

# Project Management

University of Applied Sciences Kiel

Department of Mechanical Engineering

Prof. Peter Quell

EPS 2021

# Welcome!

## to Project Management

# Time schedule

## Friday, 19.03.2021

10.00 – 11.00	Introduction
11.00 – 11.15	Break
11.15 – 12.15	Project Initiation (1)
12.15 – 13.15	Lunch
13.15 – 14.45	Project Initiation(2)
14.45 – 15.00	Break
15.00 – 16.30	Project Organization

## Monday, 22.03.2021

09.30 – 10.30	Project Definition and Planning
10.30 – 10.45	Break
10.45 – 12.00	Project Execution
12.00 – 13.00	Lunch
13.00 – 14.30	Preparation final presentation
15.00 – 16.00	Final Presentation

# Project Management Teams

Team:

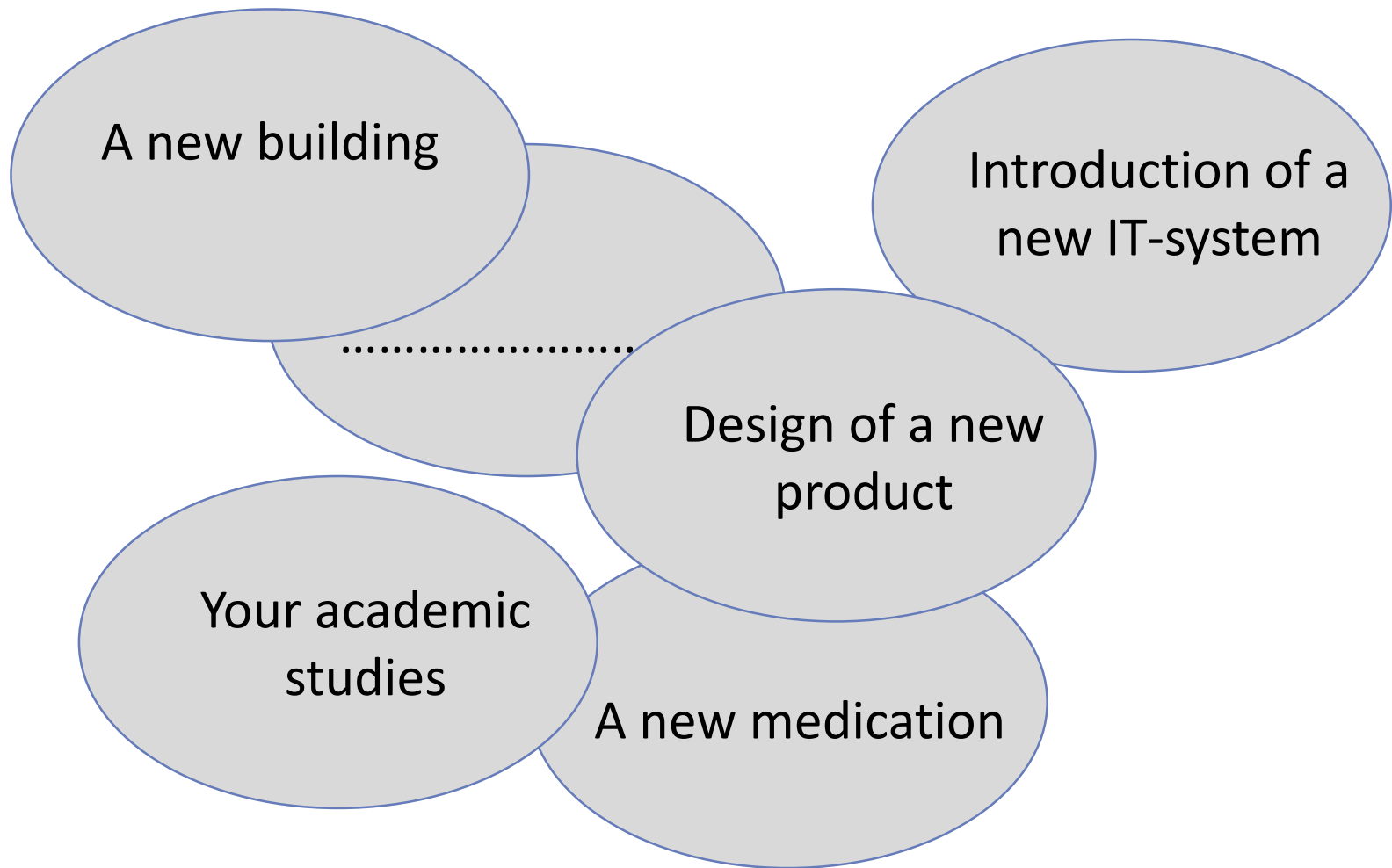
# Content

1. Introduction
2. Project Initiation (Start)
3. Project Organization
4. Project Definition and Planning
5. Project Execution

# 1. Introduction

- Definition of projects
- Organisation of project management
- Project phases

# Examples of Projects



# Historical examples



## **Egyptian Pyramids (2550 -1550 B.C.)**

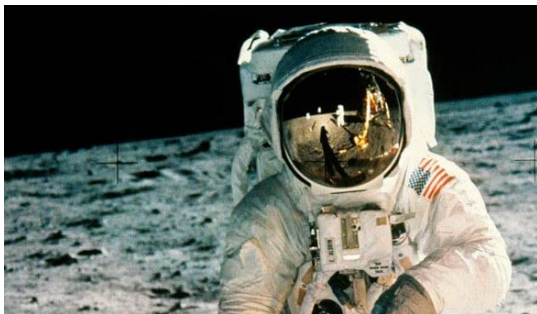
Cheops:

- 146 m height
- 20 years construction
- 100.000 Labor / slaves

## **Tower of Babel (600 B.C.)**

Objective: Reach the sky

Failed because of unrealistic objectives and bad communication



## **Landing on the moon (1969)**

Apollo program

Realization in phases / steps

2000 institutions /companies

300.000 empl., \$ 25 billion



# Example of a large project

Design of an offshore wind turbine with a rotor diameter of 180 m and a rated power of 8000 kW



# Example of a large project

- Design of an offshore wind turbine with a rotor diameter of 180 m and a rated power of 8000 kW
- The turbine shall be the most efficient one in the offshore market:
  - Annual energy yield > 35.000 MWh @  $v_m = 10$  m/s
  - Turbine costs < 12 mio. €
  - Meantime between failure (MTBF) > 3 month
- Prototype shall be erected by end of 2018
- Budget shall not exceed 50 mio.€

How many people could be supplied with energy by a single turbine?

# Example of a large projects

## What do you need for such a project?

- A large team of R&D engineers
- Support from the purchase department
- Quality engineers
- Production engineers
- Service engineers
- Sales support
- **MONEY and TIME**

### But:

- How to ensure that your product will be ready end of 2018?
- How to know that the costs will stay within the budget?
- How to ensure that you receive the needed resources?

# Definition of projects

## A project is characterized by:

- .....
- Specific objectives, defined up front
- Several persons and departments involved
- Extraordinary task (no routine work)
- Complexity
- Involving uncertainties and risks
- Temporarily
- Defined time and budget

# Organisation of project management

## Some companies work nearly solely in form of a project:

- .....
- Building of large plants
- Software development
- Biotech companies
- PR agencies
- Consultancies



