

Project Management

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 1. Project Definition
 2. Project planning
 3. Project implementation
 4. Project closure

1 PROJECT MANAGEMENT MODELS

- Definition: What is a project
- Standards
- Project tasks
- Project Management models
- Project roles

Which elements are defining a project ?

- Clear objectives – strong strategy
- Clear start– clear end (timely limited)
- Novel and risky
- Resources (budget, team, etc.)
- Complexity
- Interdisciplinary and und divisional comprehensive
- Agreed quality standards and control points

PM is a methodical approach to transform projects - not an instrument for strategic decision making.

PM is a time and cost constrained operation to realize a set of defined deliverables up to quality standards and deliverables (IPMA 2012)

Project management is the collectivity of all management tasks, - organization,- techniques and instruments, for the transaction of a project (DIN 69901).

Project management standards

- International Project Management Assoziation (IPMA)
 - Individual Competence Baseline ICB 4.0
- Project Management Institute (PMI)
 - Project Management Body of Knowledge (PMBOK)
- Prince2
- Scrum Alliance

Project Management Tasks

- Project planning
 - Project definition, planning of tasks, planning of deadlines, planning of resources, financial planning
- Project implementation / organization
 - Role definition, team formation, task arrangement, communication, interface management
- Project execution
 - Execution of the planned activities, risk management,
- Project controlling
 - Interacted surveillance of achievement, quality, deadlines resources, costs, financial resources, pursuit of the development of critical success factor

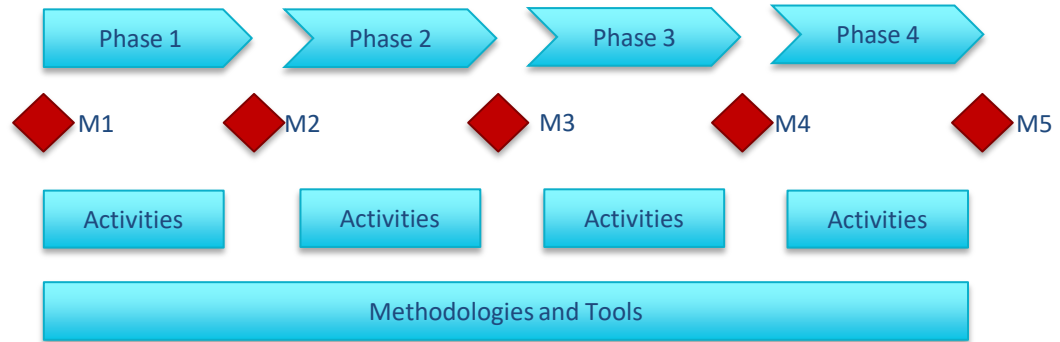
Project Management Tasks

- Project team leadership
 - Encouragement of objectives clearness and acceptance, encouragement of collaboration, formation of working conditions, team break up
- Communication & Stakeholder management
 - Stakeholder analysis, project marketing
- Project knowledge management
 - Integration of learnings to existing and future projects

Project Management Models

Sequential projects contain:

- Phases
- Milestones
- Activities
- Methodologies and tool



- The elements shown are GENERIC elements used in project management methodologies, individual project will be tailored individually for the industry and project need

