Hochschule Hof

# Project Management

Prof. Dr. Matthias Meitner

# Contact


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# Module Project Management

- Form of examination: Study project
- Study project:
  - Project plan
  - Agile project
  - Final presentation
- Students work in teams (with 4-5 persons)
- Active participation is expected!

# Contents

Hochschule Hof

# Traditional Project Management

Prof. Dr. Matthias Meitner

# Literature


- Gary L. Richardson: Project Management Theory and Practice, CRC Press
- Tony Marks: 20:20 Project Management: How to Deliver on Time, on Budget and on Spec, Kogan Page
- Russ J. Martinelli, Dragan Z. Milosevic: Project Management ToolBox: Tools and Techniques for the Practicing Project Manager, Wiley
- Project Management Institute: A Guide to the Project Management Body of Knowledge (PMBOK Guide)

# Traditional Project Management

- Project Management Foundations
- Project Launch Phase
- Project Planning
- Project Controlling
- Project Conclusion

# Exercise
# What is a project?

Name the characteristics of a project!

# What is a project?

Characteristics of a project according to DIN 69901

- Uniqueness
- Complexity
- Interdisciplinarity of the task
- Defined goals
- Time, financial, personnel and other limitations
- Differentiation from other tasks
- Project-specific organization

# Day-to-day business vs. projects

| | Day-to-day business | Project |
|---|---|---|
| Uniqueness | Low | High |
| Change | Low | High |
| Resources | Permanently | Temporary |
| Duration | Unlimited | Limited |

# Exercise
# Project criteria

You work for a medium-sized mechanical engineering company with approx. 800 employees. Check to what extent the following activities or plans are projects.

Give reasons for your decision.

1. The currently existing isolated applications for planning and controlling business processes are to be replaced by a uniform ERP software.
2. The HR manager would like to promote a sense of community through regular sports activities for employees.
3. The feasibility study for a new machine has been completed. It is now to be constructed as a prototype and then made ready for series production.

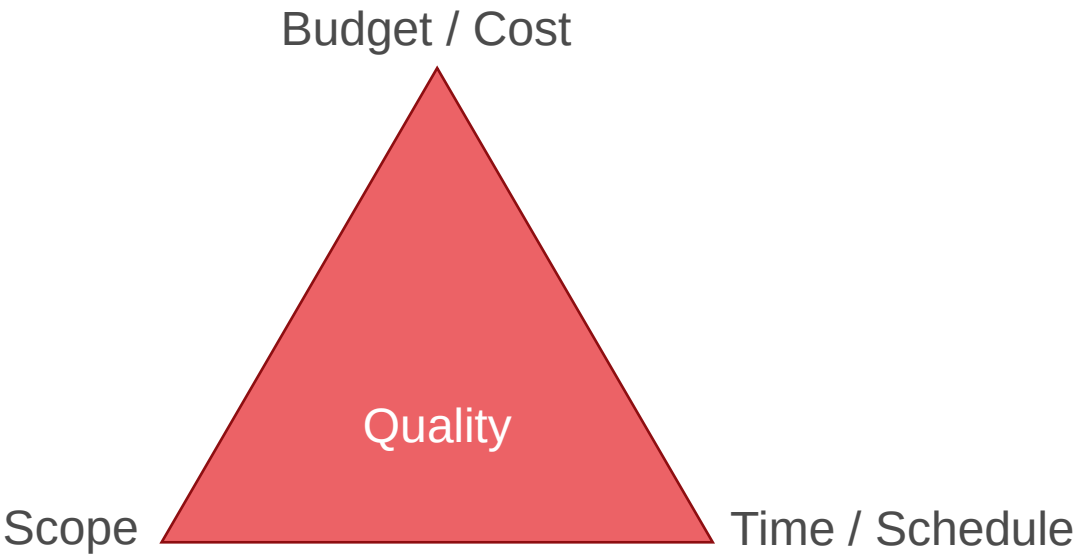
# Exercise
# Project criteria

You work for a medium-sized mechanical engineering company with approx. 800 employees. Check to what extent the following activities or plans are projects.

Give reasons for your decision.

4. Since the new machine cannot be manufactured on the existing assembly lines, an additional assembly line will have to be built until the machine is ready for series production in two years.
5. An external design office is commissioned to design a new company logo.
6. The annual report for the shareholders comprises approx. 80-100 pages and must be published every year in April.
7. The company's quality department is to convert production to Total Quality Management.

# Project management triangle



# Exercise
# Project management triangle

The following objectives were taken from a specification sheet. Assign each goal to one of the three goal dimensions of the project management triangle.

1. The manufacturing costs for the new product to be developed must be 20% lower than the previous version.
2. In case of non-acceptance, a maximum of three weeks is available for troubleshooting.
3. The first milestone "concept created" must be reached six weeks after the start of the project.
4. The language of the user interface of the device must be switchable between English, German and Spanish.
5. The product must meet the requirements of the Machinery Directive and the EMC Directive.

# Exercise
# Criteria for project success

When would you consider a project to be successful?

# Criteria for project success

- Achievement of all project goals
  - Project triangle
    - Scope
    - Time
    - Budget
  - Social goals such as employee and customer satisfaction
- Satisfaction of all relevant stakeholders

# Project types

- Investment projects
- Organizational projects
- Research and development projects
  - Uncertain relationship of input and output
  - High degree of novelty
  - Difficult to plan from the beginning

- Other classification criteria: client, business value, complexity, project organization

# Exercise
# Project types

There are investment, organizational and research & development projects.

Give an example for each of the categories!

Give an example where at least two of the categories are combined!

# IT projects
# Specific characteristics

- IT projects are all about information technology.
- IT projects are usually very complex.
- IT projects are subject to rapid technical change.
- IT is understood in very different ways.
- IT projects are always interdisciplinary.
- Goals of IT projects change frequently and quickly.
- Models, methods and techniques for developing IT systems are IT-specific.

# What is project management?

- Entirety of management tasks, management organization, management means, management techniques for the successful completion of a project
- Leadership with regard to the achievement of project objectives
- Project manager supervises the control cycle
  - Planning
  - Execution
  - Monitoring
  - Control

# Project management phases according to DIN 69901-2

- Initiation
- Definition
- Planning
- Execution/Controlling
- Closing

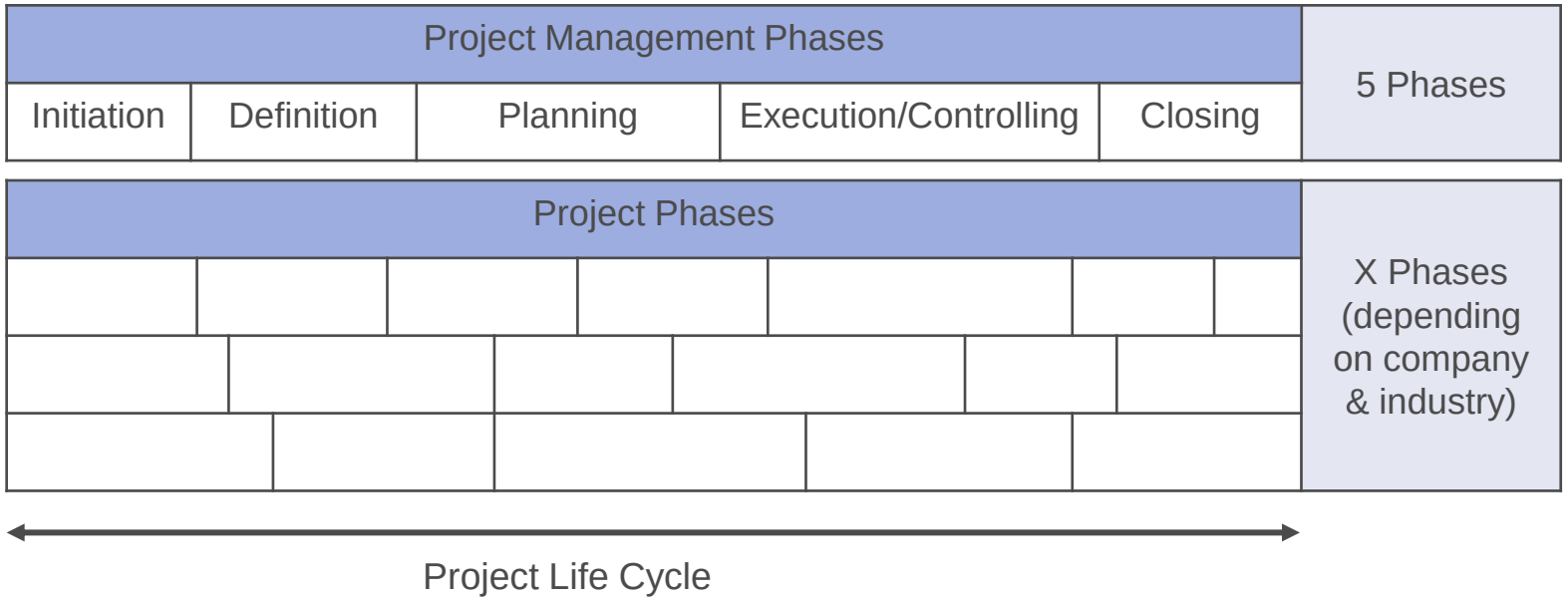
# Project management phases according to DIN 69901-2

- Initiation (e.g. clarify responsibilities, outline goals, give approval)
- Definition (e.g. define goals, analyze project environment/stakeholders, define milestones, estimate efforts, form core project team)
- Planning (e.g. create PSP, create schedule, create cost and budget plan, plan risk analysis & countermeasures)
- Execution/Controlling (e.g. controlling deadlines, controlling changes, controlling risks, controlling goal achievement, acceptance testing)
- Closing (e.g. prepare project close-out report, conduct close-out meeting, archive documents, dissolve project organization)

# Project phase models

- Project phase
  - Temporal section of a project with delimitation in relation to other sections
- Milestones
  - Events of particular importance with a deadline
  - At least at the end of a project phase
  - Decision whether to start the next phase

# Relation between Project Management Phases and Project Phases



# Process models

- Process models are standardized phase models
- Might be a prescribed standard in some industries or prescribed by the client
- Examples
  - Waterfall model
  - V-Model
  - RUP

# Exercise
# Project phases

Mr. Miller is given the task of organizing a department party for 15 people within the next 4 weeks.

1. What kind of project is it?
2. Name the phases.
3. Set meaningful milestones.

# Exercise
# Project phases

Two students (Anna and Lilly) want to do a cultural tour in the whole of Greece. They would like to see all the important cultural assets and sights. Their photo documentation is to be used for the subsequent student research project. The trip is planned for the semester break from 15.07.2025 to 30.09.2025.

The journey goes first with the ferry from Italy to Greece. They will rent a motor home from Germany, kindly sponsored by the father of one of the girls. Both definitely have to be back in Germany at the beginning of the semester. They would like to plan the trip as a project.