# Organization of project management

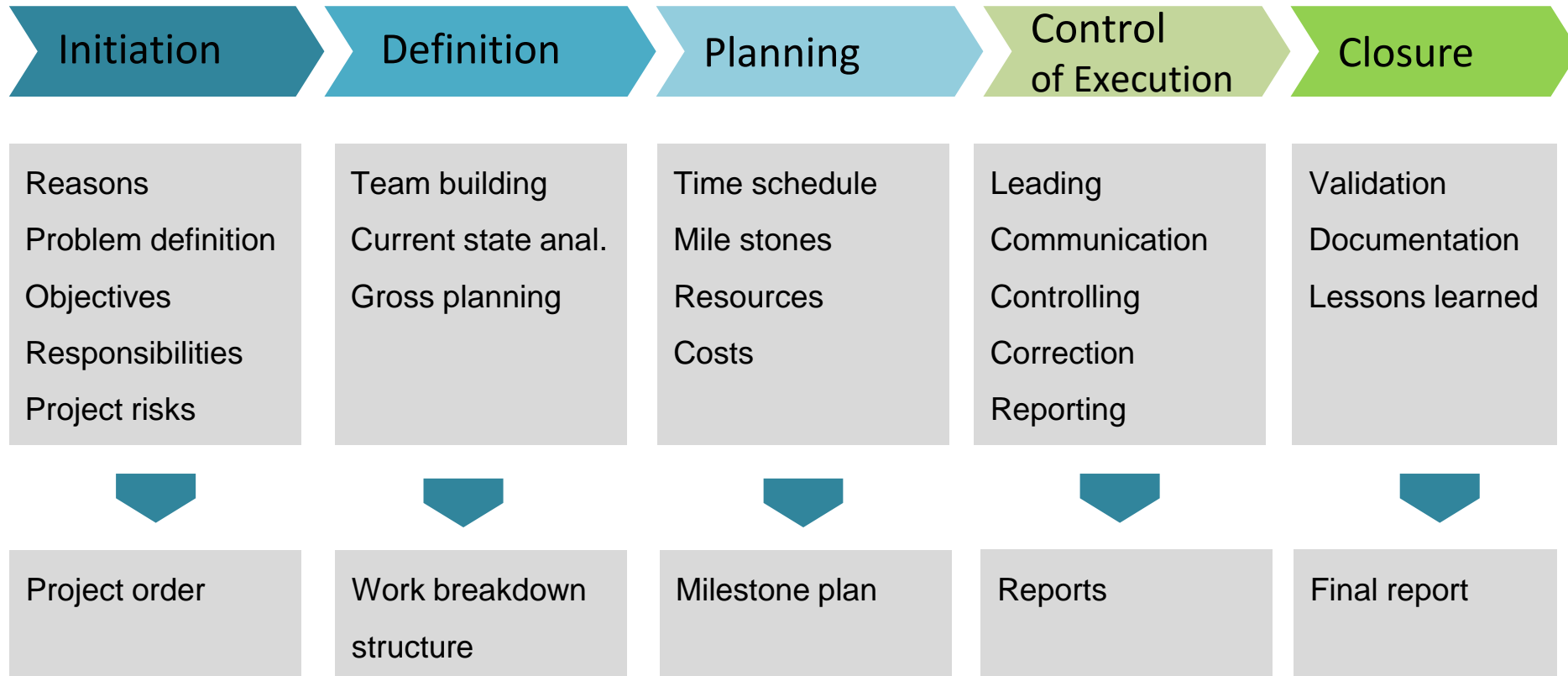
**Project management comprises all planning and executing activities for realizing projects**

- .....
- Analyzing the problem and definition of the project objectives
- Project planning (work breakdown, time line, resources)
- Internal team building and leading
- Interaction with external stakeholders
- Controlling project execution

**It is not about directly related activities to solve the problem!**

# Organization of project management

## Project management is phase oriented:





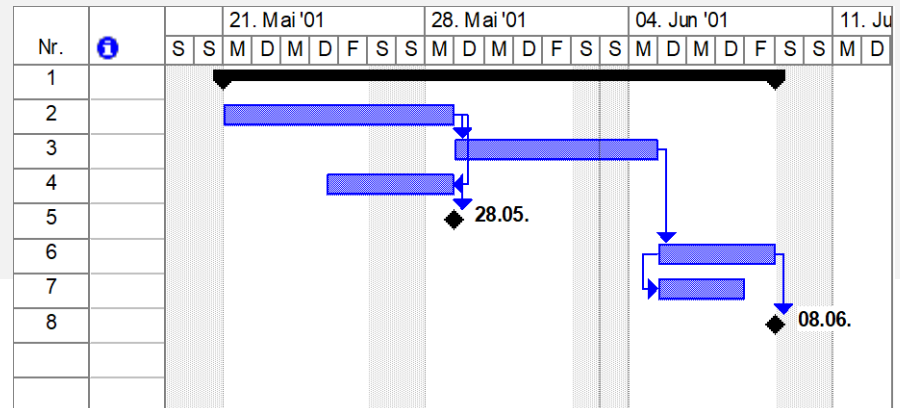
# Organization of project management

## Project management is using a specific structural organization:

- The project team (team members, team leader)
- Decision making units (sponsor, steering committee, design review teams,..)
- Embedding the project team within companies organization

## and specific methods and tools for planning and control:

- Work breakdown structures
- Network, chart diagrams
- Risk analysis,..





# Project phases – initiation

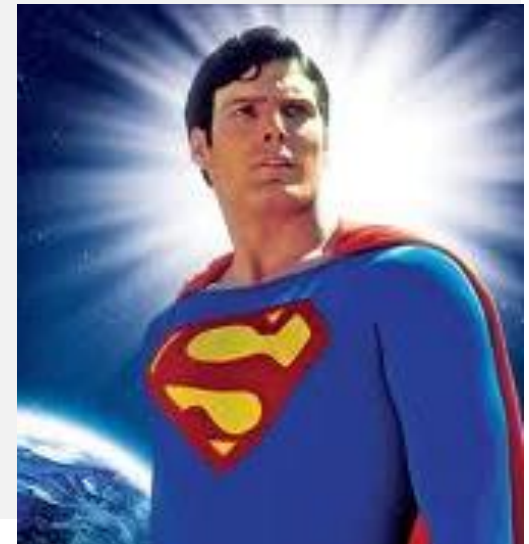
## Main questions and definitions at the start:

- What is the **problem**? What is the reason for the project?
- What are the main **objectives**? What are the benefits? Who wants it?
- Who will be the **project leader**? Should be defined as soon as possible to support the preparatory works.
- Who will be within the **steering committee**?
- What is the **time line**, which **staff** and **budget** is needed

# Project phases – initiation

## Tasks of the project leader:

- .....
- **Leading**, pushing the project
- **Allocate** clearly defined tasks within the team
- **Motivation** of team members
- Choosing and deciding on used **methods and tools**
- **Communication** to the stakeholders
- Permanent **project control**
- Taking **corrective measures** immediately