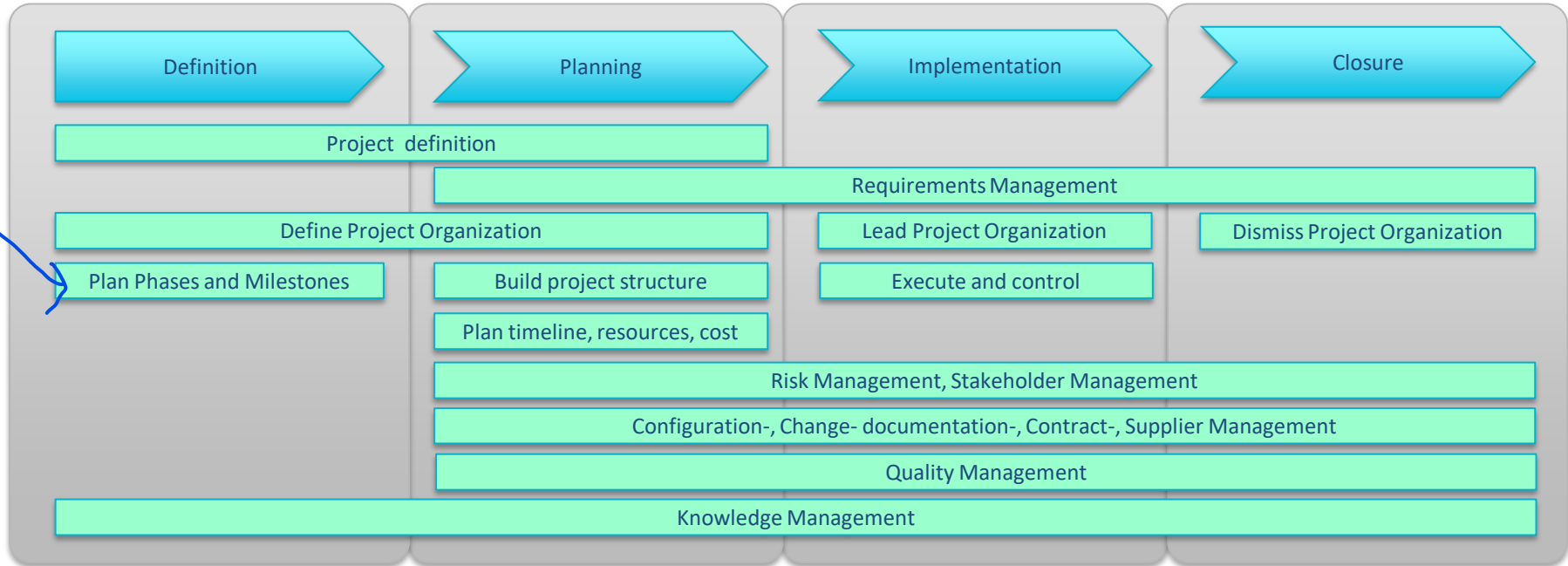
Phases and Milestones



Milestone names are typical examples

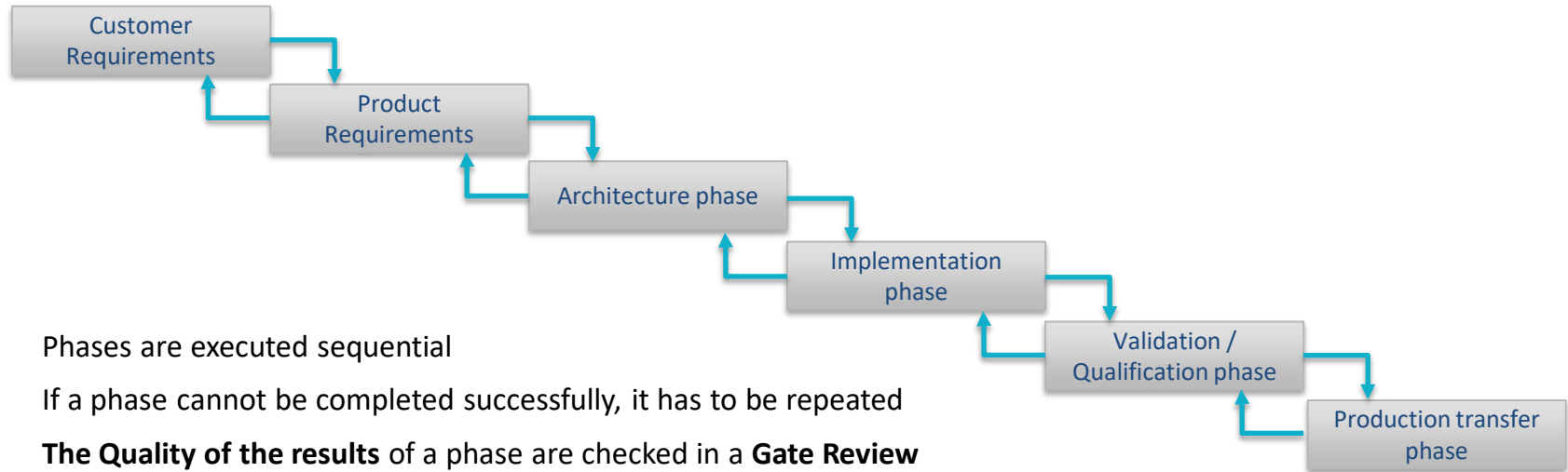
Rough structure of phases and milestones.

Typical Activities



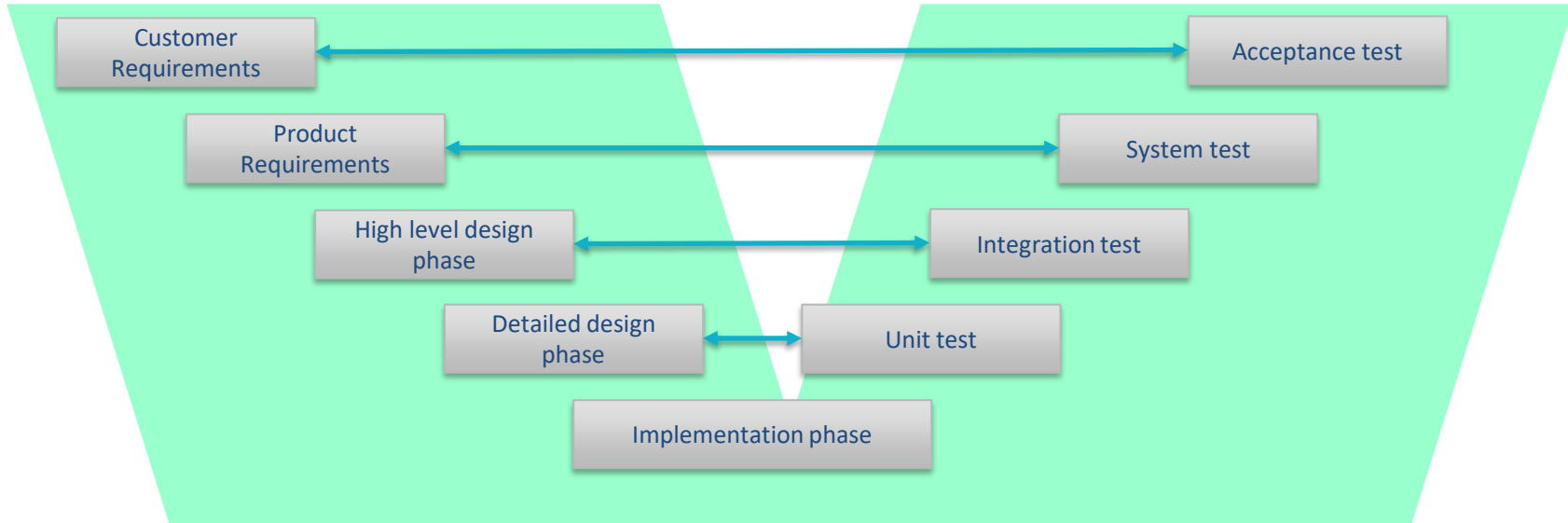
- **Project Management Models**
 - Waterfall Model
 - V-Model
 - Simultaneous Engineering

Waterfall Model



- Phases are executed sequential
- If a phase cannot be completed successfully, it has to be repeated
- **The Quality of the results** of a phase are checked in a **Gate Review meeting**, e.g. using check lists, showing and reviewing results, ...
- Passing the **Gate Review meeting** is needed to start the next phase