1. Divide the project into a maximum of five phases.
2. Assign milestones to the phases and name them.

# Traditional Project Management

- Project Management Foundations
- Project Launch Phase
- Project Planning
- Project Controlling
- Project Conclusion

# Tasks in the project launch phase

- Creation of a project charter
- Determination of the project goals and their contents
- Formation of the core project team
- Regulation of the cooperation
- Identification of the stakeholders
- Clarification of the boundary conditions (e.g. personnel, financial means)
- Setting up the project organization
- Conducting a project start workshop

# Contents of the project charter

- Project name & ID
- Client (project sponsor)
- Business case
- Project goals (also non-goals, if applicable)
- Schedule (incl. milestones)
- Budget
- Project manager & team (incl. responsibilities)
- Signatures of approvals

# Project charter template

| PROJECT CHARTER | | | |
|---|---|---|---|
| **Project name** | | **ID** | |
| **Client** | | | |
| **Project manager and his main responsibilities** | | | |
| **Business case** | | | |
| **Main goal** | | | |
| **Assumptions** | | | |
| **Project context** | | | |
| **Important stakeholders** | | | |
| **Suppliers / other team members and their responsibilities** | | | |
| **Chances & risks** | | | |
| **Costs** | Human Resources<br>Internal:<br>External: | Material | |
| **Time frame** | Start: | Finish: | |
| | Duration: | | |
| **Important milestones / phases** | | | |
| **Signatures** | | | |

# Project goals

- A goal is a desirable state lying in the future, generally different from the present state.
- A goal is thus a defined and aspired state within a sequence of events.
- Functions of project goals

# Project goals

- A goal is a desirable state lying in the future, generally different from the present state.
- A goal is thus a defined and aspired state within a sequence of events.
- Functions of project goals
  - Control (what do we still have to accomplish?)
  - Orientation (where is the journey going?)
  - Connection / motivation (for the team spirit)
  - Coordination (who does what?)
  - Selection (helps with decision making)

# Defining project goals

- S (Specific) – Simple and understandable, not general, but concrete
- M (Measurable) – Fulfillment must be verifiable
- A (Attainable) – Goal must be achievable
- R (Relevant) – Goal must be attractive
- T (Time-bound) – Fulfilment must be achieved within a certain time frame

# Types of project goals

- Overall Goal
  - Result goals
    - Cost goal
    - Functional goal
    - Social goal
  - Process goals
    - Deadlines
    - Project organization
- Non-goals (out of scope), if applicable

# Exercise
# Project goals

Determine the goals for the project

Move offices of department ABC to another building
by 31.12.2025 with a budget of 45,000€

# Exercise
# Project goals

Examine the quality of the following goal statements and make suggestions for improvement if necessary:

1. In the future, our meetings should be held in such a way that we get to the point more quickly.
2. The quality defects in our products that have accumulated in recent months must be remedied as quickly as possible.
3. In the current fiscal year, we will increase our sales figures in the southern sales region by 15% compared with the previous year.

# Exercise
# Project goals

Two students (Anna and Lilly) want to do a cultural tour in the whole of Greece. They would like to see all the important cultural assets and sights. Their photo documentation is to be used for the subsequent student research project. The trip is planned for the semester break from 15.07.2025 to 30.09.2025. They have set aside 5,000€ themselves. Anna's grandmother has added another 2,000€.

The journey goes first with the ferry from Italy to Greece. They will rent a motor home from Germany, kindly sponsored by the father of one of the girls. Both definitely have to be back in Germany at the beginning of the semester. They would like to plan the trip as a project.

What goals can you identify in this project?

# Exercise
# Project goals

You are an assistant to the technical director of a company. In a meeting dealing with the constant costs of purchasing and installing new software versions, the director gives the department heads present the order to switch to free open source programs in a timely manner. The head of the IT department points out that this is not so simple, but that a thorough analysis is necessary first. As a result, it is decided to analyze, prepare and implement the switch to open source software in a project.

You are given the task of defining the goals for this project.

What might such goals look like?

# Relationships between project goals

- Goal antinomy
  - Two goals are completely mutually exclusive
- Goal competition
  - The fulfillment of one goal interferes with the fulfillment of another goal
- Goal neutrality
  - Two goals are completely independent of each other
- Goal complementarity
  - The fulfillment of one goal simultaneously promotes the achievement of another goal
- Goal identity
  - Two goals are completely congruent

# User specification vs. functional specification

- User specification
  - All requirements of the client as well as statements about what services are to be developed and for what
  - Contents
    - Objective, goals, results to be achieved, budget, deadlines
- Functional specification
  - All realization specifications planned by the contractor (based on the requirements)
  - Contents
    - Problem description, requirements analysis, solution alternatives, acceptance conditions, phase goals, partial deliveries

# Exercise
# User specification vs. functional specification

A medium-sized company would like to manage its customer data via a web-based application in the future. For this purpose, it has placed an order with a software house to develop such an application. There, the order is carried out in the form of a project. The following statements are taken from various documents that were created in the course of setting up the project. Assess which statements come from the user specification and which from the functional specification and which statements should not be included in either of these documents.

1. The first software version will be delivered to the customer at milestone M4 for acceptance testing.
2. The application should be usable by all sales representatives at all times.
3. The project team consists of a database specialist, a web interface programmer, and two PHP programmers.
4. Customer data can be exported to the accounting database.
5. An interface in XML format will be implemented to export the customer data.

# Exercise
# User specification vs. functional specification

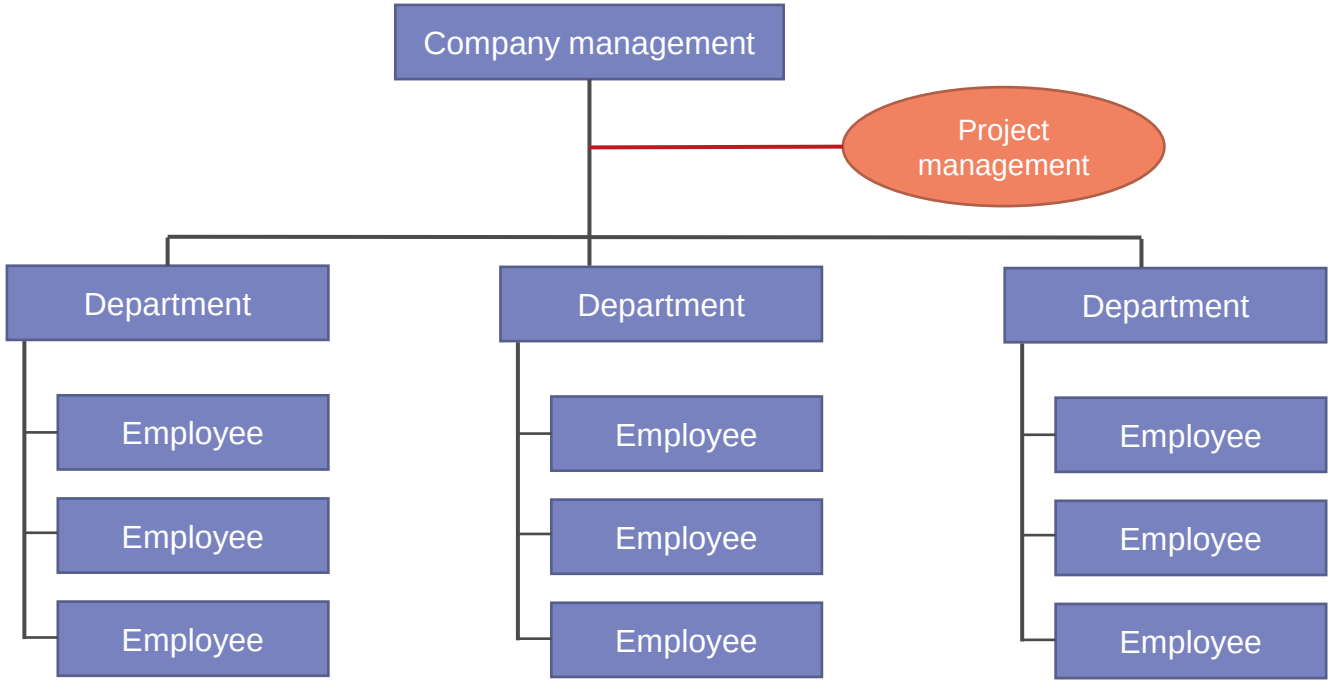
A medium-sized company would like to manage its customer data via a web-based application in the future. For this purpose, it has placed an order with a software house to develop such an application. There, the order is carried out in the form of a project. The following statements are taken from various documents that were created in the course of setting up the project. Assess which statements come from the user specification and which from the functional specification and which statements should not be included in either of these documents.

6. The project is approved with a total budget of 180,000€ and a maximum duration of eight months. A budget of 50,000€ is released for project phase I.
7. The final version of the software, including documentation, must be delivered no later than ten months after contract award.
8. The estimated personnel effort is 9.5 person-months with a standard deviation of the estimate of 0.5 person-months.
9. An input mask is required to create new customers, with fields pre-populated with default values if possible.

# Project organization

- The project organization forms the hierarchical framework for the project.
- In general, three organizational forms are distinguished
  - Staff unit organization
  - Matrix project organization
  - Pure / Autonomous project organization
- In addition, the following parameters are defined for the individual roles within the project organization
  - Tasks
  - Competencies
  - Responsibilities
  - Reporting channels

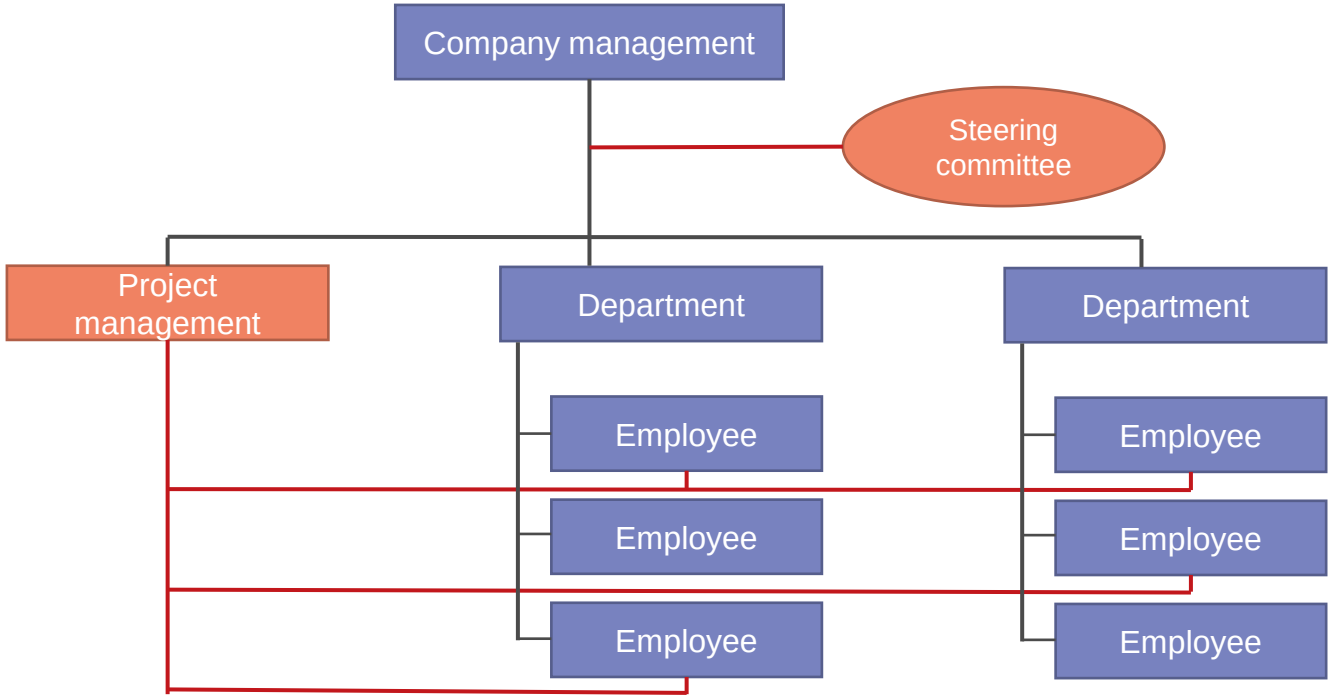
# Staff unit organization



# Staff unit organization

- Description
  - Project manager and employees remain in their department positions
  - Project manager has no authority to make decisions or issue directives
  - Project manager keeps track of project progress in terms of technical aspects, deadlines and costs
- Advantages
  - Little organizational intervention
  - Head of department remains disciplinary superior
  - Knowledge transfer after project guaranteed
- Disadvantages
  - No authority for the project management
  - Therefore, only slow reaction to problems possible