# Election of the project leader

1. Introduction

## 2. Project Initiation (Start)

3. Project Organization

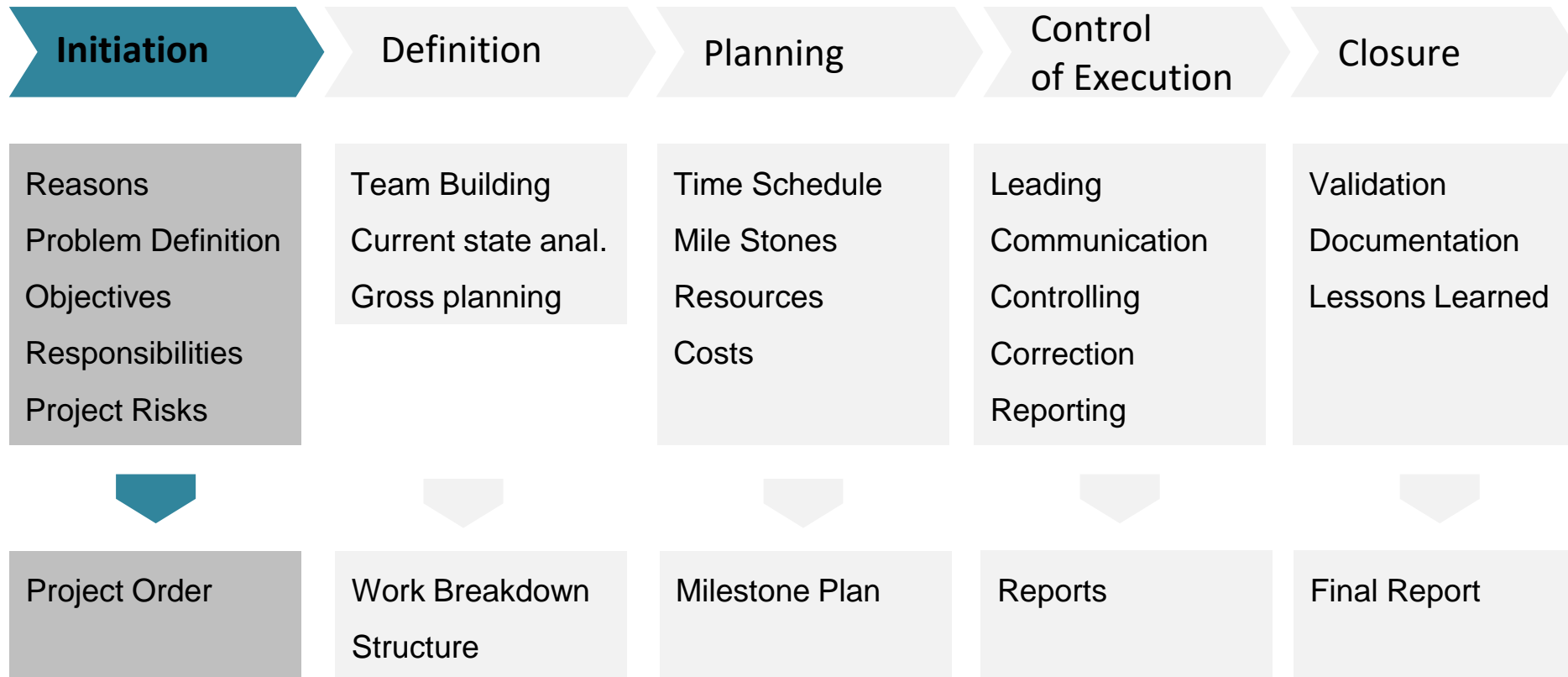
4. Project Definition and Planning

5. Project Execution

6. Project Closure



# Introduction



# Introduction

## Initiation Phase

Reasons for Projects

Problem Definition

Project Objectives

Project Proposal

P.C.

Project Order

Problem  
Marketing  
Cost reduction  
Customer Order  
New business idea  
Employee  
Suggestion System

Clarification of the problem  
Problems  
Topicality  
Alternatives  
Problem Breakdown

Results / Product  
Scope / Quality  
Costs  
Expenses  
Time / Deadline  
Process  
Objectives

Problem Definition  
Project Objectives  
Organisation  
Time / Deadline  
Profitability (Costs vs. Benefit)  
Risks

Prioritization Committee

Approved and Signed Project Proposal

Company:		Project Charter		Page:
Name of the Project:		Code:	Proj. No.:	
Project Responsibility by:				
Department:	Organisational Unit:	Name:		
<b>Project Master Data</b>				
a) Starting position				Actual
b) Scope, definition				
c) Brief description of the actual system				Target
d) Reason for the order (motivation)				
e) System objectives				
f) Prototype model of the new solution				
g) Strengths/ weaknesses of the new solution				
h) System-related restrictions/ dependencies				
i) Opportunities/ risks of the new solution				
j) Operation periodicity (time-related, event-related)				
k) Expected results (e.g. based on the pilot study etc.)				
<b>Project Management Data</b>				
a) Project priorities (based on the project portfolio)				
b) Special features, variances				
c) Process organisation				
d) Execution objectives				
e) Profitability				
f) Budget				
g) Scheduling (bar charts, network plan)				
h) Documentation and information system				
i) Organisational structure (organisational chart)				
<b>Signatures of the department management</b>				
Date:	Department:	Signature:	Department:	

# Project Order

The phase ‚Project Initiation‘ will end up in a written project order, signed by the sponsor (or customer) and project leader.

## Contents:

- Problem description
- Project objectives
- Organisation
- Milestones
- Profitability analyzis
- Restrictions
- Risk management
- Reporting

The project order ensures that all relevant people are informed and the sponsor does agree to the basic parameters.

Project Order			
Project Name:	3rd source Gearbox 2,5 MW	Project Number:	1.100.321
Customer:	Otto Lilie, Head of Purchase Departm.	Head of Project:	Klaus Meier
Date:	08.10.2012		
Problem Description (Reason for the project, strategic purposes):			
Gearboxes are too expensive. Actual suppliers are in a very comfortable situation, cause they know about our increasing demand.			
Project Objectives:			
Establishing a 3rd source supplier.			
Prototype running from 10/2013. Serial supply starting from 04/2015.			
Max. price: 250.000,-€/gearbox @ 100 gearboxes/year			
Savings of 20.000,-€/gearbox: 2.000.000,-€/p.a.			
Development/validations cost max. 630.000,- €			
Gearbox shall fit into existing turbine design without any modifications			
Organisation (Committees, People, Responsibilities):			
Steering Committee:	Head of R&D, Head of PD, Head of QS		
Project Team:	Will be defined later. Head of project and probably 3x from R&D, 1x QA, 1xPD		
Dates, Milestones			
Start:	01.11.2012		
Specification:	07.01.2013		
Prototype test indoor:	01.10.2013		
Prototype installation:	01.12.2013		
Release for serial prod.:	01.04.2015		
Profitability (Costs, Benefits):			
External costs:	Indoor overload test	150.000 €	
	Depriication of 2 test gearboxes	200.000 €	
Personal costs:	Head of project (30 month with 25%):	120.000 €	Basis: € 100,-/h
	3 empl. R&D	100.000 €	
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Risk assessment will be conducted within the detailed plannin phase, latest Week 51/2012			
Reporting:			
Monthly reports to steering committee			
Customer:	Head of Project:		
Date:		Date:	
Signature:		Signature:	

# Reasons for projects

Very often projects are started based on **organisational or technological problems**, which can not be solved easily. E.g. the CAD-System is overloaded and can not support anymore your actual design tasks.

Other projects are started based on the demand of the marketing or the customer for new and more **competitive products** to ensure future business.

**Improvement** projects are started by the wish or need to remedy deficiencies e.g. in the production, IT, organisation, facilities, infrastructure. These projects could be triggered as well by an employee suggestion program.

With the aim to find out **new solutions** research projects are started like new materials, medications,...





# Choice of a common reference project

# Problem definition

**Every project should start with a valid reason!**

Before starting a project the reason should be analysed thoroughly:

- Discuss the reason and motivation with the directly involved colleagues
- Speak to internal (and if possible external) customers
- Look for similar experiences

Derive a problem definition out of the reason:

- No problem definable? -> Why starting a project?
- Obvious work around -> follow the alternatives!
- Very complex problem? -> Split the master problem into several isolated problems

The problem definition should be specific but should not include the solution (could limit the search for the best way).

# Problem description of our common project

# Project objectives



**Objectives** are describing the requested and desired future status and conditions.

Objectives will give you **orientation** on your long way to reach them.

*For a ship not knowing its harbour of destination no wind will blow in the right direction.*

*Seneca (1-65 n.Chr.)*



# Project objectives

## Objectives typically should include:

**The Object:** What is to be designed or redesigned (new products, new processes,..)?



**Characteristics of the Object:** Which properties and characteristics the new solution should feature? E.g. power of a turbine, weight of a car,..



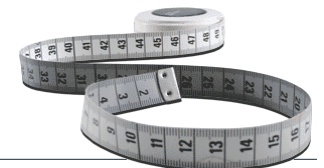
**Costs / Benefits:** How is the budget defined? What are the maximum costs of the new solution? What is the benefit (profit) of the new solution?



**Deadline:** When the new status should be reached, the new product be ready?



**Measures:** How to measure the project success? E.g. production costs, failure rates (MTBF),..



# Project objectives

## What are objectives good for in Project Management ?

- Clear and long lasting guideline to all involved parties
- Giving transparency within the whole organization
- Activating the search for solutions
- Present the need of decisions and support decision making
- Giving legitimation to the project manager



# Project objectives

## Characteristics of project objectives:

realistic and realisable

understandable and transparent

well known and accepted by all involved parties

consistent without conflicting each other

without predefined solutions

clearly allocable

measurable



# Project objectives

## The magic triangle in project management:



**TIME:** Minimized time consumption and adherence to schedule

**MONEY:** Small budget / expenses for realization

**QUALITY:** High quality of the solution or the product

The triangle is named magic cause it is almost impossible to optimize the 3 criteria in parallel (e.g. a short project time or little resources probably will harm the quality).