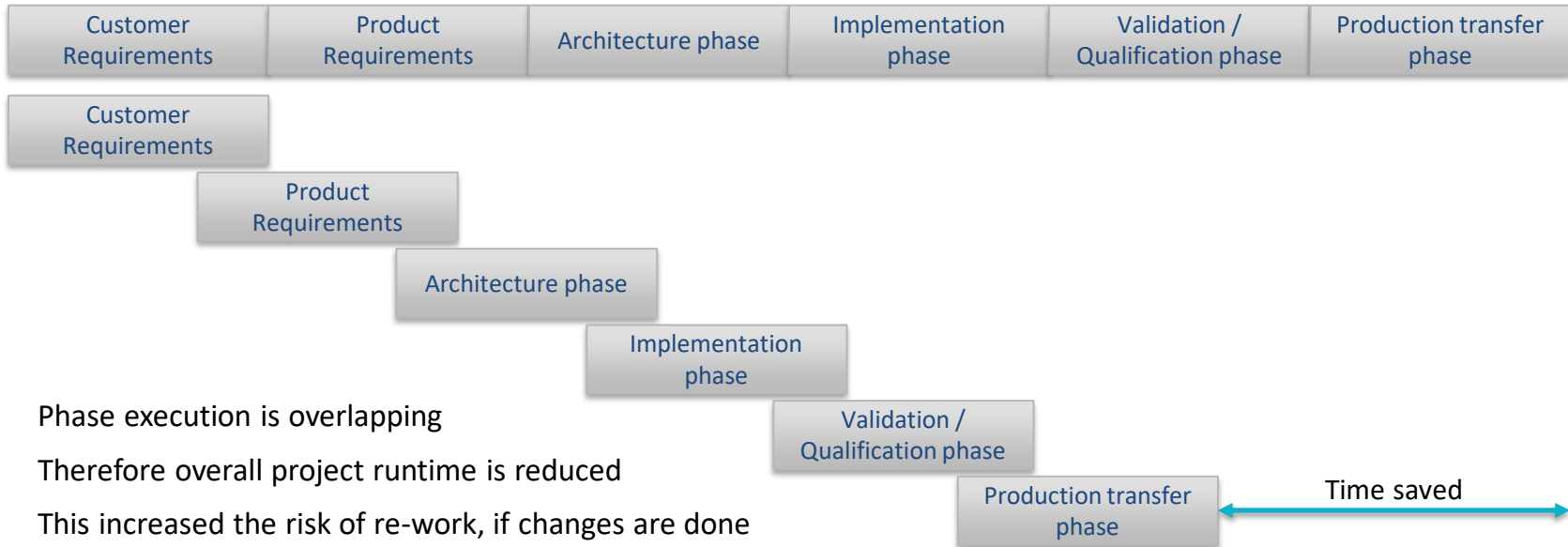
V – Model



V-Model

- The V Model is used in a sequential way to execute the project phases
- Customer requirements are broken down from high level design (e.g. System) into low level design (e.g components, blocks).
- The left side of the V-Model is executed from top to bottom.
- To each level corresponding tests are defined and have to be executed and passed. Then the blocks can be integrated, and the next level of tests can be executed.
- The right side of the V-Model is executed from bottom to the top.
- **The Quality of Results** is ensured by **passing a dedicated sets of tests** for each level

Simultaneous (Concurrent) Engineering



- Phase execution is overlapping
- Therefore overall project runtime is reduced
- This increased the risk of re-work, if changes are done in the previous phase

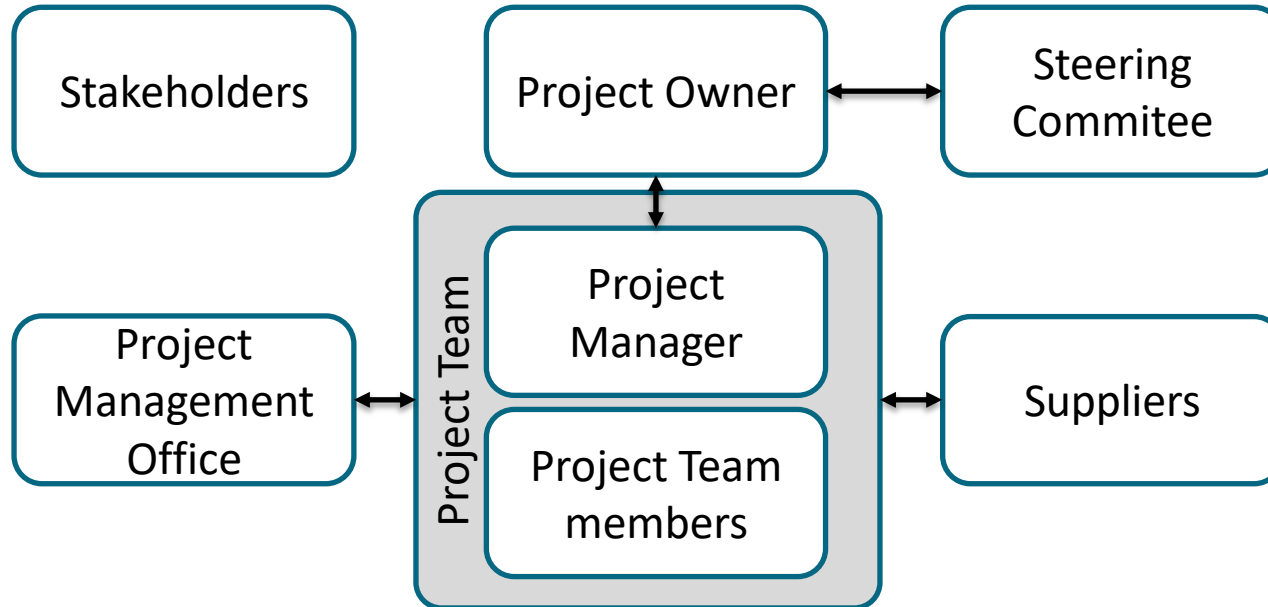
Summary

- Traditional, sequential project management is the execution of activities according to a project plan
- During the implementation phase the goal is to minimize deviations from the plan
- A typical model includes Phases, Milestones, Activities and methodologies and tools
- Typical models: Waterfall, V-Model, Simultaneous engineering
- All models try to plan the activities of the complete project until project closure as early as possible
- Typical phases: Definition, Planning, Implementation, Closure

PROJECT ROLES

Project Roles

Stakeholders are people not responsible and not involved in the project (They may have nothing to do with the project. But still they have opinions on the project and also influencing it).



