>
<td>2. Stakeholder analysis</td>
<td>2. Organizational chart</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Staffing management plan</td>
</tr>
</tbody>
</table>

7. Project Change Management
Baseline

Definition: The originally approved plan plus or minus approved changes.

Baselines are used to compare the actual performance and forecasts of the project with the original plan.

Change

Definition: Any deviation from a previously approved baseline.

Internal origins of changes
- Design, implementation, cost, etc.

External origins of changes
- Scope of work, requirements, schedule, cost

Other origins: Issues, Risks
Why Change Management?

- Prevent scope creep
- Allow the impact of all changes to be understood and managed
  - Impact on triple constraint
- Allow each change to be accepted, rejected, or deferred by the appropriate authority
  - Management
  - Customer
  - Contractual partners

Change Control Process

- Change Request
- Identify impact on activities
- Identify impact on cost and schedule
- Evaluate benefits and costs
- Identify alternatives
- Accept or reject changes
- Implement changes

Decision by Change Control Board
Follow-Up Actions

- If accepted
  - Plan incorporation into the system
  - Create new baselines
  - Modify the schedule and allocate resources
- If rejected
  - Communicate and document the decision
- If deferred
  - Perform further analysis
  - Consider further alternatives
  - Hold until a specified time

Scope Change Control: Summary

- Purpose
  - To influence the factors that create scope changes to ensure changes are agreed upon
  - To determine that a scope change has occurred
  - To manage the actual changes when and if they occur

<table>
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<tr>
<th>Inputs</th>
<th>Tools &amp; Techniques</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Work breakdown structure</td>
<td>1. Scope change control</td>
<td>1. Scope changes</td>
</tr>
<tr>
<td>2. Performance reports</td>
<td>2. Performance measurement</td>
<td>2. Corrective action</td>
</tr>
<tr>
<td>3. Change requests</td>
<td>3. Additional planning</td>
<td>3. Adjusted baseline</td>
</tr>
<tr>
<td>4. Scope management plan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7. Project Change Management

Examples

- Change Request

- Change Process

Conclusion
Feedback

- What did you like about the course?
- What should be improved?
- Did the course meet your expectations?

Appendix
A. Appendix

A.1 Definitions

A.2 References

What is an IT-Project?

- Definition:
  
  An IT-project is a project to create a product or service, of which the usage of information technology is the decisive characteristic

- Examples
  
  - The development of a software application is an IT-project (IT-based product)
  
  - The development of a car is not an IT-project, although information technology is involved substantially
Project Management

- Definition of Project Management (PM):
  
  *Project Management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements.*

Project Success

- Definition:
  *A project is successful if the specified results are delivered in the required quality and within the predetermined time and resource limits.*

- Computer scientists tend to focus on scope and quality only
  - The development of a technically perfect application is not a success if the cost exceeds the price clients are willing to pay
  - Excellent project results often are worthless if they come too late (temporary market windows, external deadlines)
Progressive Elaboration

Characteristics of a unique product or service must be progressively elaborated

- During the project, characteristics are defined in more detail as the project team develops a better and more complete understanding of the product.

Deliverables

- Definition:
  *Any measurable, tangible, verifiable outcome, result, or item that must be produced to complete a project or part of a project*

- Examples
  - An object-oriented design, described by a UML diagram
  - A project schedule as MS Project file
  - A user guide for a new application
  - Software, delivered as compiled binary
Project Phases

- Definition:
  *A collection of logically related project activities, usually culminating in the completion of a major deliverable*

Assumptions

- Definition:
  *Assumptions are factors that, for planning purposes, are considered to be true, real, or certain*

- Assumptions affect all aspects of project planning, and are part of the progressive elaboration of the project

- Project teams frequently identify, document, and validate assumptions as part of their planning process

- Assumptions generally involve a degree of risk
Constraints

- **Definition:**
  
  *Constraints are factors that limit the project team’s options*

- A single project may contain cost, time, human resource, technical, and other constraints

- **Examples**
  - External deadlines (e.g., Y2K, Euro)
  - Fixed upper limits for budget
  - Dependencies on other projects, etc.

Baseline

- **Definition:**
  
  *The originally approved plan plus or minus approved changes.*

- Baselines are used to compare the actual performance and forecasts of the project with the original plan
Work Breakdown Structure (WBS)

- Definition:
  A deliverable-oriented, hierarchical grouping of project elements that organizes and defines the total work scope of the project. Each descending level represents an increasingly detailed definition of the project.

Milestones

- Definition:
  A significant event in the project, usually completion of a major deliverable

- Milestones have no effort or duration
- Milestones do not have resources

- Example: Painting completed
Float

- Definition:
  *The amount of time that an activity may be delayed from its early start without delaying the project finish date*

  \[ \text{Float} = \text{LF} - \text{EF} = \text{LS} - \text{ES} \]

- Interpretation
  - Float > 0: Time is available
  - Float = 0: Situation is critical
  - Float < 0: Project is behind

- Sometimes called *Total Float*, *Slack*, or *Total Slack*

Critical Path

- Definition:
  *The series of activities that determines the duration of the project (the longest path through the network)*

  Sum of float on critical path is zero (or negative)

- Critical path is important
  - To shorten project duration
  - To focus progress control
  - To identify schedule risks

- There can be several critical paths in a project
Free Float

- Definition:
  *The amount of time that an activity can be delayed without delaying the early start of any immediately following activity*

- Free Float = ES’ – EF – L

A. Appendix

A.1 Definitions

A.2 References
A. Appendix

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A. Appendix

Contact Information

- Peter Müller
  - Email: peter.mueller@inf.ethz.ch

- Hermann Lehner
  - Email: hermann.lehner@inf.ethz.ch

- Web
  - Group page: sct.inf.ethz.ch
  - Course page
    http://sct.inf.ethz.ch/teaching/ss2005/ipm_cc/