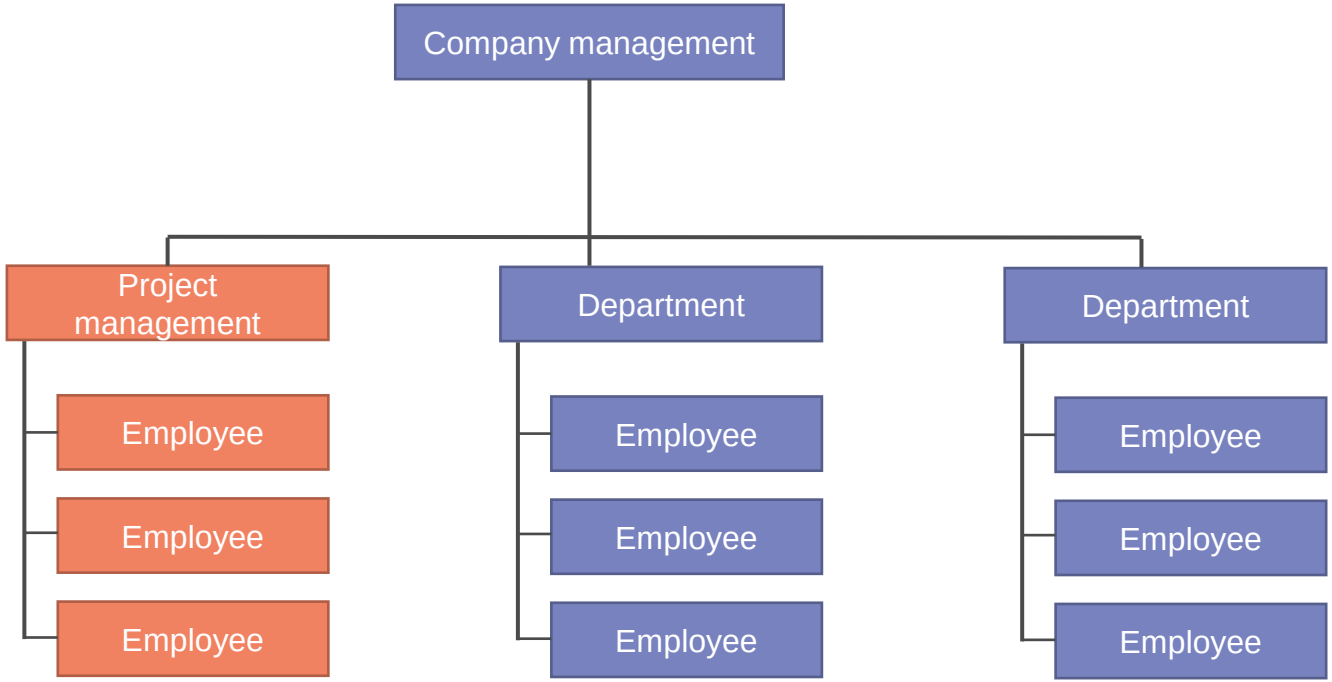
# Matrix project organization



# Matrix project organization

- Description
  - Division of responsibilities between project manager and department manager
  - Employees work for the project and for the department
  - The most common form of project organization
- Advantages
  - Hardly any changeover costs
  - Easier to adapt to changing personnel requirements
  - Project management responsible for project goals
- Disadvantages
  - Communication-intensive
  - Conflicts of competence between project management and department management

# Pure / Autonomous project organization



# Pure / Autonomous project organization

- Description
  - All employees under the direction of the project manager
  - Project manager has all formal competencies
  - Employees work exclusively for the project
- Advantages
  - No conflicts of resources
  - No conflicts between project and department
  - Project manager disciplinary superior
- Disadvantages
  - Possible underutilization of personnel
  - Difficult integration of staff into departments after project end

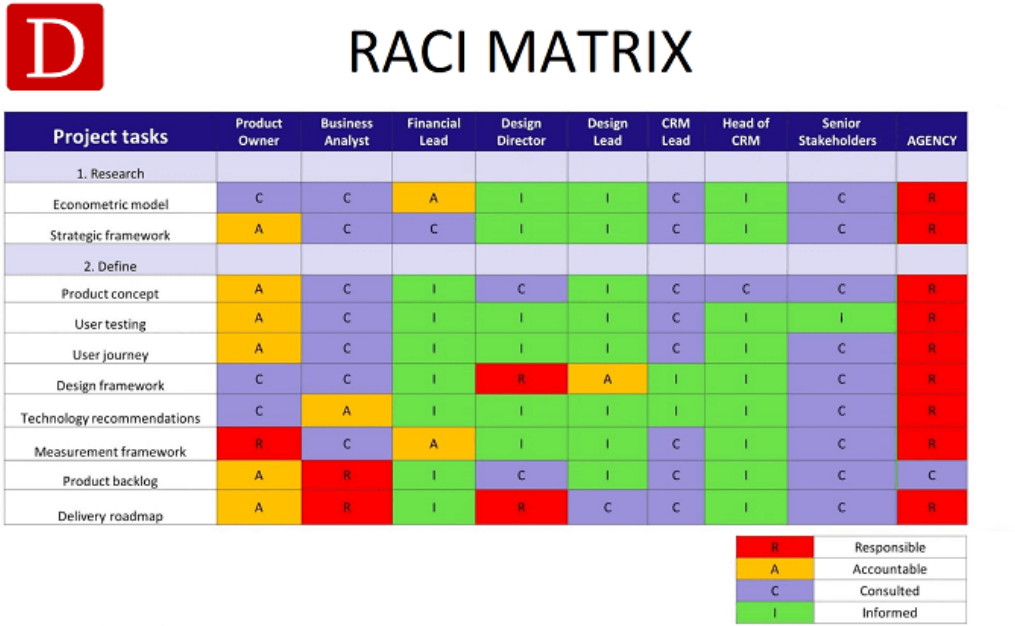
# Criteria for the selection of the project organization form

| | Staff unit | Matrix | Pure |
|---|---|---|---|
| Importance for company | Low | Medium | High |
| Project duration | Short | Medium | Long |
| Risk | Small | Medium | High |
| Technology | Standard | Standard | Novel |
| Complexity | Low | Medium | High |

# Roles and responsibilities in the project

- Responsibility assignment matrix (RAM)
  also: RACI Matrix
  - Responsible
  - Accountable
  - Consulted
  - Informed
- Alternative
  - Tasks
  - Accountabilities

# Responsibility assignment matrix - Example



RACI MATRIX

| Project tasks | Product Owner | Business Analyst | Financial Lead | Design Director | Design Lead | CRM Lead | Head of CRM | Senior Stakeholders | AGENCY |
|---|---|---|---|---|---|---|---|---|---|
| 1. Research | | | | | | | | | |
| Econometric model | C | C | A | I | I | C | I | C | R |
| Strategic framework | A | C | C | I | I | C | I | C | R |
| 2. Define | | | | | | | | | |
| Product concept | A | C | I | C | I | C | C | C | R |
| User testing | A | C | I | I | I | C | I | I | R |
| User journey | A | C | I | I | I | C | I | C | R |
| Design framework | C | C | I | R | A | I | I | C | R |
| Technology recommendations | C | A | I | I | I | I | I | C | R |
| Measurement framework | R | C | A | I | I | C | I | C | R |
| Product backlog | A | R | I | C | I | C | I | C | C |
| Delivery roadmap | A | R | I | R | C | C | I | C | R |

| | |
|---|---|
| R | Responsible |
| A | Accountable |
| C | Consulted |
| I | Informed |

from: https://www.dragon1.com/terms/raci-matrix-definition

# Traditional Project Management

- Project Management Foundations
- Project Launch Phase
- Project Planning – Context & Stakeholders
- Project Controlling
- Project Conclusion

# Project planning
# Tasks

- Project Context Analysis
- Stakeholder Analysis
- Risk Analysis
- Project Structure Plan (also: Work Breakdown Structure) Creation
- Scheduling
- Resource & Cost Planning

# Project environment (or project context)

- The success or failure of a project does not depend solely on the technical implementation. Rather, various influencing factors can generate both positive and negative impulses. Therefore, it is essential to consider the environment at the beginning of the project as well as regularly during the course of the project.

- Project environment – environment in which the project is created and carried out and which influences the project and/or is affected by it

- Stakeholders – persons or groups of persons who are involved in the project, interested in the project process or affected by the project

# Project environment
# Classification criteria

- Factual: environmental, cultural, technological, economic or political factors (input for risk analysis)
- Social: people (input for stakeholder analysis)

- Internal: within the executing organization
- External: outside the executing organization

# STEEP & PESTEL analysis

- (S) ocial
- (T) echnological
- (E) conomical
- (E) nvironmental
- (P) olitical

(P) olitical
(E) conomical
(S) ocial
(T) echnological
(E) nvironmental
(L) egal

# Project environment
# Examples

| | Internal | External |
|---|---|---|
| Factual | Company agreement | Laws |
| | PM Handbook | Norms and standards |
| | Guidelines | Market development |
| | Sales development | |
| Social | Works council | Client |
| | Representative (e.g. QM, safety) | Employees of the client |
| | Board of directors | Supplier |
| | Employees (outside project team) | Customers |
| | Project manager and project team | Competitors |

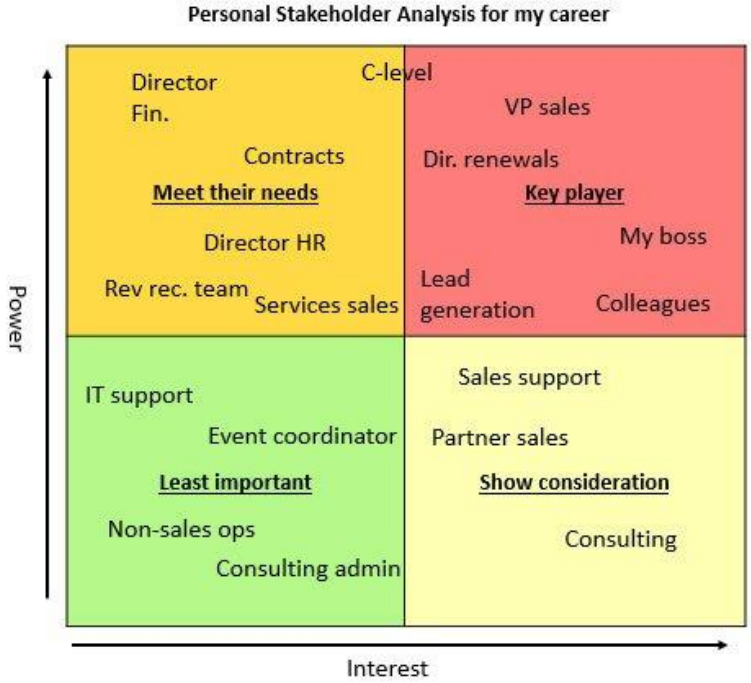
# Exercise
# Project environment

Perform a project environment analysis for the project
“Build a climbing wall in kindergarten”!

# Steps of stakeholder management

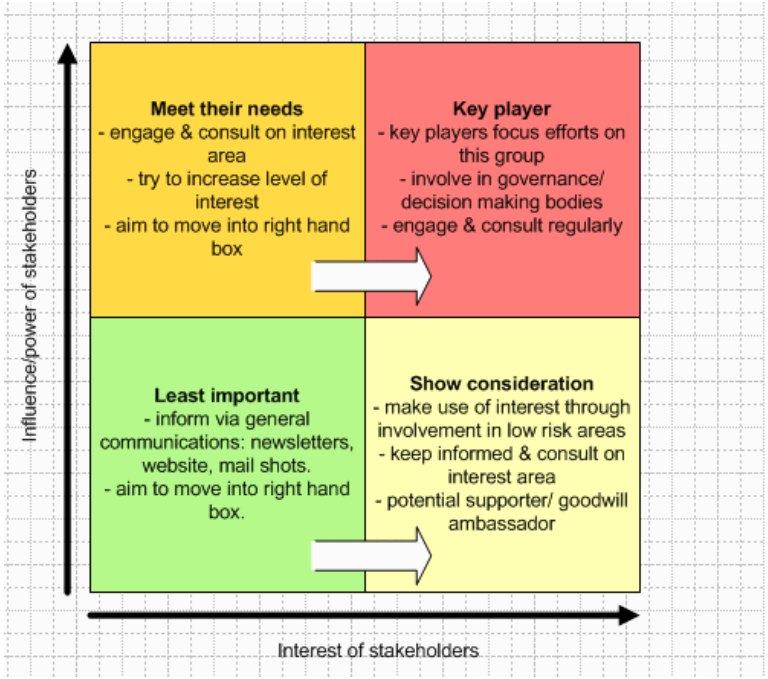
- Identification
- Analysis
- Evaluation
- Planning measures
- Monitoring

# Stakeholder analysis




from: https://www.stakeholdermap.com/stakeholder-analysis/stakeholder-analysis-for-career.html

# Stakeholder management strategies




from: https://www.stakeholdermap.com/images/stakeholder-analysis-strategy.gif

# Stakeholder-measure-matrix Example

| Nr. | Stakeholder | Interest | Influence | Measures |
|---|---|---|---|---|
| 1 | Max Miller | High | High | Regular status reports<br>Involvement in decision making<br>Early information in case of problems |
| 2 | … | … | … | … |

# Exercise
# Stakeholder analysis

Your application to a company in Newport was successful. In a few weeks you will start to work there. You want to move together with your family, quit your rented apartment in Oldtown and look for an apartment or better a house to rent in Newport.