Project Owner

Role description:

- Ensures the budget
- Sets the budget, time and scope targets
- Makes strategic decisions in the project
- Head of the steering committee, when a steering committee is installed

Responsibilities and Authorities:

- Starts, finishes and terminates projects
- Decides on change requests influencing project targets
- Communicates the project purpose and value
- Ensures the project has the needed priority
- Approves project and risk management plans

Steering Committee

Role description:

- Is an escalation and decision committee
- Contains Management representatives
- Can have members from the internal organization as well as from the customer organization

Responsibilities and Authorities:

- Decides on conflicts, which cannot be solved by the project manager and project owner
- Balances the interests between customer and executing company

Project Manager

Role description:

- Responsible for the project's success.
- Plans, organizes, drives, and controls the project.
- Form and lead the project team
- Makes operational decisions in the project.
- Central contact person for all questions regarding the project.

Responsibilities and Authorities:

- Ensure achievement of strategic project targets: scope, budget/effort, time.
- Break down the project targets into work packages / tasks
- Ensure appropriate composition of the project team.
- Ensure that appropriate information on project/work package targets and project status is available to the team members.
- Continuously evaluate and track risks. Plan and execute mitigating measures.
- Respond to change requests to project targets in alignment with Project Owner.
- Perform Stakeholder and Expectation Management
- Execute the project according to existing business processes and legal requirements.
- Provide a constantly available, up-to-date, and transparent project status and project documentation.
- Perform lessons learned at end of project

Project Team Member

Role description:

- Performs assigned tasks / work packages within the project.
- Autonomously completes individual tasks / work packages that have been defined by the Project Manager.

Responsibilities and Authorities:

- Commitment to achieve the agreed tasks / work package targets: scope, budget, time.
- Ensure correctness of the deliverables of all assigned tasks and work packages.
- Communicate all project relevant information to the Project Manager, e.g. resource/time constraints, risks, status of his/her tasks / work packages.
- Proactively report delays, technical and resource conflicts to Project Manager.
- Assess risks for the execution of a task / work package and perform agreed risk mitigation measures.
- Documentation of results.

Supplier

Role description:

- Delivers external deliverables to the project
- Suppliers can be
 - internal, e.g. other teams, departments, projects
 - external companies

Responsibilities:

- Deliver agreed deliverables according to agreed scope, time and quality

Project Management Office

Role description:

- Supports the execution of the project
- Is supporting in administrative and commercial tasks, e.g.
 - project data analysis
 - project reporting
 - Documentation
 - progress analysis
 - purchase orders, ...

Project Stakeholders

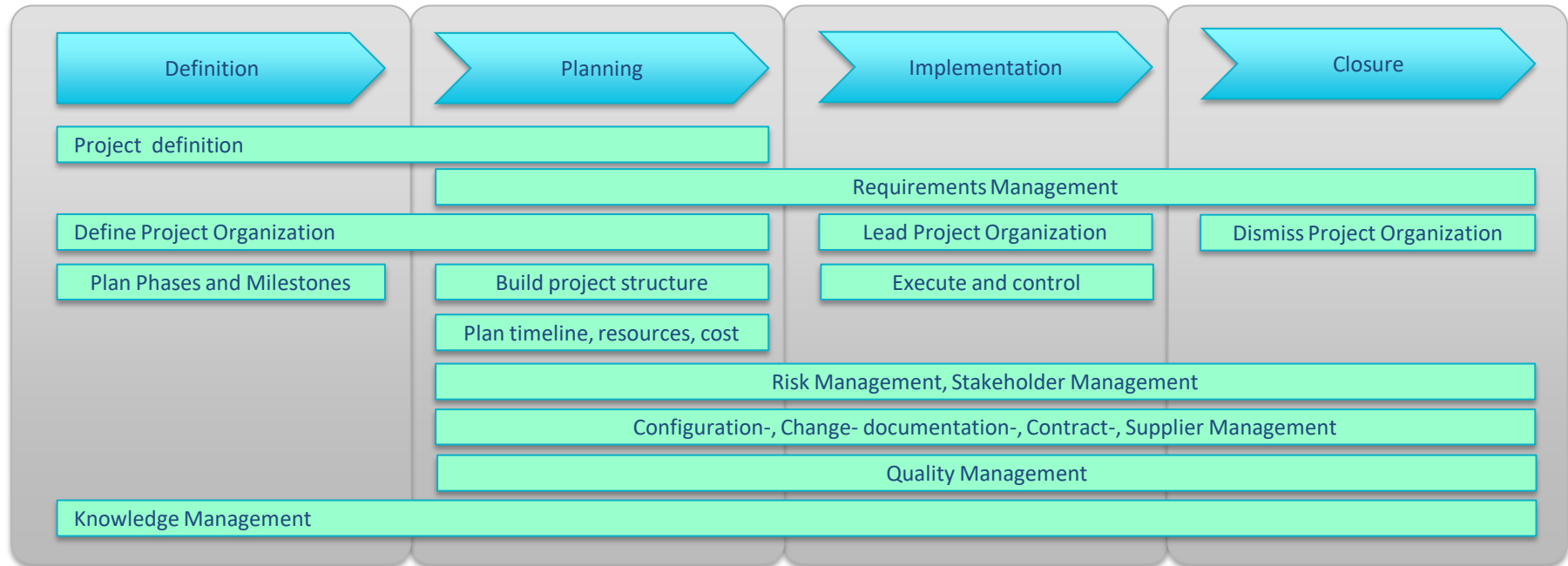
Role description:

- Project stakeholders are an individual, group, or organization, who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project.
- Project stakeholders are entities that have an interest in a given project. These stakeholders may be inside or outside an organization which:
 - sponsor a project, or
 - have an interest or a gain upon a successful completion of a project;
 - may have a positive or negative influence in the project completion.
- The following are examples of project stakeholders:
 - Senior management
 - Marketing
 - Production
 - Resource Managers
 - ...