**A good project management is the only way to balance all 3 criteria in parallel.**



# Project objectives

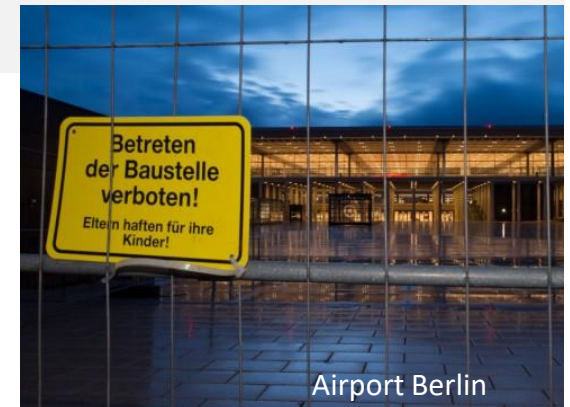
**MONEY: Negative consequences by over exceeding costs or wrong predicted prices**

**Development Costs:** Project is loosing support by the sponsor, project may be stopped. Costs may burden the profit of the developed solution.

**Production Costs (machining, raw materials, production time):** Costs are burdening the profit over the whole production cycle time. Eventually a redesign is necessary.

**Maintenance and Service Costs:** Effort of Service might be to high. It could harm companies profit during the warranty period.

**Falling prices:** The development of the market prices should predicted thoroughly. Otherwise the new designed product might run out of profitability.



# Project objectives

**Time: Negative consequences by poor adherence to schedule:**

**Contractual penalty**, e.g. loss of use of infrastructure (airport Berlin), loss of use of products (Boeing Dreamliner) .

**Loss of market share** towards competitors, not easy to gain back.

**Loss of profit** by late market introduction.

**Damage of reputation**, following might by placed to competitors.



# Project objectives

**Quality: Negative consequences by not fulfilling requirements or producing bad quality**

**Contractual penalty and long lasting remedies,** blocking the R&D department.

**Damage of reputation,** following order might be placed to competitors. In the case of consumer products it could endanger the company itself, e.g. rust damages at cars.

**Loss of market share** towards competitors, not easy to gain back.

**Loss of profit.**



# Project objectives

*Please define the objectives of our common project*

Object:

.....

Characteristics:

.....

Costs/Benefits:

.....

Time:

.....

Remember: the objectives should always be **measurable**!

# Organisation

In the initiation phase the most important players within the project organisation should be defined:

- sponsor (customer)
- project manager
- steering committee

If already known the team members should be mentioned as well.

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Reporting:			
Monthly reports to steering committee			
Customer:	Head of Project:		
Date:		Date:	
Signature:		Signature:	

# Organisation

## Steering committee

The steering committee acts like a ‚**Supervisory Board**‘ of the project.

It will **monitor** the processing of the project by regular meetings with the project manager and regular reports filed by the project manager.

It will **support** and advice the project manager for achieving the objectives.





# Profitability

Profitability is the most relevant driver of a commercial project.



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# Profitability

## Profit = Benefits - Costs

### Benefits:

- + Financially quantifiable benefits [€]  
(increased margin)
- + Differentially quantifiable benefits  
(reduced production time)
- + Not quantifiable benefits  
(reputation, market share)

### Costs:

- Project costs
- Investment costs
- (Financing costs)
- Production costs
- Overhead costs
- Warranty costs

The costs and benefits of the solution should be estimated for the whole life cycle.

Try to include all relevant costs but do not exaggerate the strictness.



# Profitability analysis of our common project

# Project Order

## Miscellaneous information

**Restrictions:** All relevant restrictions already known at the beginning should be mentioned in the project order to properly inform the sponsor.

**Risk management:** Major project risks (market development, quality, time delays, cost overrun) and related measures to be described.

**Reporting:** Regular reports and/or meeting with the steering committee should be determined.

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# **Restrictions**

# **Risk management (risks and measures)**

# **Reporting**

0. General Information

1. Introduction

2. Project Initiation (Start)

3. Project Organization

**4. Project Definition and Planning**

5. Project Execution

6. Project Closure



# Project Definition and Planning

1. Fundamentals of planning
2. Work breakdown structure
3. Work packages
4. Estimation of costs, work load and time
5. Time planning
6. Human resources planning
7. Materials planning
8. Cost estimation
9. Requirement specification

# Fundamentals of planning

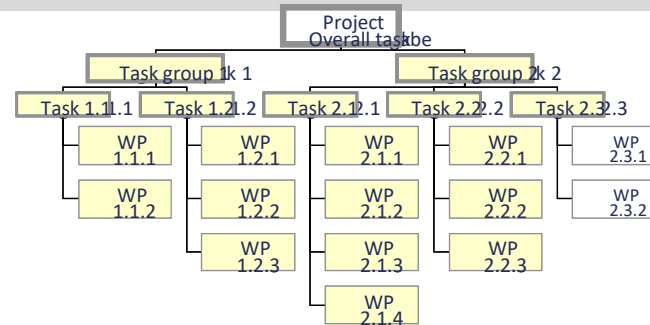
## Planning tasks

- Time schedule
- Cost planning
- Budget planning
- Resource planning (people, tools, infrastructure)
- Tasks and work packages
- Responsibilities of team members
- Recruiting of team members
- Planning financing
- Risk planning
- Quality planning
- Communication planning (reports, meetings, public relation)