1. Which stakeholders can you identify for this project?
2. Who is actively involved, who is only affected?
3. Which stakeholders have a positive, negative or neutral attitude towards this project?

# Project marketing

- Purpose

- Possible measures

# Project marketing

- Purpose
  - Secure top management attention and funding
  - Gain recognition from the customer and possibly a follow-on project
  - Increase project awareness
- Possible measures
  - Media work (e.g. local newspaper)
  - Information events
  - Presentations of (partial) results
  - Internet presence
  - Personal conversation

# Traditional Project Management

- Project Management Foundations
- Project Launch Phase
- Project Planning – Risk Management
- Project Controlling
- Project Conclusion

# Project risks

- Project risk: uncertain event with negative impact on project progress
- Risk types

# Project risks

- Project risk: uncertain event with negative impact on project progress
- Risk types
  - Schedule risks
  - Technical risks
  - Resource risks
  - Financial risks
  - Political risks
  - Social risks

# Exercise
# Risk management

In the case of a company that has so far sold its products exclusively in Germany, consideration is being given to marketing the products abroad in the future. In preparation for a decision, a list of possible risks was drawn up.

1. Establishment of a distribution channel for the product abroad
2. Currency fluctuations
3. Cultural discrepancies
4. Translation of the documentation and possibly the user interface of the product
5. Increased effort, e.g. for the translation of the documentation

Check which factors are actually risks and where the factors represent tasks or problems.

What is the difference between the two?

# Exercise
# Risk management

In the case of a company that has so far sold its products exclusively in Germany, consideration is being given to marketing the products abroad in the future. In preparation for a decision, a list of possible risks was drawn up.

6. Incorrect assessment of the market situation
7. Recording of the market situation (demand, competitors)
8. Incorrect assessment of the legal framework conditions
9. Recording of the legal framework conditions (e.g. taxes, licensing conditions)

Check which factors are actually risks and where the factors represent tasks or problems.

What is the difference between the two?

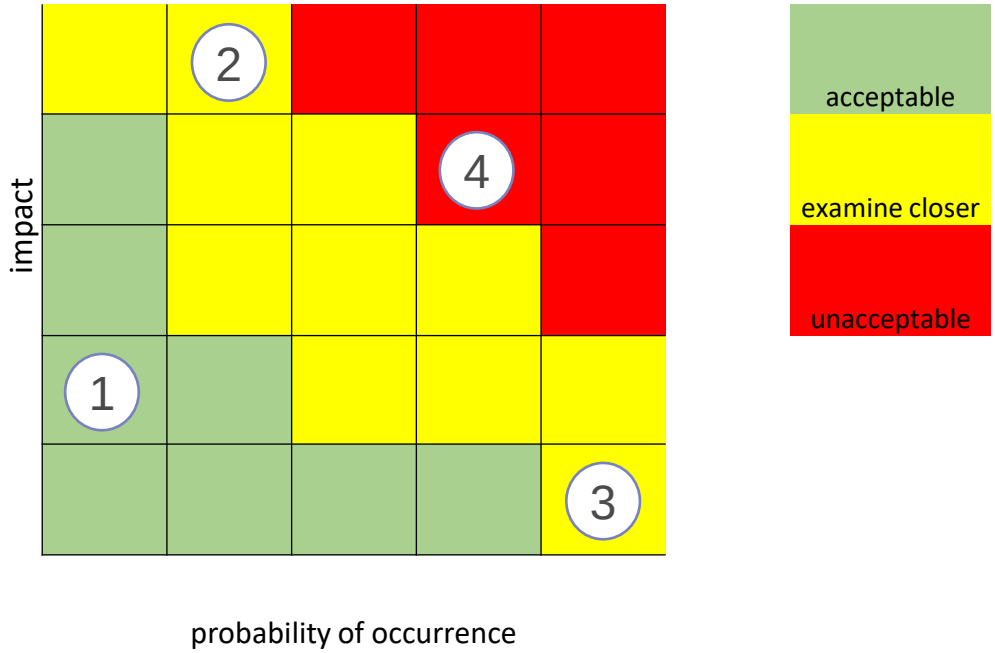
# Steps of risk management

- Identification
  - Project environment analysis
  - Best practices / lessons learned
  - Risk workshop
- Analysis
  - Risk portfolio with risk values
- Evaluation
  - Classification into categories
- Planning of counter measures
  - Definition of a plan for each identified risk
- Monitoring

# Risk management
# Analysis & evaluation

- Risk description (incl. impact)
- Risk causes
- Determination of risk value (= probability of occurrence * impact)
- Risk classification

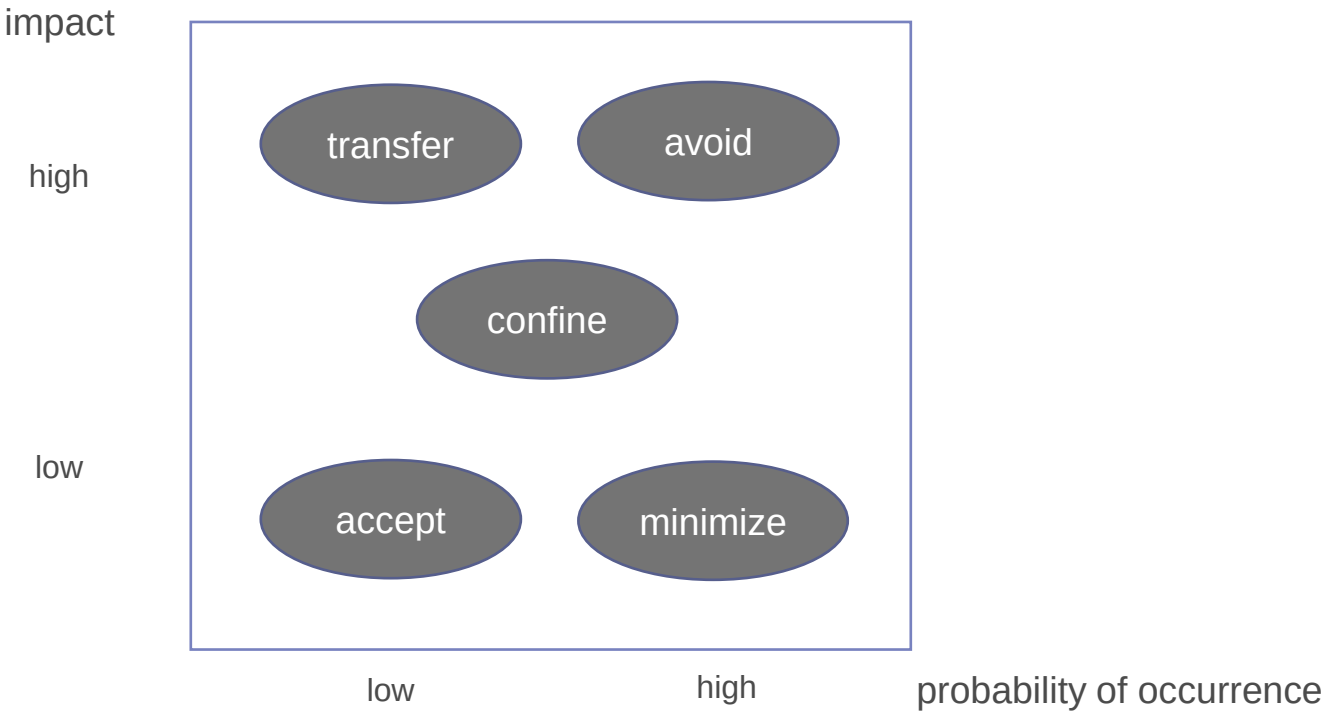
# Risk portfolio



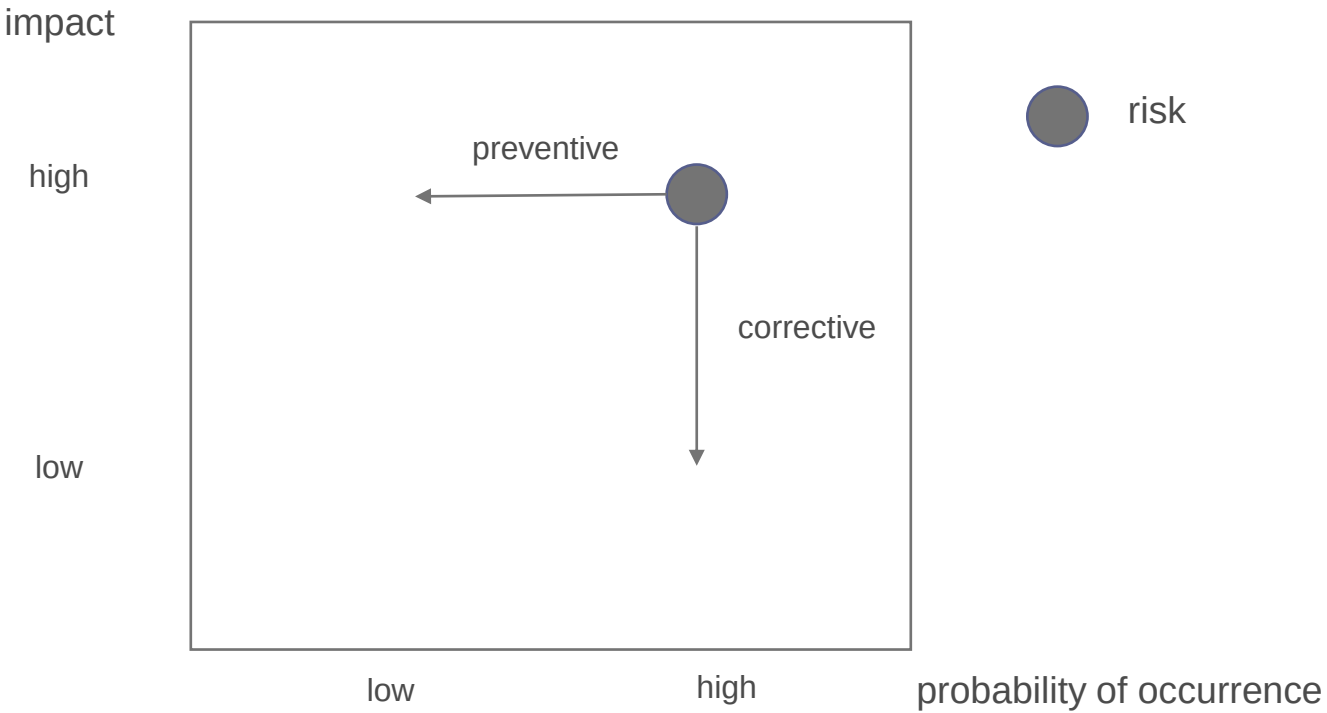
# Planning of counter measures

- Strategies for dealing with risks
  - Avoid (exclude)
  - Transfer (insure or pass on)
  - Minimize / confine
    - preventive measures (reduce probability of occurrence)
    - corrective measures (reduce impact)
  - Accept

# Counter measures



# Preventive vs. corrective counter measures

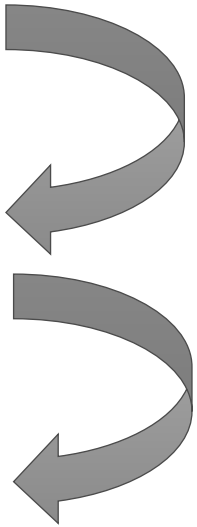


# Risk management plan

| | Risk Evaluation before Risk Management Plan | | | |
|---|---|---|---|---|
| Nr. | Description of Risk | Probability in % | Threat 1 in Euro | Risk Value 1 in Euro |
| 1 | | 20 | 16000 | 3200 |
| 2 | | | | |

| | Risk Management Plan | | | |
|---|---|---|---|---|
| Nr. | Strategy | Action | Costs | Responsible |
| 1a | preventive | | 2000 | |
| 1b | corrective | | 500 | |

| | Risk Evaluation after Risk Management Plan | | | |
|---|---|---|---|---|
| Nr. | Final Risk | Probability in % | Threat 2 in Euro | Risk Value 2 in Euro |
| 1a | | 10 | 16000 | 1600 |
| 1b | | 20 | 10000 | 2000 |



# Exercise
# Risk management

Consider the following risk with measure planning and evaluation. Would you implement the measure or not? Give reasons for your decision!