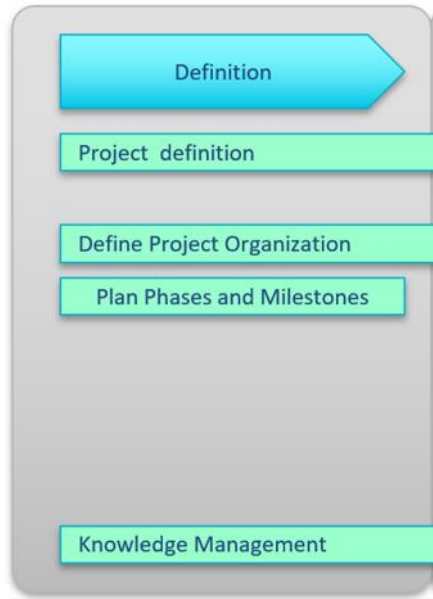
2. PROJECT TOOLS AND METHODS

Quality gates. Milestone meeting in between of phases, Project owner has the last last word. Project manager presents the organizational or (administrational) things of the project and the technical stuff is accompanied by team experts.

Typical Activities



2.1 Project Definition Phase



Project Goals (Time, Quality, Cost)

Customer Requirements

High Level Planning

Project Organization

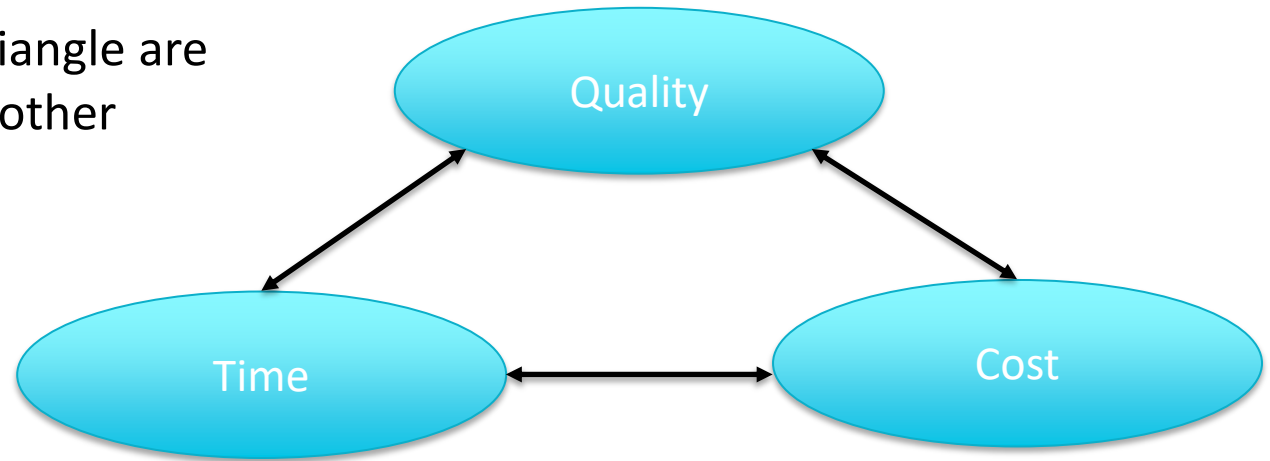
Project One Pager

Kick Off Meeting

Project Goals / Scope of the project

“Magic Triangle”

The 3 elements of the triangle are interdependent to each other



Project goals

- Cost Goals
 - Project cost, production costs, maintenance costs, disposal costs
- Time goals
 - Project deliverables, product lifetime, maintenance interval
- Quality goals
 - Functional aspects, producibility, product environment (e.g. Automotive vs. consumer products)

SMART Goals

S	specific	clear, precise and understandable
M	measurable	clear criteria to check fulfilment
A	achievable	can be reached in realistic circumstances
R	relevant	important for the project and overall goal
T	time bound	planable

Additional aspect of goal definition

- Goals have to be formulated neutral to solutions
- Goals have to be known to all stakeholders in the project and outside the project
- Goals shall be formulated in a way, that they stay stable for the complete project lifecycle
- Conflicts of goals are not allowed
- Goals shall be given a priority ranking

Requirements Management

- Defining the goals of a project is the first point to capture requirements to be used in the project
- Requirements are the base for the product design
- They are used to validate and release the product developed
- Requirements should follow a common syntax during requirements definition
- Requirements shall not include more than one requirement
- Requirements should be measurable

Requirements Traceability

During the complete project life cycle requirements are used, they are broken down and getting more detailed during the project life cycle.

Requirements are the base to develop test cases for the verification and validation phase.

Therefore requirements need to be **traceable**. For each requirement it should be known

- What is the source of the requirement ?
- How are requirements connected to each other ?
- What are design elements, the test cases and test results connected to a requirement

Customer Requirement Document (Lastenheft)

A Customer requirements document is the collection of requirements given by the customer to a project

It documents, **WHAT** the customer would like to get as a result of the project, and it is created by the customer

A customer requirements document can be used to request quotes from different suppliers and to select the best supplier for this product (e.g. RFQ Request for Quotation)

Product requirement document (Pflichtenheft)

A product requirements document describes **HOW** the supplier (project team) will fulfil the customer requirements

Product requirements shall be released by the customer to ensure a common understanding. (e.g. Review process)

Product requirements are the base for the break down into product architecture, high-level and low-level design requirements used in the implementation phase of the project

Phases and milestone planning

The phases and milestone planning is the creation of the first high level project plan
It includes

- A high-level structure of the project, including sequential and parallel phases
- A high-level set of activities and in the phases
- A high-level view on needed resources
- A first draft of project cost and project timeline

Milestones are used to document dates for important results of the project
There can be one or more milestones defined per phase

Project organization

Core team

During the definition phase not the complete project team will be needed and will be known. A core team will work together with the project manager to define and plan the project

The core team is defined, e.g using an org chart. The org chart shall clearly indicate the areas of responsibility for each team member

Project organization

Infrastructure:

Define Meeting structure

Prepare directory structure for the project data

Define tools and templates for documentation, requirements management, change management, ...