# Fundamentals of planning

## Procedure of project planning

### 1. Structure the project



### 2. Define work packages (WP)



Work breakdown structure

### 3. Estimate cost / time / resources of every work package

### 4. Link work packages together



Project schedule

### 5. Identify (inter-)dependencies

### 6. Resource planning



Resource plan

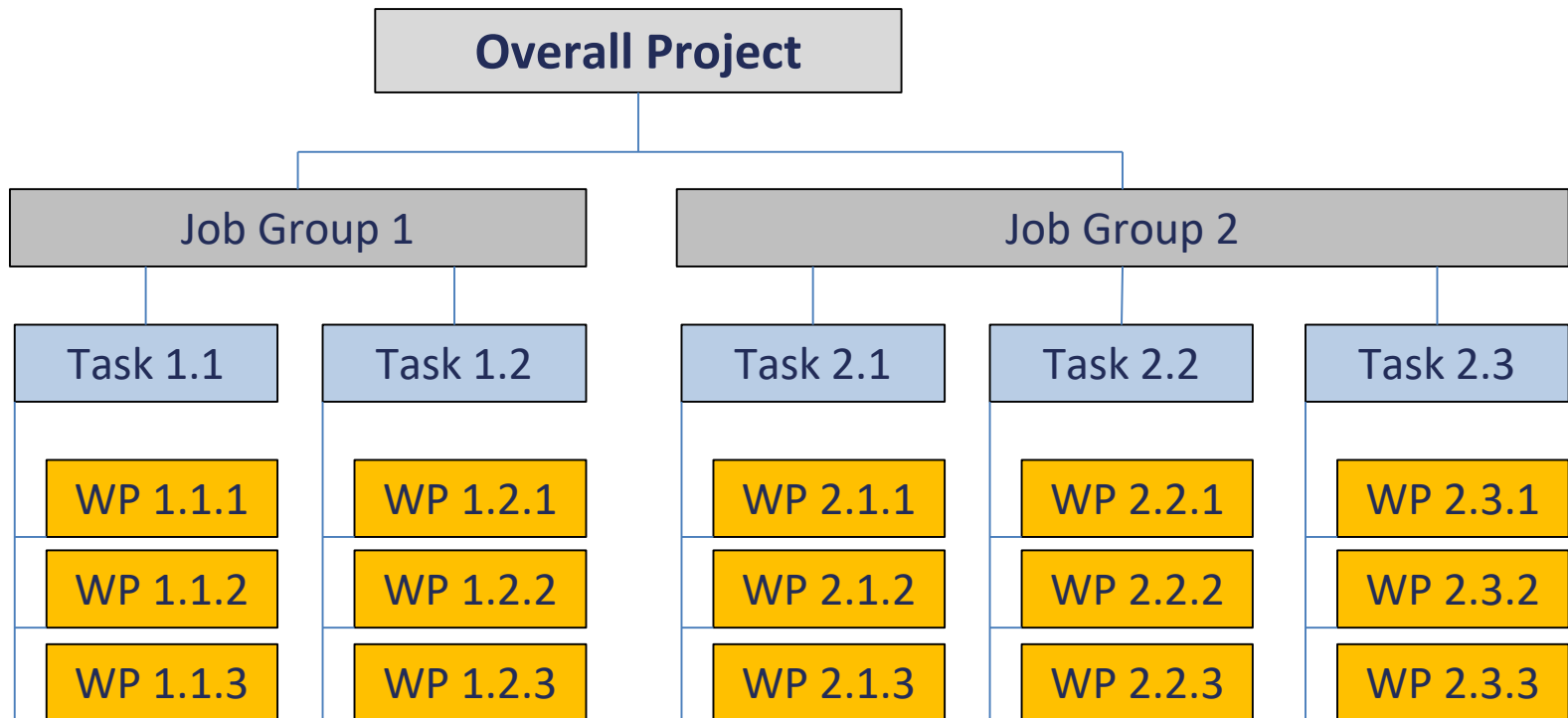
### 7. Costs planning



Cost schedule

# Work breakdown structure

## Structuring a project by a work breakdown structure



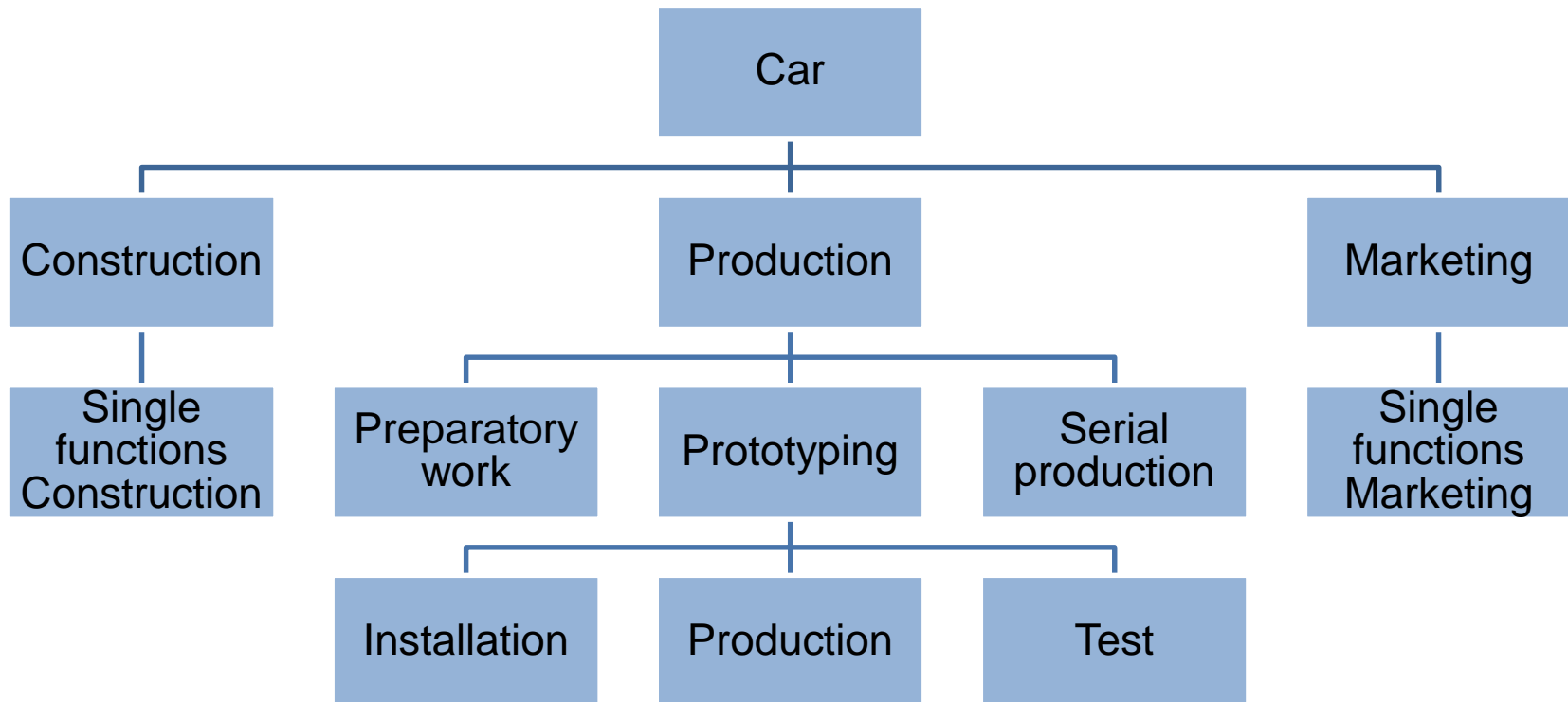
Work packages (WP), tasks and job group should be serially numbered for clear identification in following planning process



# Work breakdown structure

## Function-oriented work breakdown structure

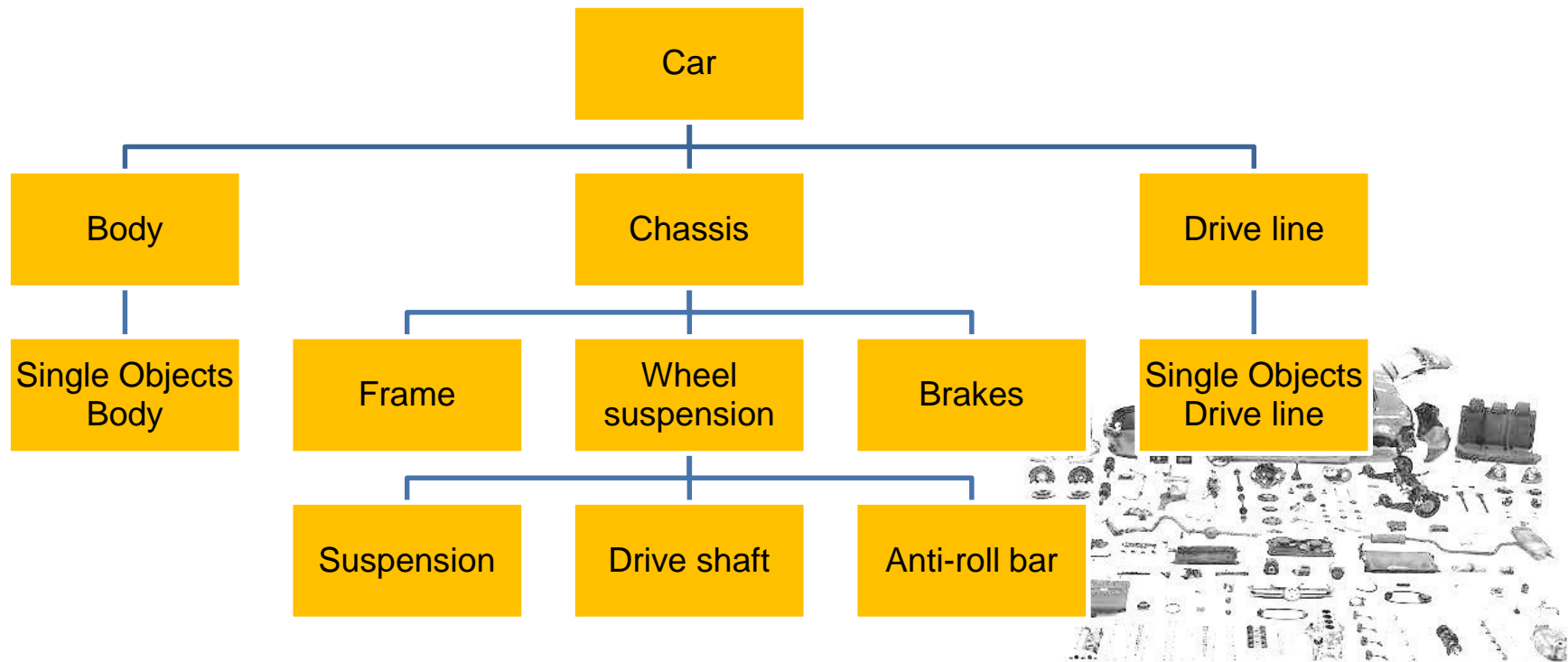
Classification according to companies functional structure (e.g. R&D, purchase, production,..)