- Risk: Rework due to undetected defects in test phase
- Cause: new technology and complex design
- Probability of occurrence: 25%
- Potential damage: 20,000€
- Measure: Pre-design of a prototype
- Cost of the measure: 5,000€
- Probability of occurrence after measure: 5%
- Potential damage: 20,000€

# Exercise
# Risk management

A thesis is an important part of most degree programs. It extends over several months. A risk assessment is now to be carried out for a final thesis.

1. Name at least three important goals for a thesis.
2. Now find at least three events (risks) that can cause the non-achievement of these goals.
3. What measures can be taken to reduce the risks?

# Traditional Project Management

- Project Management Foundations
- Project Launch Phase
- Project Planning – Project Structure Plan
- Project Controlling
- Project Conclusion

# Project structure plan (PSP)
# also called work breakdown structure (WBS)

- The project structure plan (PSP) breaks down the project into more controllable parts.
- It presents the complete project content (including the project management process) in a tree structure and thus forms a central instrument for external communication.
- The PSP forms the basis for effort estimation as well as further planning such as scheduling and resource planning.

# Structure

- Project (project that is essentially characterized by the uniqueness of the conditions in their entirety)
  - Subproject (part of a project, which is structurally connected with the whole project)
    - Subtask (part of a project that is usually broken down further in the PSP)
      - Work package (describes a self-contained work set with a clearly defined result. The work package is not to be broken down further).

# Project structure plan
# Overview

- Elements
  - Graphical / semi-graphical / textual inventory of activities (= work packages) and collective elements (= subtasks) required to complete the project
- Purpose
  - Central instrument of order, control and communication in the project
- Tasks
  - Creation of a uniform understanding of tasks, facilitation of effort and cost estimation, basis for the distribution of tasks, basis for internal order control, risk analysis, sequence and schedule planning and resource planning

# Work packages

- Work package
  - Self-contained task within a project
  - Smallest element of a PSP
- Defines
  - the work required
  - the responsibilities
  - the expected output

# Work package description
# Contents

- Date, project, work package number
- Results, activities, prerequisites, person in charge
- Deadlines (e.g. start date and end date)
- Effort (workload)
- Involved employees
- Progress measurement, risks, interfaces

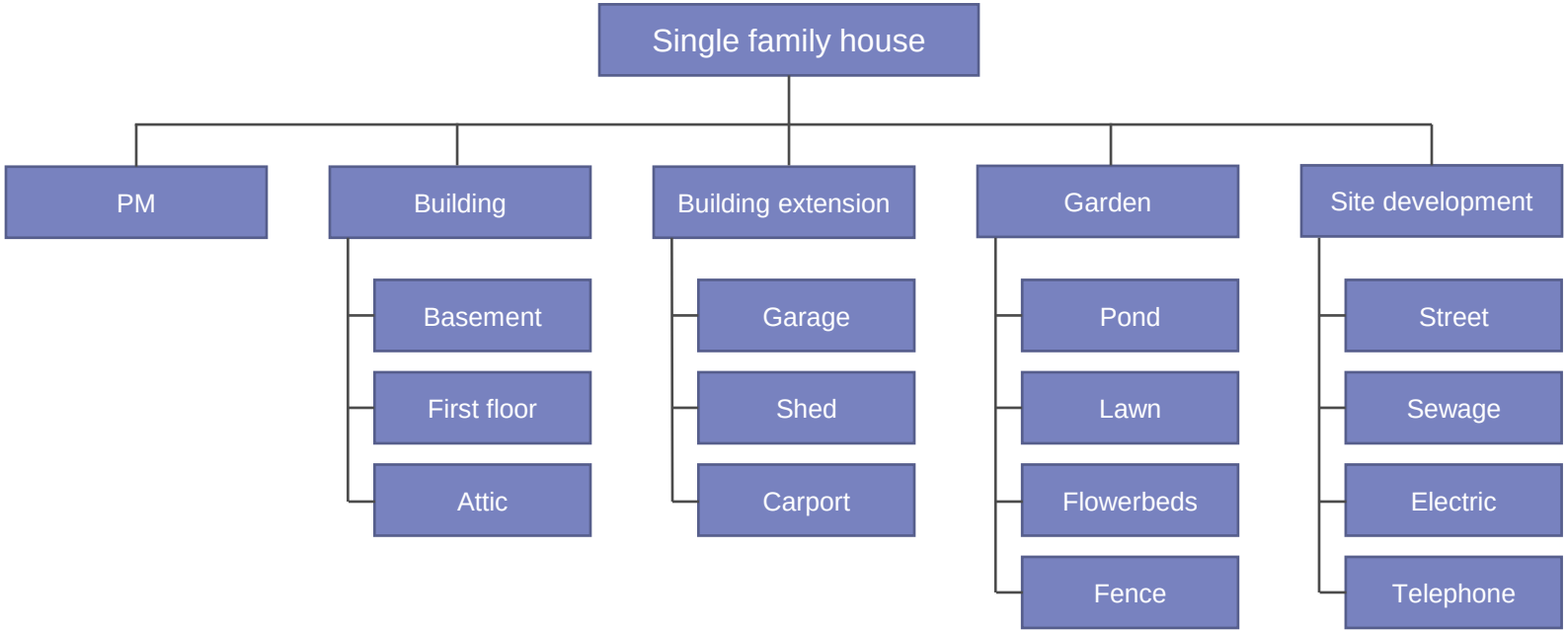
# Work package description

| Work Package Description Form | | | |
|---|---|---|---|
| Date: | Version: | WP-Nr.: | Project: |
| Project Phase | | | |
| WP Owner | | | |
| Result(s) | | | |
| Activities | | | |
| Pre-Requirements | | | |
| Interfaces | | | |
| Risks | | | |
| Estimated costs | | | |
| Work load | | | |
| Progress measurement | | | |
| Start | | | |
| Finish | | | |
| Project Team Members | | | |

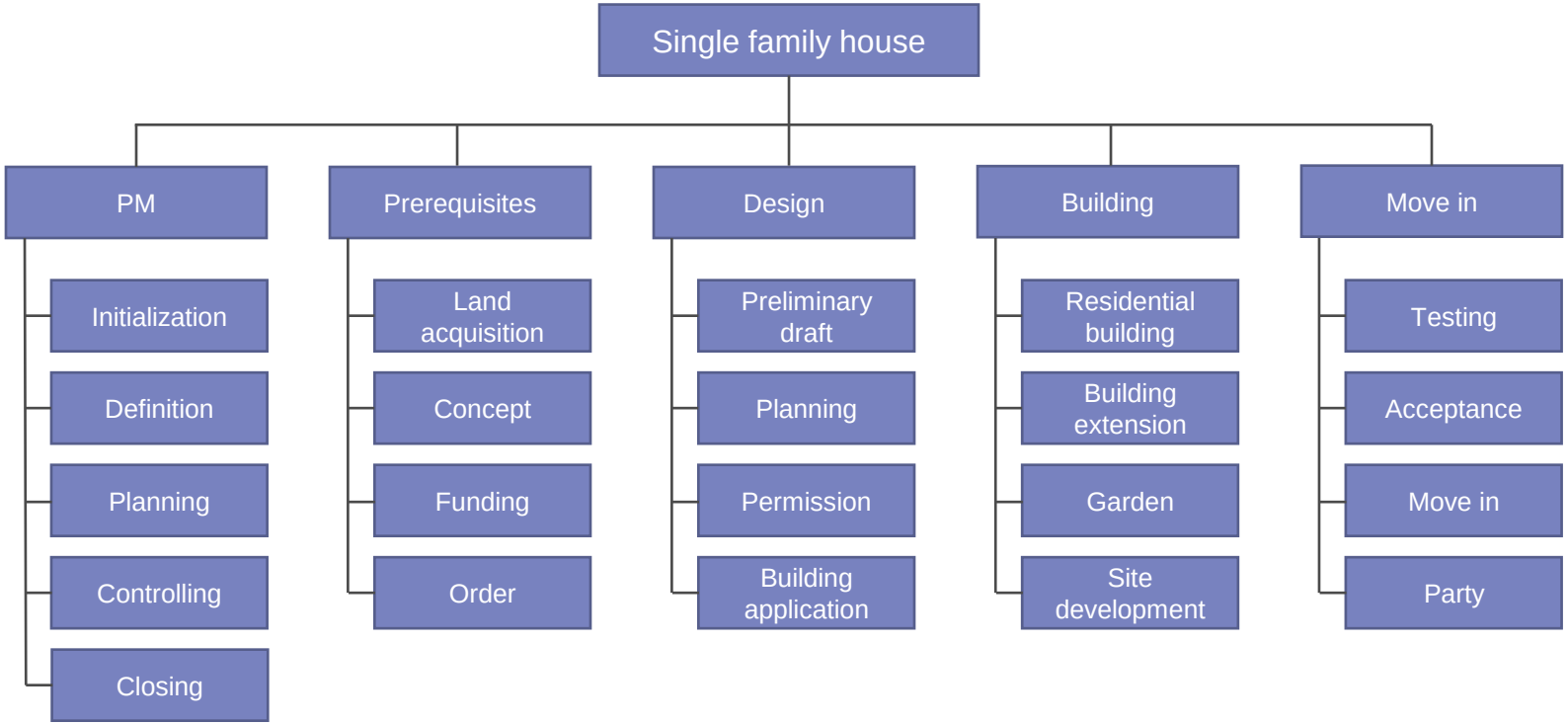
# Ordering principles for the PSP

- By product
- By phases
- Mixed-oriented

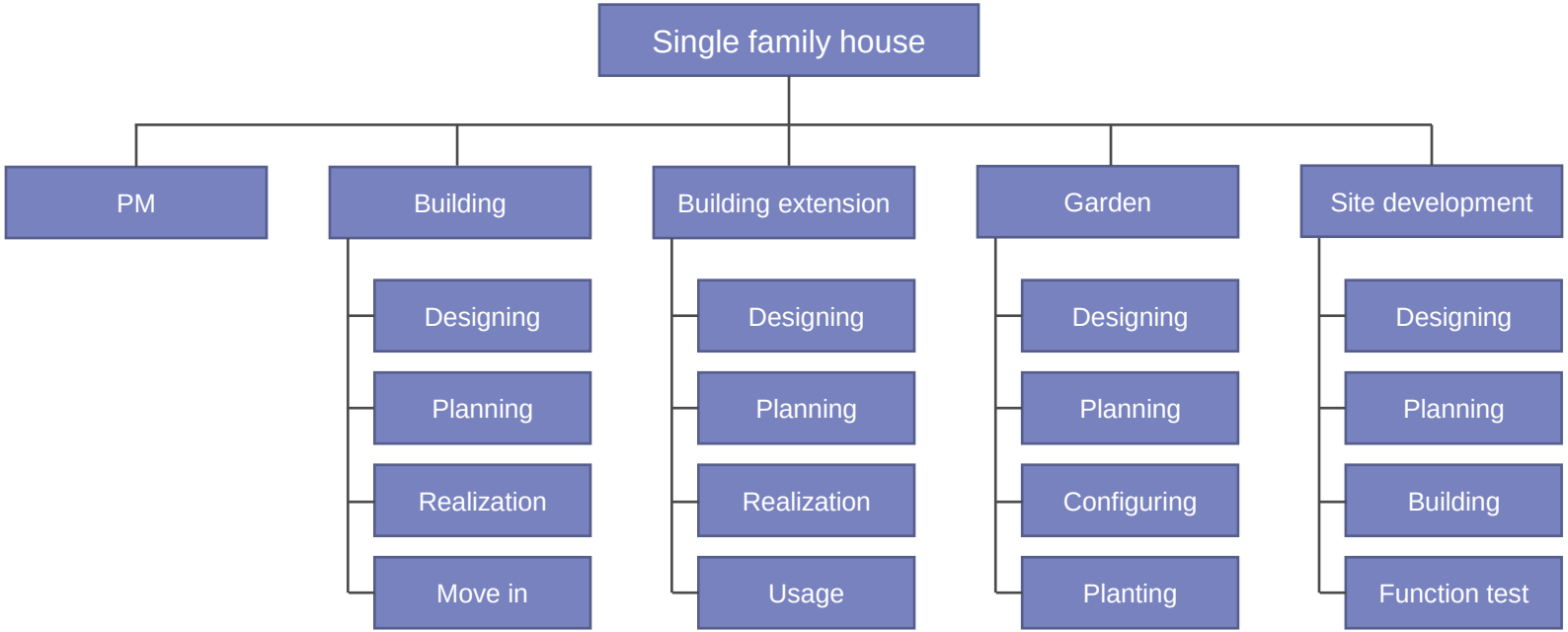
# Product-oriented structure Example



# Phase-oriented structure Example



# Mixed-oriented structure Example



# Exercise
# Project structure plan

Your old apartment building is being demolished and you need to move. You want to plan your move as a project so that all items arrive at the new home undamaged. You need to enlist friends to help with the dismantling and set-up work.