Very often company wide standards are used for infrastructure

Project Kick Off Meeting

The Kick Off Meeting is used to share and align information to all involved stakeholders of the project according to the phase, e.g. customer, project manager, core team,

Typical agenda points:

- Intro Round
- High level project goals, known customer milestones
- Next steps in the project

Project Start Workshop

The project start workshop is a working meeting.

a typical agenda includes:

- Introduction round
- Presentation project management model
- Definition of stakeholders
- Definition of high-level project goals
- Project phases and milestones, activities
- Resource and cost estimation
- Project organization
- First project risks

This leads to the creation of an Project One Pager

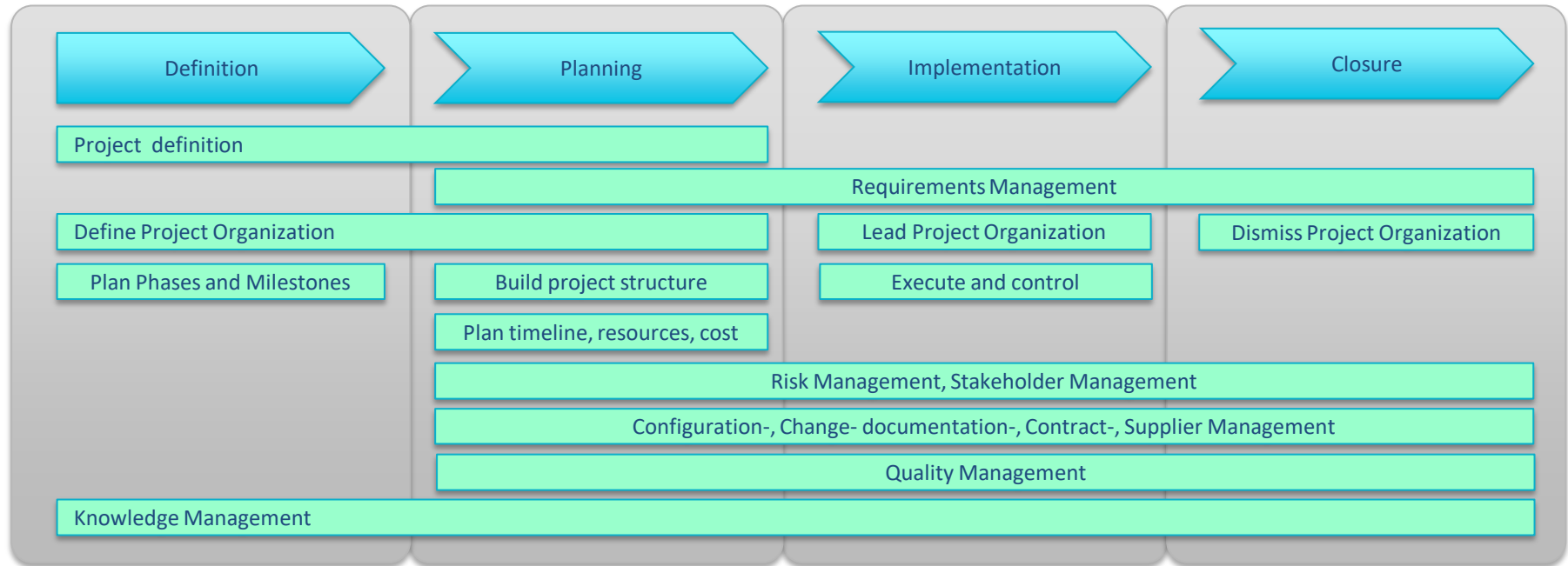
Project One Pager

The project one pager is a first high level summary of the project

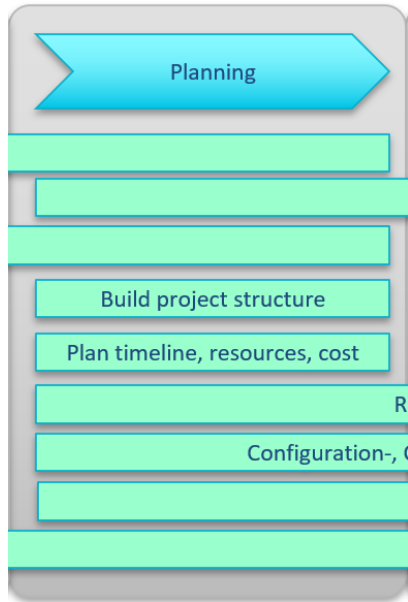
Is a result of the definition phase and input for the planning phase of the project

FH JOANNEUM Electronic Engineering		Project Name
Project One Pager		
Project Name:		
Project Phase:		
Objectives: Short description of the project		
Project Goals: <ul style="list-style-type: none"> • Goal • 		
Risks:		
Project Startdate:	Project Finish date:	
Milestones: M1: M2:	Project Cost: Human Resources: Material: Total:	
Project Owner: Name	Project Manager: Name	
Project Core Team: Name Name		
Signature Project Owner		
Signature Project Manager		
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Typical Activities



2.2. Project Planning Phase



Work breakdown structure

Effort estimation

Time planning

Resource and cost planning

Risk Management

Communication / Meeting plan

Project Handbook

Project Planning Phase

The Project planning phase starts after passing the “Project Start” Milestone

It uses the data created during the **definition phase** as input for further detailing and working out the project plans

During the **planning phase** a set of detailed plans must be created:

- Work breakdown structure → WHAT needs to be done
- Time Plan → WHEN does it need to be done
- Resource Plan → WITH WHOM will it be done
- Cost Plan → HOW MUCH is the cost to do it

The result are reviewed during the Gate “Project Approval”. During this Review the quality and completeness of the plans is checked. If the Gate “Project Approval” is passed, the **Implementation Phase** of the project can be started

Work breakdown structure

Work breakdown structure (or WBS) is a hierarchical tree structure that outlines your project and breaks it down into smaller, more manageable portions.