# Work breakdown structure

## Object-oriented work breakdown structure

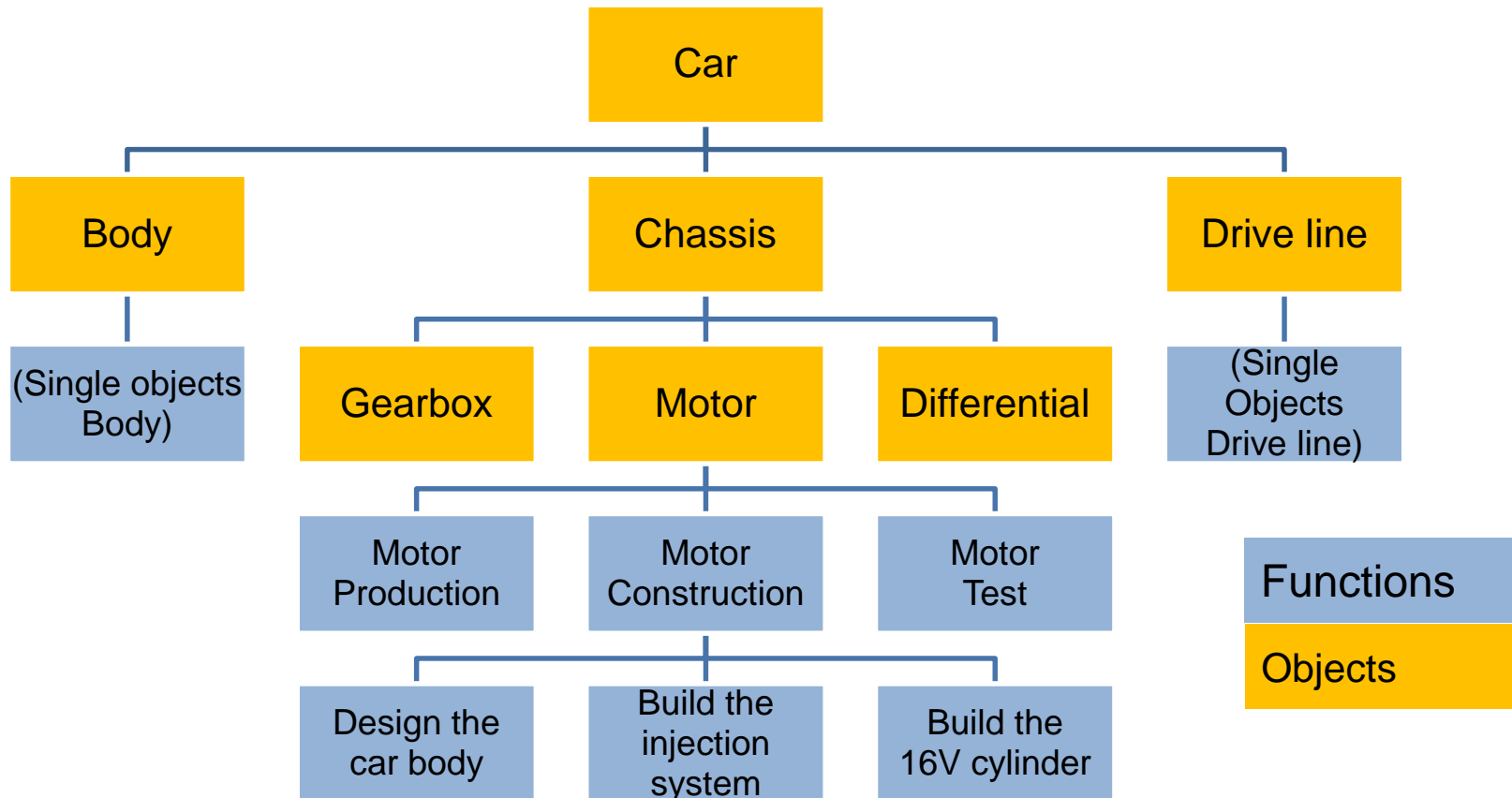
Classification based on the product. Division into modules, assembly groups, parts.



# Work breakdown structure

## Mixture of objects and functions

Both classification criteria used (in practice very common).



# Work breakdown structure

## Tips for creating a work package structure (WBS)

Involve the whole team:

- Common understanding is provided
- Standard terminology is developed
- Motivation increased, synergies are used
- Nothing will be forgotten

Define the work packages precisely cause they are the basis for the next planning steps (resources, costs, time schedule,..)

Start your WBS horizontally, then go into the depth (vertically)

Compare the upper level with the objectives of your project. Are all relevant aspects shown?

Just plan that much in detail that manageable work packages are derived

Do not place work packages on the first level

# Work breakdown structure

Develop within your team a work breakdown structure for our common project

# Work packages

## Work package (WP) as the smallest unit of the WBS

WP should contain all relevant definitions and information equivalent a development order to an external companies:

- Tasks (clearly defined and differentiated), no overlapping
- Well defined interfaces
- Responsibilities
- Expected results
- Relevant conditions (terms, restrictions,..)
- Requirements for performing work
- Time schedule
- Budget and costs
- Reporting

Work Package (WP)			
Project Name:		Project No.:	
Customer:		Head of Project:	
WP Name:		WP No.:	
		WP Responsible:	
Task:			
Expected Results:			
Conditions (Predecessor, Terms, Restrictions..):			
Requirements for Work:			
Dates			
Start of WP:			
End of WP:			
Workload, Costs, Compensation			
External Costs:			
Hours:			
Total sum costs:			
Reporting:			
Head of Project:		WP Responsible:	
Date:		Date:	
Signature:		Signature:	

# Work packages

## Example of a work package (WP)

Project: Restoration bath room

WP: Removal old installations



Work Package (WP)			
Project Name:	Restoration Bath Room	Project No.:	X-1.17
Customer:	My Wife	Head of Project:	Me
WP Name:	Removal old Installation	WP No.:	X-1.17-01
		WP Responsible:	CleanKiel
<b>Task:</b>			
Deinstall old elements			
Removal of tiles			
Disposal of the waste			
<b>Expected Results:</b>			
Empty and clean			
No damages in flat or bath room			
<b>Conditions (Predecessor, Terms, Restrictions..):</b>			
No toilet, use public toilet			
No parking slot			
Penalty 300,- € / per day			
Flat just accessible between 8.00 am and 4.00 pm.			
Just use the direct way to the bath room			
<b>Requirements for Work:</b>			
Company using their own tools			
Waste container by the company			
<b>Dates</b>			
Start of WP:	17.12.2012		
End of WP:	19.12.2012		
<b>Workload, Costs, Compensation</b>			
External Costs:			
Hours:			
<b>Total sum costs:</b>	max. 1500,- € all inclusive		
<b>Reporting:</b>			
Weekly meetings in customers flat, Monday, 10.00-11.00 pm			
<b>Head of Project:</b>		<b>WP Responsible:</b>	
Date:		Date:	
Signature:		Signature:	

# Work packages

*Please define 2 work packages for your work breakdown structure.*





# Estimation of costs, work load and time

## Most common methods of cost and time estimation: Expert Surveys

With the help of experiences from the past, known information are evaluated and converted into work

**Good knowledge base and a lot of experience is necessary! Furthermore...**

- Exact scope of the work packages
- Definite results of the work packages
- Required steps for the execution
- Extensive experiences from similar projects

**Discuss in detail the work packages with responsible employees**

Elbphilharmonie:

Costs: 241 Mio.€ (2007) → 789 Mio.€

Opening: 2010 -> 2017



# Estimation of costs, work load and time

## Hints concerning the estimation

Don't calculate with a too narrow margin in case of unforeseeable events

Do not accept compromises in negotiations if you are not convinced

Participate the project team members in the estimation process -> motivation!