You also want to take the opportunity to set up a new office with a network connection. The furniture will be transported to the rooms in the new apartment (kitchen: electric stove, oven / living room: multimedia equipment, TV, etc. / bedroom: wardrobe, electronically adjustable bed). All lamps will be connected only after the move in a quiet period. At the end there will be a housewarming party. A change of address must be made at the residents' registration office and the new address must be emailed to your friends.

Create a phase-oriented PSP for the project above!

# PSP

The PSP provides transparency with regard to the functional or organizational structure of the project and shows all tasks to be performed in the project (as a set of all work packages).

The PSP does not provide information about:

- The order in which all WP are processed
- Interfaces between subprojects/subtasks and WP
- Exact sequence and execution times

Based on the work packages, the logical arrangement of the tasks is determined during sequence planning and the temporal arrangement of the tasks is determined during (time) scheduling.

# Traditional Project Management

- Project Management Foundations
- Project Launch Phase
- Project Planning – Scheduling
- Project Controlling
- Project Conclusion

# Sequence and schedule planning

- Sequence and schedule planning are carried out based on the PSP.
- For creating a schedule, we also need to
  - take into account the available resources
  - map the network diagram to a calendar.
- Optionally, the schedule can also be optimized (shortening the project duration).

# From the PSP to the Gantt Chart

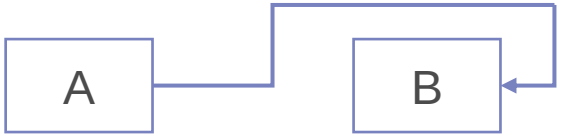
- PSP: Breakdown of the overall project into subprojects / subtasks / work packages
- Break down work packages into activities / tasks (if necessary)
- Determine duration for each activity
- Define predecessor / successor for each activity
- Define type of relationship and (if necessary) time intervals between activities
- Determine critical path and floats
- For schedule creation: determine necessary resources & map to calendar

# Relationships between activities

Finish to start (FS)


Start to start (SS)


Finish to finish (FF)




Start to finish (SF)

# Relationships between activities

- Finish-start relationship (FS)
  - The predecessor must finish before the successor can start.
- Start-start relationship (SS)
  - The predecessor must start before the successor can start.
- Finish-finish relationship (FF)
  - The predecessor must finish before the successor can finish.
- Start-finish relationship (SF)
  - The predecessor must start before the successor can finish.

# Relationships with time intervals
# Examples

- FS + 2
  - Two days after completion of the foundation, the building of the walls can be started.
- SS + 3
  - Three days after the start of the mechanical assembly, the wiring of the first assemblies can be started.
- FF + 10
  - Ten days after handover of the documents, the inspection of the same can be completed.

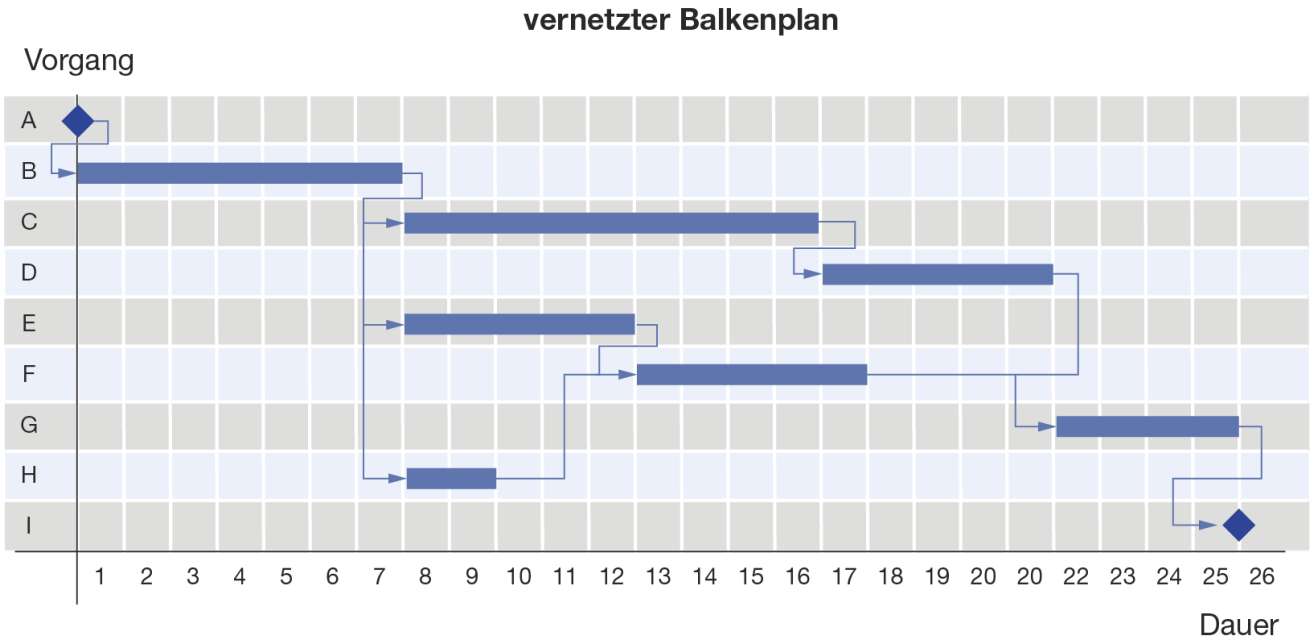
# Scheduling

- To develop an initial schedule, we also need to
  - determine the personnel and non-personnel resources required for all activities
  - identify all activities or milestones outside your project that affect our project's activities
- The initial schedule can further be optimized by
  - rechecking the original estimates
  - using more personnel or more-experienced personnel
  - applying different strategies for performing the activities (using a contractor)
  - performing tasks that are normally done sequentially in parallel
- The project duration can only be reduced by reducing the time of the critical path.

# Displaying a schedule

- The optimized schedule can finally be mapped to a calendar to get actual dates.
- There are different formats to display such a schedule. The most common is called Gantt (or bar) chart (a timeline that shows the start and end dates of each activity).
- Advantages of Gantt charts
  - clearer picture of the relative lengths of activities and times when they overlap
  - better high-level overview of the project
- A linked Gantt chart includes all the information from a simple Gantt chart, but additionally represents the dependencies between the activities and milestones with lines drawn between the bars.

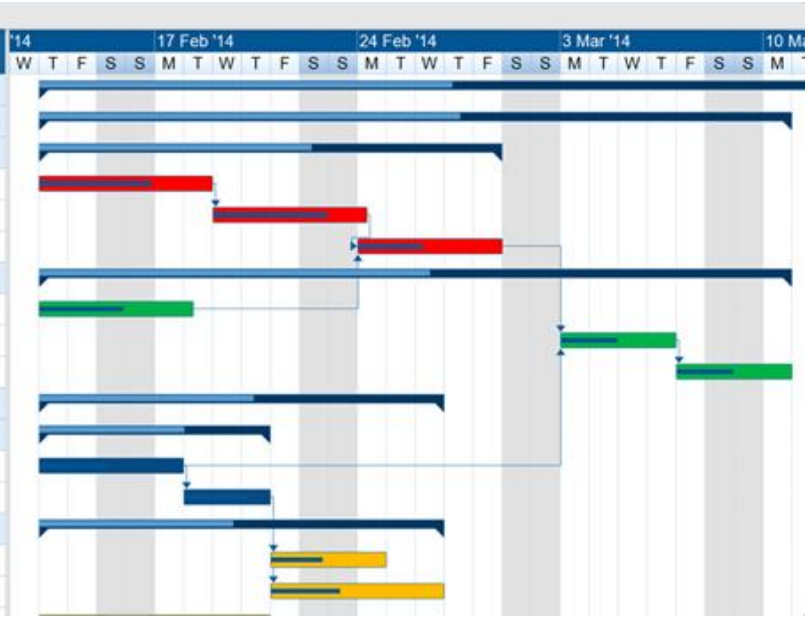
# Gantt chart




from: PM4, 1. Auflage 2019, S. 1193

# Gantt chart

| | Task Name | Duration | Start | End |
|---|---|---|---|---|
| 1 | Construction of a House | 20 days? | 2/13/2014 | 3/12/2014 |
| 2 | 1. Internal | 18 days | 2/13/2014 | 3/10/2014 |
| 3 | 1.1 Electrical | 12 days | 2/13/2014 | 2/28/2014 |
| 4 | 1.1.1 Rough-in electrical | 4 days | 2/13/2014 | 2/18/2014 |
| 5 | 1.1.2 Install and terminate | 3 days | 2/19/2014 | 2/24/2014 |
| 6 | 1.1.3 HVAC equipment | 5 days | 2/24/2014 | 2/28/2014 |
| 7 | 1.2 Plumbing | 18 days | 2/13/2014 | 3/10/2014 |
| 8 | 1.2.1 Rough-in plumbing | 3 days | 2/13/2014 | 2/18/2014 |
| 9 | 1.2.2 Set plumbing fixtur… | 4 days | 3/3/2014 | 3/6/2014 |
| 10 | 1.2.3 Test and clean | 2 days | 3/7/2014 | 3/10/2014 |
| 11 | 2. Foundation | 10 days | 2/13/2014 | 2/26/2014 |
| 12 | 2.1 Excavate | 6 days | 2/13/2014 | 2/20/2014 |
| 13 | 2.1.1 Pour Concrete | 3 days | 2/13/2014 | 2/17/2014 |
| 14 | 2.1.2 Cure & Strip Forms | 3 days | 2/18/2014 | 2/20/2014 |
| 15 | 2.2 Steel Erection | 10 days | 2/13/2014 | 2/26/2014 |
| 16 | 2.2.1 Steel Columns | 2 days | 2/21/2014 | 2/24/2014 |
| 17 | 2.2.2 Beams | 4 days | 2/21/2014 | 2/26/2014 |




from: https://www.gantt.com/

# Traditional Project Management

- Project Management Foundations
- Project Launch Phase
- Project Planning – Resources & Costs
- Project Controlling
- Project Conclusion

# Resource planning

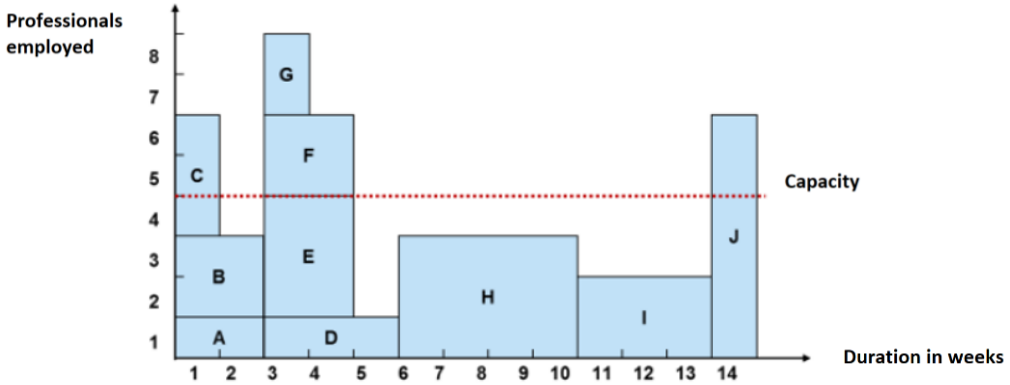
- Resource planning (or capacity planning) in project management considers the question of "who" and "with what".
- The aim of resource planning is to schedule the resources required for project execution.
- The detailed PSP with the work package descriptions provides information about which tasks need to be done during the project.
- In resource planning, additional information is provided on who can actually implement the work packages and the resources necessary to do so.