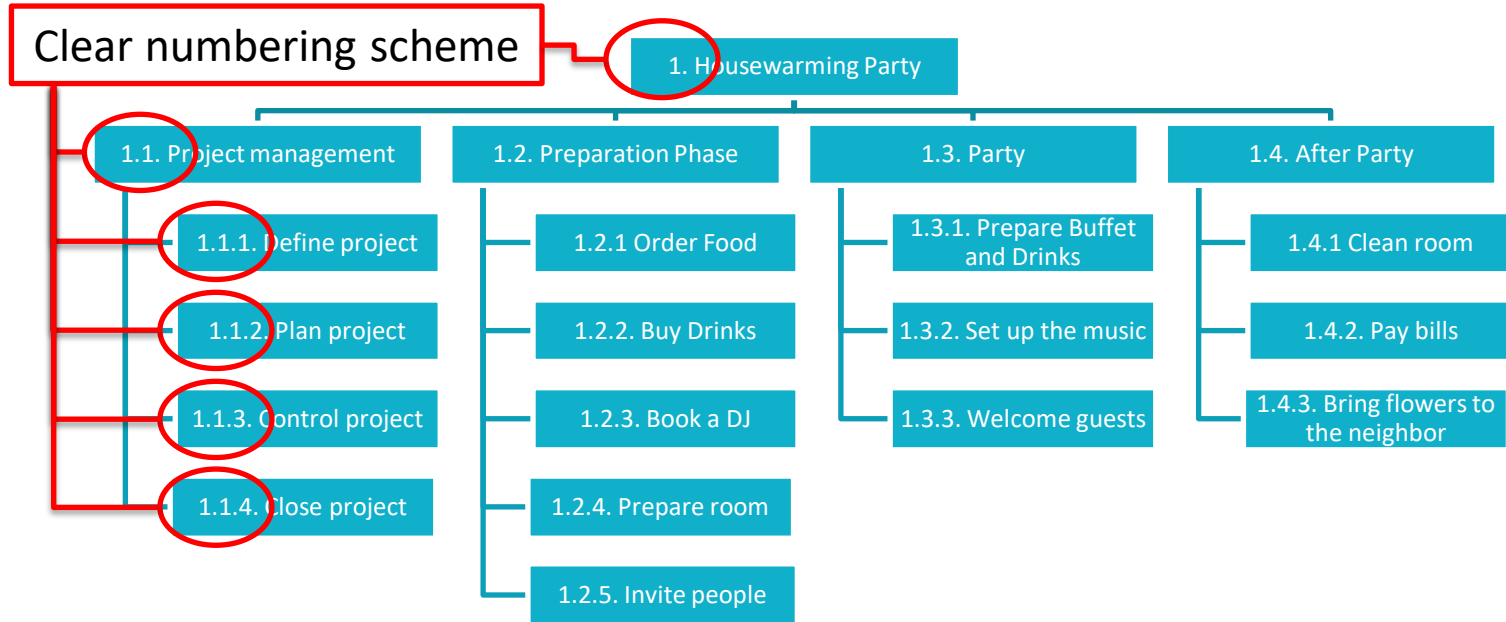
Breaking it down into smaller chunks means work can be done simultaneously by different team members, leading to better team productivity and easier project management overall

The minimum item size in a work breakdown structure is a **work package**

The WBS contains **ALL** work packages to be done in the project, therefore creates an overview, what has to be done in the project

The WBS is the starting point for all other plans created in the project

Work breakdown structure



Work packages

- Work packages included in the WBs are the base for further detailed plans. Therefore the right amount of work packages is essential. A typical amount of work packages is in the range of 20 to 100 work packages, dependent on the project size. A work package shall cover typically 1 – 5 % of a project
- Work packages have to be clearly defined and include a complete set of activities / tasks to be executed
- Work packages have one work package owner, who is responsible for the work package results
- The work package owner is typically a technical expert in the domain
- Several project team members can work in a work package to fulfil all needed tasks

Work package template

Work Package Number	Name of the Work Package			
Work Package Owner				
Work Package Members				
Content				
Results				
Task ID	Task Name	Effort	Due Date	Owner
WP_No.1				
WP_No.2				
WP_No.3				
WP_No.4				
WP_No.5				
WP_No.6				
WP_No.7				
WP_No.8				
WP_No.9				
WP_No.10				
WP_No.11				
WP_No.12				
WP_No.13				
WP_No.14				
WP_No.15				
WP_No.16				
WP_No.17				
WP_No.18				
WP_No.19				
WP_No.20				

Effort Estimation

Projects have an innovative and new nature. Therefore it is difficult to use old data from previous projects to define the efforts needed to execute the project. Typically efforts for a new project need to be estimated.

- **Effort:** the needed amount of time or money to realize an activity.
 - (e.g. person hours, person days, person months, machine hours, ...)
- **Duration:** The time needed from start to end to finalize an activity, taking the available resources into account
 - e.g. Effort: 10 person days, 2 team members → Duration 5 days
Effort: 10 person days, 4 team members → Duration 2,5 days

Attention: A linear scaling is not always realistic; activities have to keep a useful size and cannot be split into indefinite slices. Larger teams need more administrative overhead and alignment

Effort Estimation Methodologies

- Expert judgement
 - One or more domain experts are invited for an estimation session on activities defined in the work package description
 - If several experts estimate an activity and create significantly different results, the highest and lowest estimates should be discussed to understand the reasoning for the big variance
 - If activities are very hard to estimate, try to break them down into smaller parts or add these activities to the risk register of the project to follow up later.
- Analogous Estimates
 - Historical data of similar activities or projects can be used for estimation. Improvements based on more efficient processes, tools, know how and ways of working have to be taken into account
 - Historical data needs to be found easily and has to be realistic → Effort tracking has to be done during the implementation phase and has to be analysed and stored during the project closure phase

Effort Estimation Methodologies

Three-point Estimation

Three-point estimations asks during the estimation process for three values:

- the optimistic estimate (o)
- the pessimistic estimate (p)
- The most likely estimate (m)

The estimate E can be calculated: $E = (o + 4*m + p)/6$

Advantage: very transparent, shows the spread of estimates openly and therefore reduces the risk, that untransparent contingency buffers are added to the estimate.

Communication / Meeting plan

Planning of the meeting structure and communication is one of the important tasks for project management.

It ensures that

- all stakeholders **inside** the project (Project Manager, Project team members, Suppliers, ...)
 - and **outside** the project (Project Owner, Steering Committee, Line Management, Quality , ...)
- are informed on a regular base and that the status of the project can be tracked and shared.