Document your assumptions / dependencies of your calculation

Evaluation at the end of the project (lessons learned)

Ask for review by experienced colleagues / experts

# Time planning

## Time scheduling



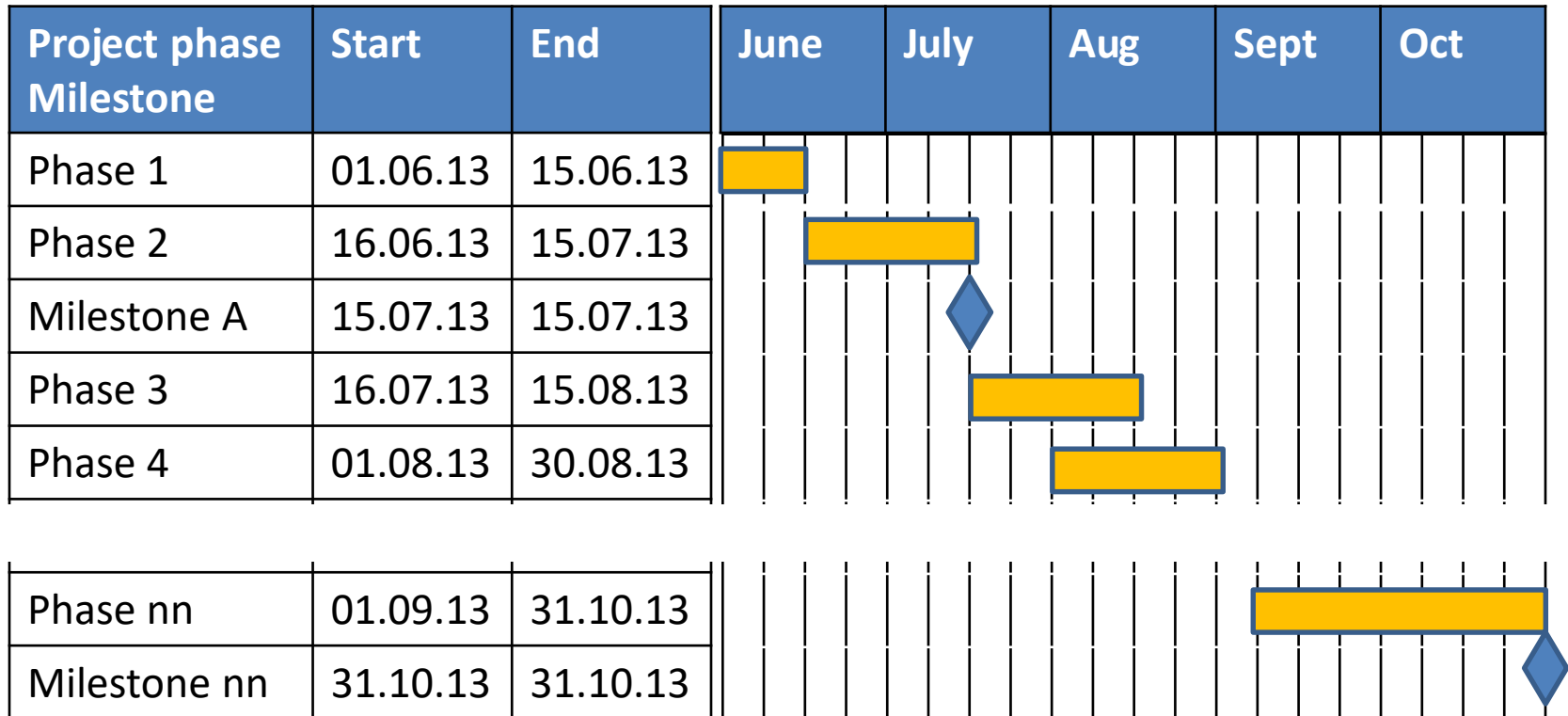
### Goal:

Create a common time schedule of the whole project displaying the major activities (work packages) and relevant milestones in a logical and efficient order.

### Procedure:

- Unpack the activities which are contained in the work packages of the WBS, bring them into a logical order and provide them with calculated data
- Analyse work packages and combine them to collective processes / tasks
- Identify precedence relationships and logical dependencies
- Define milestones (checkpoints for important intermediate results)
- Present the processes with duration and dependencies by:
  - Bar charts (Gantt charts)
  - Network plans
  - Deadline lists (~ To Do lists)

# Time planning



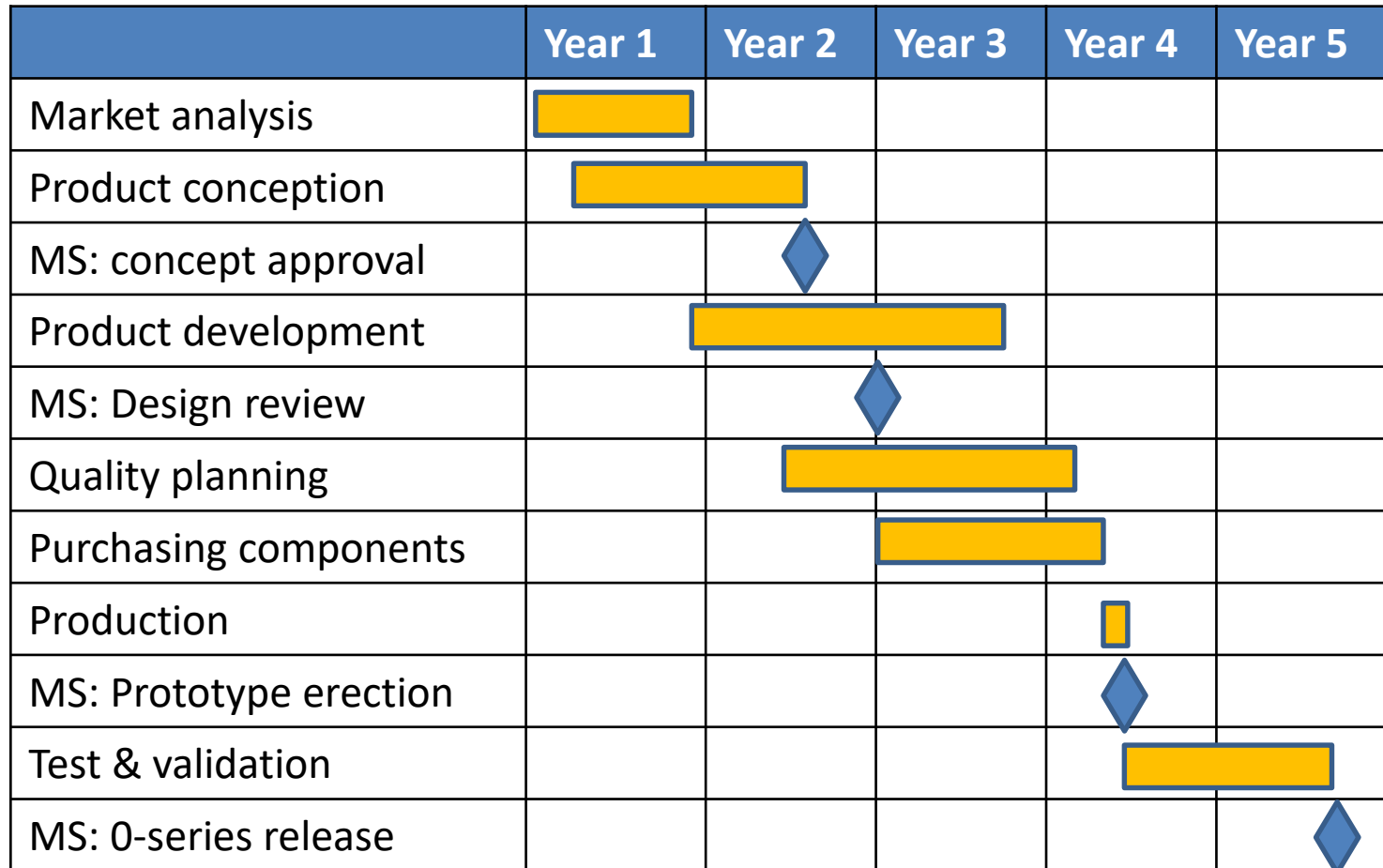
Period



Point of time

# Time planning

## Development of a new wind energy converter



- 0. General Information
- 1. Introduction
- 2. Project Initiation (Start)
- 3. Project Organization
- 4. Project Definition and Planning
- 5. Project Execution**
- 6. Project Closure