# Resource planning

- Basis: network diagram
- Steps
  - Identify resources (man, machine, material)
  - Determine requirements for each resource
  - Availability analysis
  - Creation of a resource histogram
  - Determination of over- or undercapacities
  - Optimization of resources

# Resource histogram

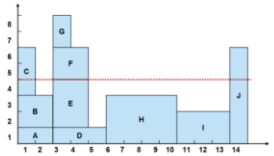
- Graphical representation showing the demand of a resource or resource type for one or more work packages over a specified period of time.
- Identification of over- or undercapacities of resources

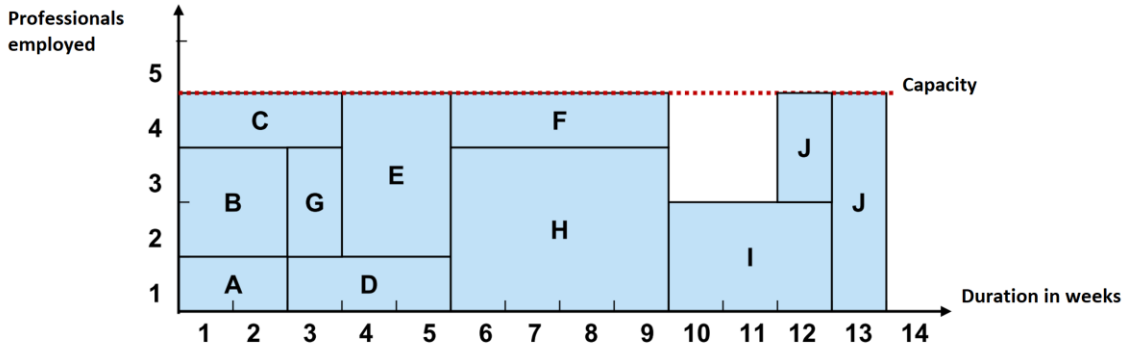


# Optimization of resources

- Postponing work packages
- Splitting work packages
- Removing work packages
- Extending the duration of work packages
- Shortening the duration of work packages
- Increasing available resources
- Extending project duration

# Resource adjustment



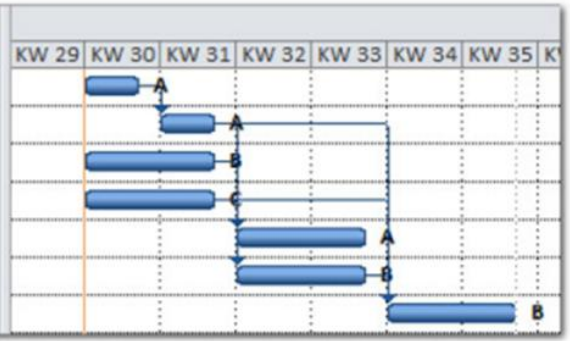


# Exercise
# Resource planning

The screenshot in the following figure shows the planning for a project with seven activities V1 to V7, taking into account the relationships ("predecessors"). The activities have been scheduled as early as possible and assigned to the three persons ("resources") A, B, and C. The persons are qualified to perform all work packages. Person C now drops out. Therefore, only the two persons A and B are available to you. This results in an overload in the existing scheduling.

Can you remedy this? Is this possible without extending the project duration?

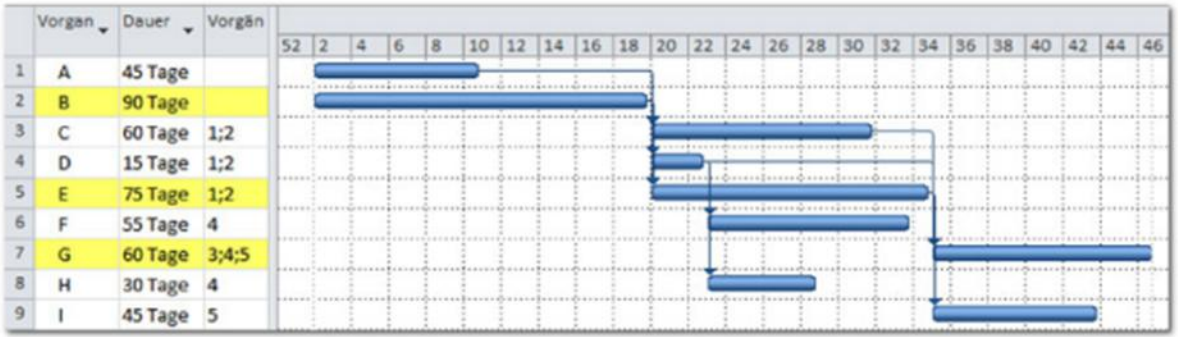
| Vorgang | Dauer | Vorgänger | Ressourcen |
|---|---|---|---|
| V1 | 5 Tage | | A |
| V2 | 5 Tage | 1 | A |
| V3 | 10 Tage | | B |
| V4 | 10 Tage | | C |
| V5 | 10 Tage | 2;3 | A |
| V6 | 10 Tage | 3 | B |
| V7 | 10 Tage | 2;6;4 | B |



# Exercise
# Resource planning

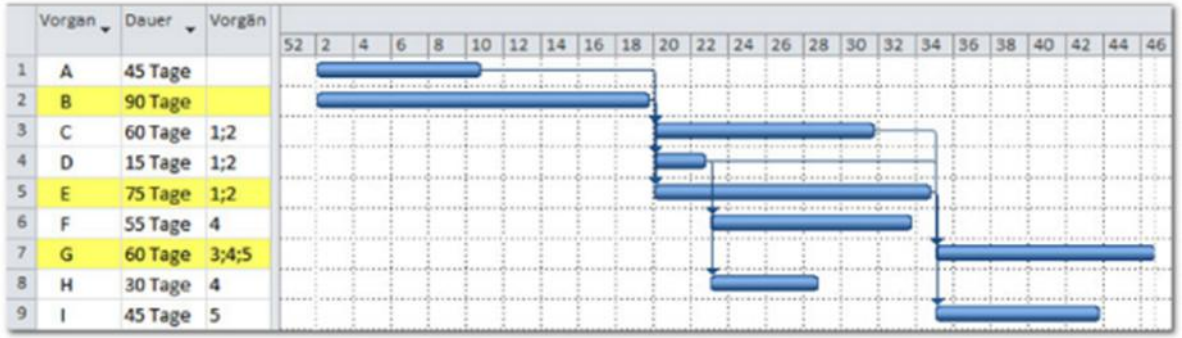
The following figure shows the bar chart of the "New production line" project. The critical path is formed by activities B, E and G (marked in yellow). The runtime of the project on this path is 225 working days. Since there are no more than four activities in parallel at any time, the project can be carried out with four people without capacity overruns. However, there are now only three people available. These have the competencies to be able to process each activity.

How can the project be executed with these three people without exceeding capacity and runtime while maintaining the activities and their relationships?



| | Vorgan | Dauer | Vorgän |
|---|---|---|---|
| 1 | A | 45 Tage | |
| 2 | B | 90 Tage | |
| 3 | C | 60 Tage | 1;2 |
| 4 | D | 15 Tage | 1;2 |
| 5 | E | 75 Tage | 1;2 |
| 6 | F | 55 Tage | 4 |
| 7 | G | 60 Tage | 3;4;5 |
| 8 | H | 30 Tage | 4 |
| 9 | I | 45 Tage | 5 |

# Exercise
# Resource planning



| | Vorgan | Dauer | Vorgän |
|---|---|---|---|
| 1 | A | 45 Tage | |
| 2 | B | 90 Tage | |
| 3 | C | 60 Tage | 1;2 |
| 4 | D | 15 Tage | 1;2 |
| 5 | E | 75 Tage | 1;2 |
| 6 | F | 55 Tage | 4 |
| 7 | G | 60 Tage | 3;4;5 |
| 8 | H | 30 Tage | 4 |
| 9 | I | 45 Tage | 5 |



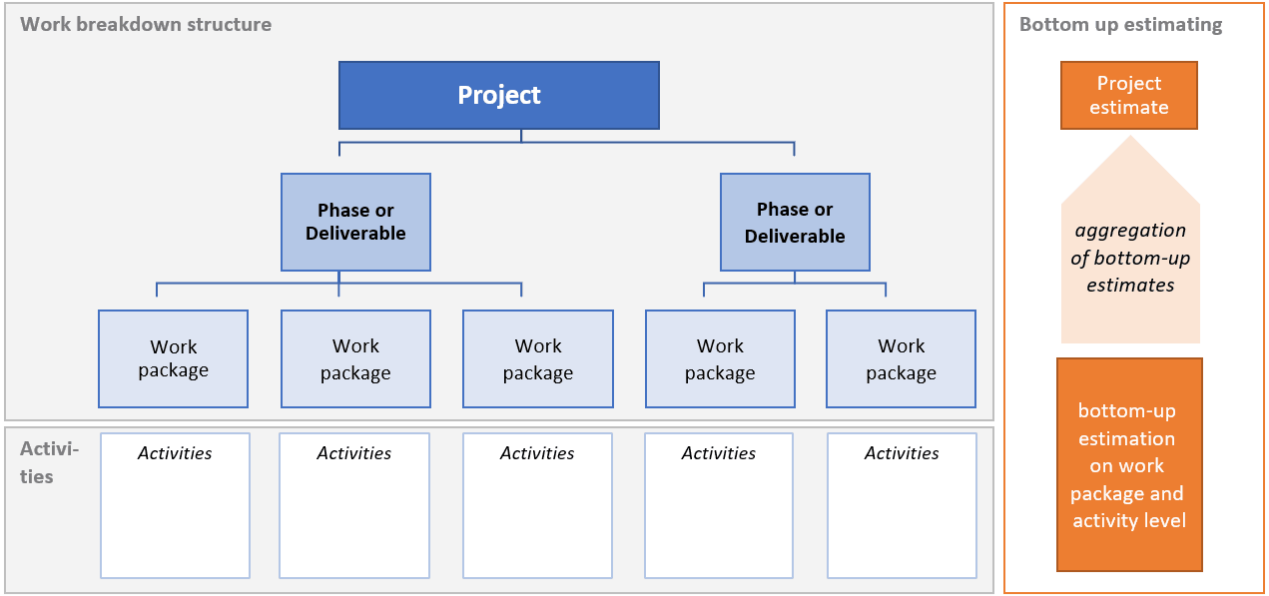
Now the client is asking for the project duration to be shortened by at least 25 days. Additional staff is not available and overtime is not allowed.

Do you think this goal is realistic? What can you do to achieve this goal?

# Project accounting

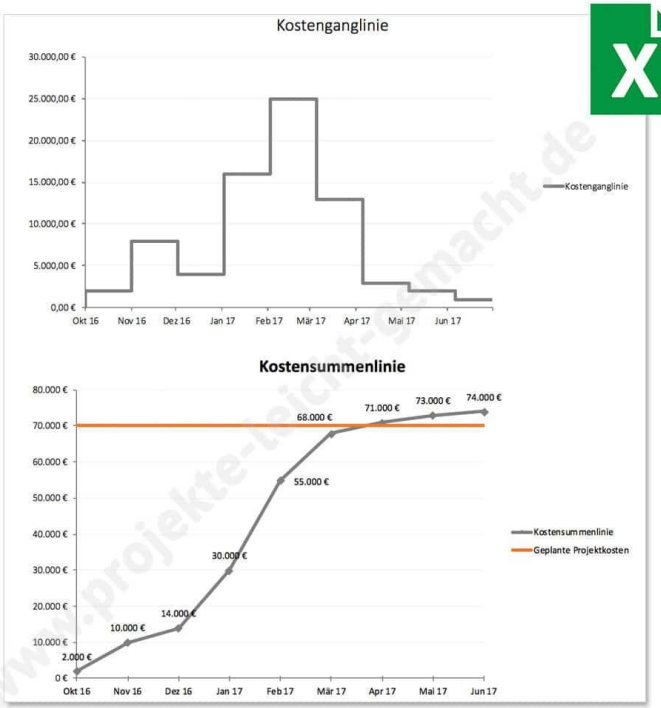
- Cost types: personnel costs, material costs, service costs, capital costs
- Cost planning
  - Bottom-up based on input requirements and potential risks from work packages
  - Based on calculations, expert estimates, price lists
- Cost monitoring
- Cost control
  - Part of project controlling
  - Data collection, comparison of planned vs actual values, progress and completion determination
  - Earned value analysis, cost trend analysis

# Bottom-up estimating




from: https://project-management.info/bottom-up-estimating-definition-example-pros-cons/

# Cost development line and cost baseline (cumulative cost curve)



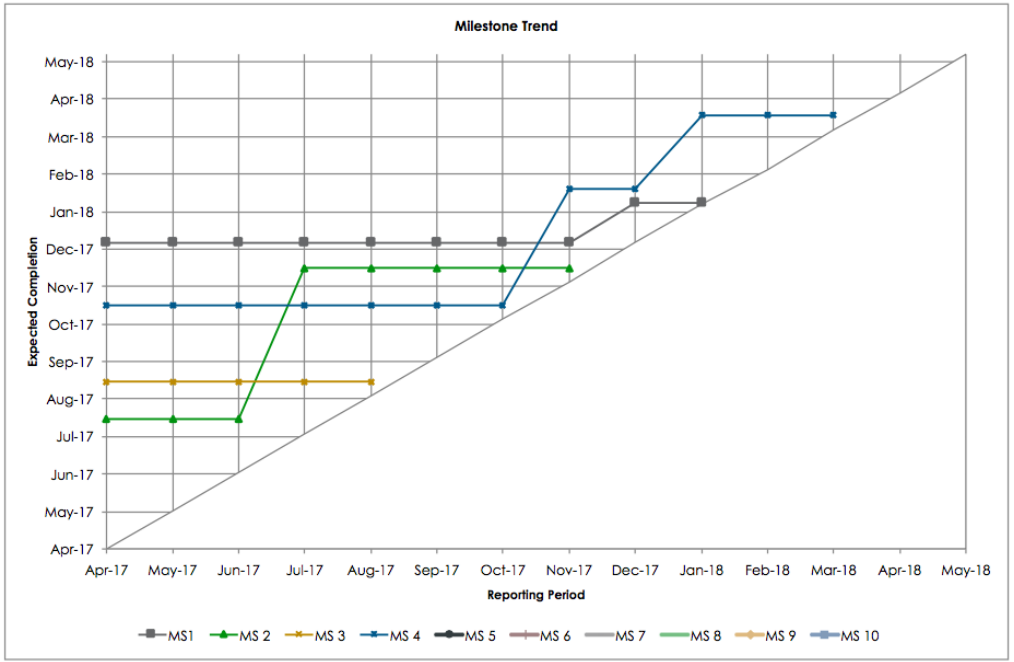
# Traditional Project Management

- Project Management Foundations
- Project Launch Phase
- Project Planning
- Project Controlling
- Project Conclusion

# Project controlling

- The aim of project controlling is to identify deviations from the planned course of the project at an early stage and to initiate counter measures.
- Procedure
  - Planning
    - Specification of planned data
  - Execution
  - Monitoring
    - Recording of actual data
    - Comparison of planned and actual values
    - Analysis and forecast
  - Control
    - Initiation of counter measures to achieve the planned data

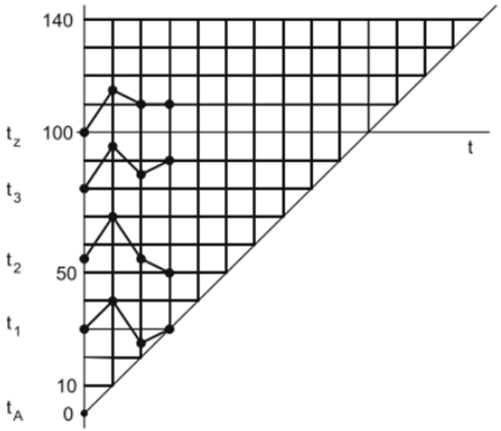
# Milestone trend analysis




from: https://prommpt.com/the-milestone-trend-analysis/

# Exercise
# Milestone trend analysis

1. How far has the project progressed in terms of time and content?
2. What mistakes have been made so far in the progress planning?
3. What needs to be done to avoid them in the further course of the project?



# Earned value analysis (EVA)

- Method for integrated cost monitoring
- Basis for forecasting the further course of the project
- Prerequisites for the EVA
  - Breakdown of the project into work packages
  - Planning of the effort per work package
  - Defined measurement method of the degree of progress per work package
  - Regular progress reports

# Methods of measuring the degree of progress

- Status step technique (also called milestone technique)
- 50-50 procedure
- 0-100 procedure
- Quantity proportionality
- Time proportionality
- Estimation methods (beware of the 90% syndrome!)

# Earned value analysis
# Formulas

| Name | Formula |
|---|---|
| Planned value | PV = % complete where the project should be * BAC (budget at completion) |
| Earned value | EV = % complete * BAC (budget at completion) |
| Cost variance | CV = EV – AC (actual cost) |
| Schedule variance | SV = EV – PV |
| Cost performance index | CPI = EV / AC |
| Schedule performance index | SPI = EV / PV |
| Estimate at completion, standard formula | EAC = BAC / CPI |
| Estimate at completion, future work at planned costs | EAC = AC + BAC – EV |

# Exercise
# Earned value analysis

The table below shows the status of seven different projects P1 to P7 with Planned Value (PV), Actual Cost (AC) and Earned Value (EV) .

Describe the situation of the projects in terms of project progress and costs.

Which projects are expected to end with budget overruns and which with schedule overruns?

| Project | PV | AC | EV |
|---|---|---|---|
| P1 | 100,000 | 100,000 | 100,000 |
| P2 | 100,000 | 90,000 | 80,000 |
| P3 | 100,000 | 92,000 | 97,000 |
| P4 | 100,000 | 108,000 | 115,000 |
| P5 | 100,000 | 120,000 | 104,000 |
| P6 | 100,000 | 110,000 | 90,000 |
| P7 | 100,000 | 80,000 | 105,000 |

# Exercise
# Earned value analysis

You are the project manager of an ongoing project with 500,000€ budget at completion (BAC) and ask your employee about the project status on the current date. He gives you the following information:

- The planned value (PV) on the current date should be 420,000€.
- The percentage of completion (POC) on the current date is 62%.
- The actual costs (AC) up to the current date are 405,000€.

1. Determine the current earned value (EV) of the project on the reporting date!
2. What is the planned percentage of completion (PPOC) on the reporting date?
3. Compare the earned value with the actual costs on the reporting date.
   How large is the current cost variance (CV) in €?

# Exercise
# Earned value analysis

You are the project manager of an ongoing project with 500,000€ budget at completion (BAC) and ask your employee about the project status on the current date. He gives you the following information:

- The planned value (PV) on the current date should be 420,000€.
- The percentage of completion (POC) on the current date is 62%.
- The actual costs (AC) up to the current date are 405,000€.

4. Carry out a forecast of the total project costs at the end of the project. Calculate the estimate at completion (EAC) using the standard formula.
5. Explain which assumption the standard formula is based on.

# Reasons for schedule deviations

# Reasons for schedule deviations

- Change in general conditions
  - Capacity shortfall (material, people)
  - Change in scope
- Incorrect scheduling
  - Capacity is not sufficient
  - Tasks forgotten / incorrectly estimated
- Late delivery
- Risk occurrence

# Project control measures

# Project control measures

- Change of resources
  - e.g. relief of project staff, vacation block, working overtime
- Reduction of effort
  - e.g. technical alternatives, purchase of partial products, alternative suppliers
- Increase of productivity
  - e.g. training employees, increase motivation, organizational changes
- Change of scope
  - e.g. performance reduction, versioning, quality reduction
- Improvement of process quality
  - e.g. conflict resolution, increase stakeholder involvement

# Exercise
# Fix scheduling problems

For a project with a planned duration of twelve months, a percentage of completion of 45% is determined after seven months. This should have been achieved after five months. The cost budget is almost half used up.

What is not the problem?

What can basically be done to meet the planned target date?

# Traditional Project Management

- Project Management Foundations
- Project Launch Phase
- Project Planning
- Project Controlling
- Project Conclusion

# Project conclusion

- Project completion report
- Acceptance Testing
  - Transfer of ownership
  - Transfer of risk
  - Reversal of burden of proof
  - Obligation to pay
  - Start of warranty
- Transfer of the project object to the department
- Termination of the project organization
- Social dimension (closing ceremony, adjourning, feedback round)

# Project completion report

- Planned and actual performance goals achieved
- Planned and actual end date
- Planned and actual costs incurred (with reasons for deviations)
- Information about consequences for future projects (project learning)
  - Learning from mistakes
  - Documentation
  - Knowledge transfer
- List of open points
- Archiving

# Exercise
# Responsibilities

The following list contains a number of tasks that occur in different phases of a project. Decide which of these tasks are to be performed by the project manager and which by members of the project team. If neither the project manager nor the project team is responsible, identify another responsible stakeholder.

1. Define requirements for the project
2. Estimate effort for the elements of the project structure plan
3. Ensure quality of work package deliverables
4. Select a project to be executed from several planned ones
5. Assign a person for the project from the line department
6. Provide necessary resources
7. Handle and resolve conflicts in the project

# Exercise
# Responsibilities

The following list contains a number of tasks that occur in different phases of a project. Decide which of these tasks are to be performed by the project manager and which by members of the project team. If neither the project manager nor the project team is responsible, identify another responsible stakeholder.

8. Close the project
9. Accept project result
10. Communicate project status to steering committee
11. Determine remaining workload of work packages
12. Monitor the progress of the project
13. Negotiate content and scope of project

# Exercise
# Project activities

Sort the following project activities:

1. Resource planning
2. Project structure plan
3. Cost planning
4. Project completion
5. Control
6. Requirements
7. Sequence planning
8. Goal definition
9. Scheduling
10. Specification

# Traditional Project Management

- Additional Questions
- Topics Not Covered

# Additional questions

- How do projects differ from non-projects?
- According to which criteria could you classify projects?
- What are the essential tasks of project management?
- Describe the criteria for formulating goals.
- What does the project triangle describe?
- What forms of organizational structure are there for projects? Describe their most important features. How do they differ?

# Additional questions

- What is meant by a work package, a subproject, a milestone and a project phase?
- What is a project structure plan?
- What is the difference between the top-down approach and the bottom-up approach to creating structured lists?
- Explain the relationship between time duration and number of people for a fixed size work package.
- What is meant by an activity?
- What is a relationship among work packages? Describe the different types of relationships.

# Additional questions

- What does a network diagram consist of?
- Which dates and time values are determined during scheduling?
- What is a critical path?
- What is a Gantt chart?
- What is a project risk?
- What is a risk portfolio?
- What steps make up the risk management process?
- Explain the basic approach to earned value analysis!

# Additional questions

- How can progress in a project be determined?
- What is a milestone trend diagram?
- How can you react to deviations from the plan as part of project control?
- What work is required for the completion of a project?

# Traditional Project Management

- Additional Questions
- Topics Not Covered

## Topics not covered and many more…

- Quality management
- Procurement process
- Contract management
- Configuration and changes
- Documentation
- Communication
- Leadership
- Social skills
- Creativity
- Negotiations
- Conflicts
- Ethics
- Program orientation
- Portfolio orientation
- Business cases
- Human resource management
- Health, safety and environment
- Financing
- Legal aspects
- Standards and guidelines