# Project Execution

1. Project Controlling
2. Milestone-Trend-Analysis
3. Earned-Value-Analysis
4. Reporting
5. Risk Management
6. Change Management
7. Claim Management



# Project controlling

## Tasks during project execution

### Project manager:

#### **Project controlling**

- **Coordination und communication**
- **Check dates and deadlines**
- **Control costs**
- **Corrective measures**
- **Change management**
- **Motivation of the project team**
- **Quality management**

### Project team members:

#### **Executing tasks & reporting**

- **Execute work packages**
- **Check dates and deadlines**
- **In-time reporting to the project manager in case of project risks**
- **Reporting status quo**
- **Focus on own tasks and responsibilities**

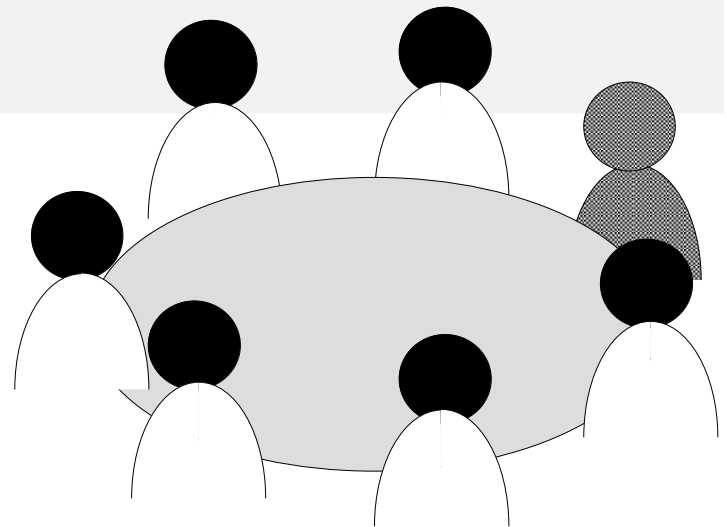
**Preconditions for effective project controlling:    project planning**



# Project controlling

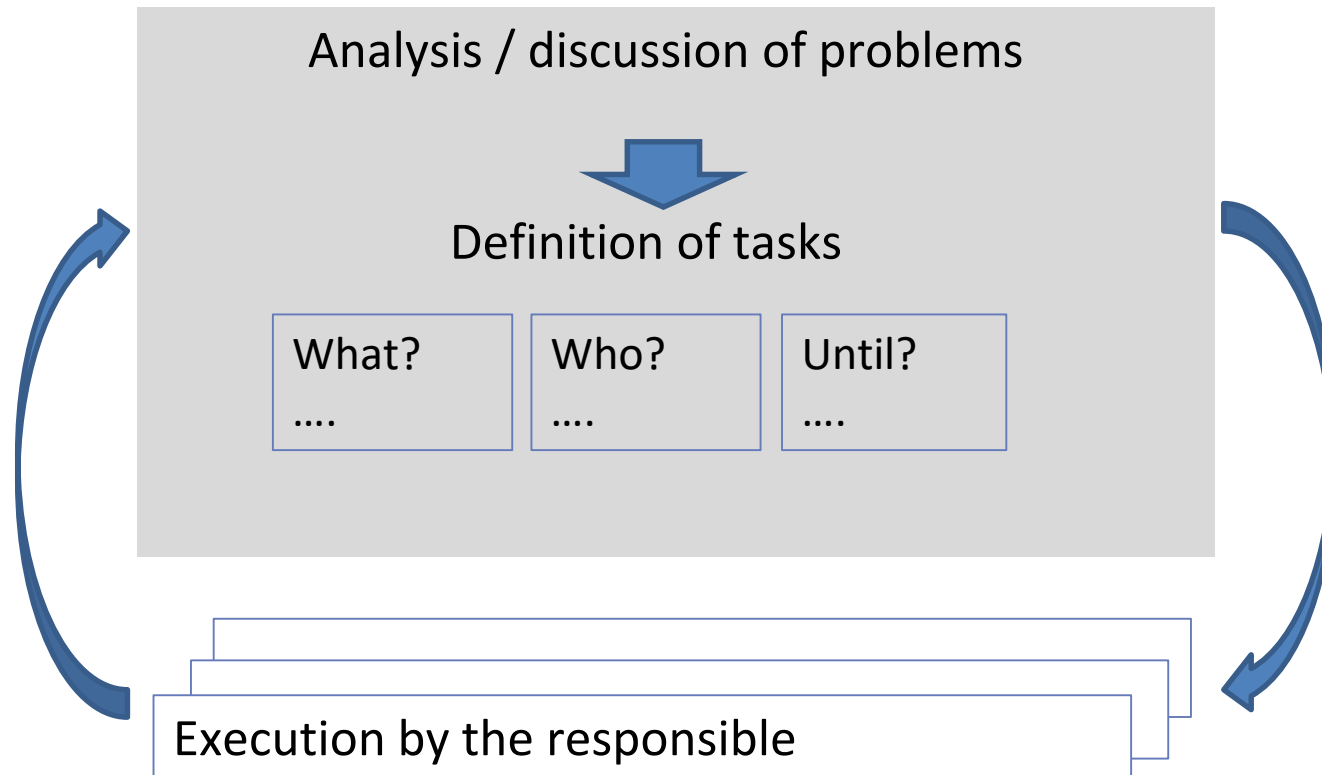
## Regular team meetings

- Regular team meetings as one of the most important elements within PM
- Project situation will be analyzed within the team
- Tasks will be derived and clearly allocated to team members with a defined time line
- Results and todo's will be documented. The fulfillment will be checked on the next team meeting.



# Project controlling

## Regular team meetings



# Project controlling

## Organisation of team meetings:

1. In-time invitation of participants (incl. agenda, place, date, duration)
2. Booking the meeting room, checking office infrastructure (data projector,..), drinks, (meals)...
3. Starting the meeting in-time
4. Address of welcome (new participants, birthdays,..). Respect different cultures!
5. Denominate keeper of minutes (Protokollführer)
6. List attendances
7. Ask for acceptance of protocol from last meeting
8. Introduction (topics, agenda, ..)
9. (Open issues from last meeting - discussion of todo-list)
10. Presentations and discussions
11. Controlling the duration of the meeting, keeping in-time
12. Following the objectives of the meeting
13. Listing of all resolutions, results and todo's
14. Clarification, allocation of responsibilities and due dates for new work packages
15. Definition of date, duration and place of next meeting
16. Closing the meeting in-time

# Project controlling

## Team meetings: minutes of meeting

For every team meeting the minutes of meeting should be taken

### Contents of minutes of meeting:

1. Topic of the meeting, e.g. project meeting ....(number)
2. Date and place
3. Chair of meeting / moderator
4. Keeper of minutes
5. Attendees (present, authorized absence, unexcused absence)
- 6. Resolutions, results, tasks with due date and responsibilities**
7. Next meeting (place, date, duration)

In case of regular and recurrent project meetings it makes sense to add a todo-list to the minutes of meeting. In the todo-list the tasks , date of registration, target date and responsibilities are listed.

The list will be checked at the beginning of the meeting.

# Final presentation

**1<sup>st</sup> Subject / Team 1 (Maria-Magdalena Munteanu / Merve Avci / Stephane Enit):**

Development of a vaccine against COVID 19

You are working in a pharmaceutical firm which is developing an new vaccine against COVID 19. The vaccine should be developed, tested and delivered in high numbers short-term.

**2<sup>nd</sup> Subject / Team 2 (Omar Rezk / Maxime Douchain):**

Development of a medication against Dengue Fever

You are working in a pharmaceutical firm which is developing a new medication against Dengue Fever. The medication should have high effectiveness, be cost-efficient and be producible world wide.

# Final presentation

## Scope:

Perform a project plan of your project with the following content:

- Project order (fill in the template, present the content in PowerPoint)
- Work breakdown structure (min. 4 levels, 16 work packages)
- 1 work package (fill in the template, present the content in PowerPoint)

**Presentation:** max. 15 min., everyone to present one part with PowerPoint

# Thank you for listening!