Based on the audience the content and nature of the meetings and the content of the communication will be different

Goals of the communication plan:

- Optimization of the information and communication flow
- Regular exchange of information
- Creating Transparency in the project
- Planning of meeting structure
- Planning of communication structure

Typical meetings

- Kick Off meeting
- Steering committee meeting
- Project Owner meeting
- Project status meeting
- Project working meeting
- Project Info

Project Kick Off Meeting

The Kick Off Meeting is used to share and align information to all involved stakeholders of the project according to the phase, e.g. customer, project manager, core team,

Typical agenda points:

- Introduction
- Project objectives, Business background
- High level project goals
- Project organization and project roles
- Communication plan
- Project Plan
- Q&A

Steering committee Meeting

The steering committee meeting is used for strategic project controlling with higher management levels

Typical Agenda points:

- Condensed project reporting (status, progress, risks)
- Outlook on progress and next steps
- Requests for decisions, which cannot be done by the Project Manager and Project Owner alone
 - e.g. Resource needs from other departments,
 - changes impacting the business case of the project or product,
 - ...

Project Owner Meeting

The project Owner Meeting is used for strategic project controlling within the portfolio of projects, the project owner is responsible for.

Typical Agenda points:

- Condensed project reporting (status, progress, risks)
- Outlook on progress and next steps
- Requests for decisions, which cannot be done by the Project Manager alone
 - e.g. Resource needs from other project or subprojects
 - Priority decisions within project or project portfolio
 - Information on risk status
 - decisions on the handling of risk items
 - changes impacting the cost / business case of the project or product,
 - ...

Project Status Meeting

The project status meeting is a regular meeting with the project team or the project core team, dependent on the project size.

Typical Agenda points:

- Project controlling
- Verbal or written progress reporting from project (core) team members on work package status
- Status check on running activities and open ToDo's
- Discussion of open points and actual problems in the project
- Identification of delays and deviations from the plan
- Definition and decision on countermeasures for deviations
- Needed Decisions
- Outlook and next steps in the project

Project working meetings

Individual meeting organized by the project manager or by a project team member to discuss, align or review technical content of the project.

Agenda and frequency are given by the actual situation in the project and the topics to be discussed

Examples:

- Change Control Board (CCB) Meetings
- Risk Assessments
- Meetings to discuss / decide technical solutions within the project
- Review meetings to ensure the quality of deliverables
- Milestone / Gate preparation
- Quality & Process reviews
- ...

Project Information

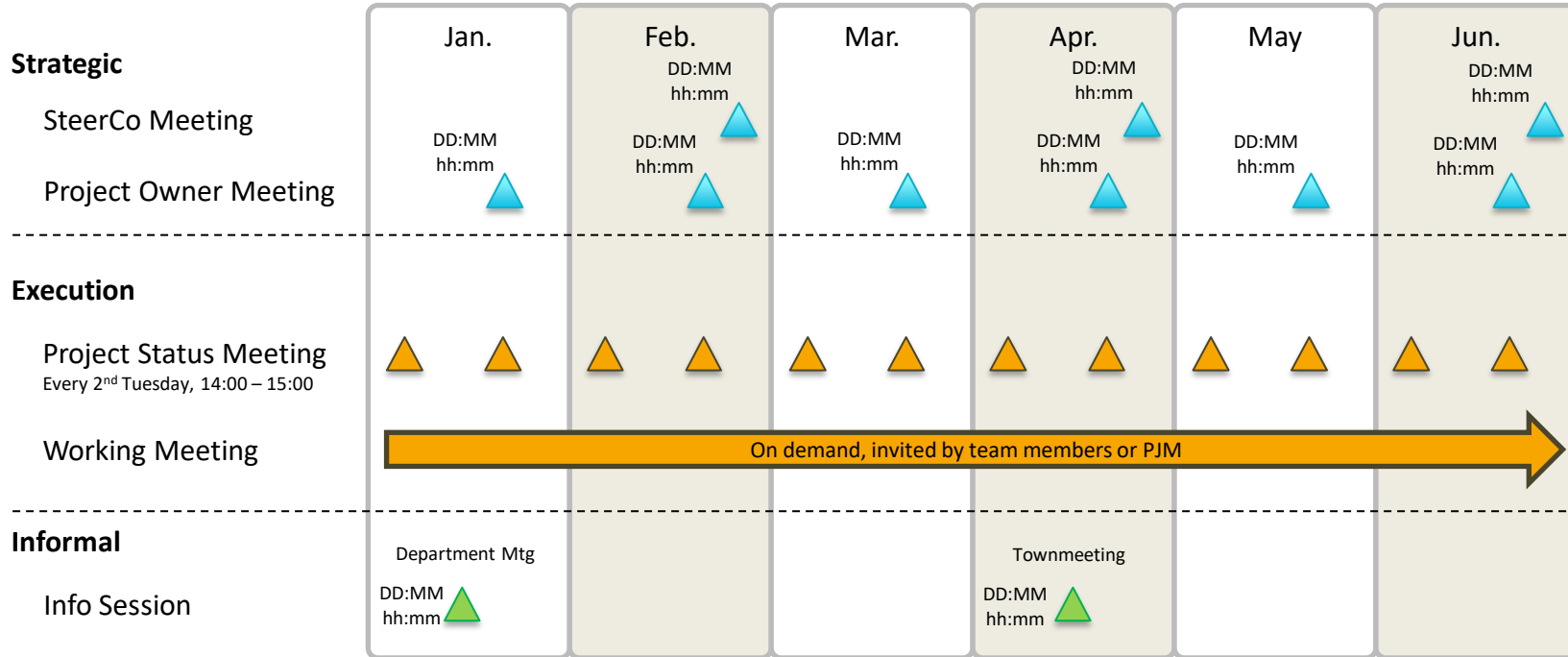
Information to the company / organization / department about the project goals, the project status and progress, customer situation,

Used to ensure transparency and to promote the project in the organization

Can be done during:

- Department meetings
- Town meetings
- Project Newsletters
- ...

Example: communication plan

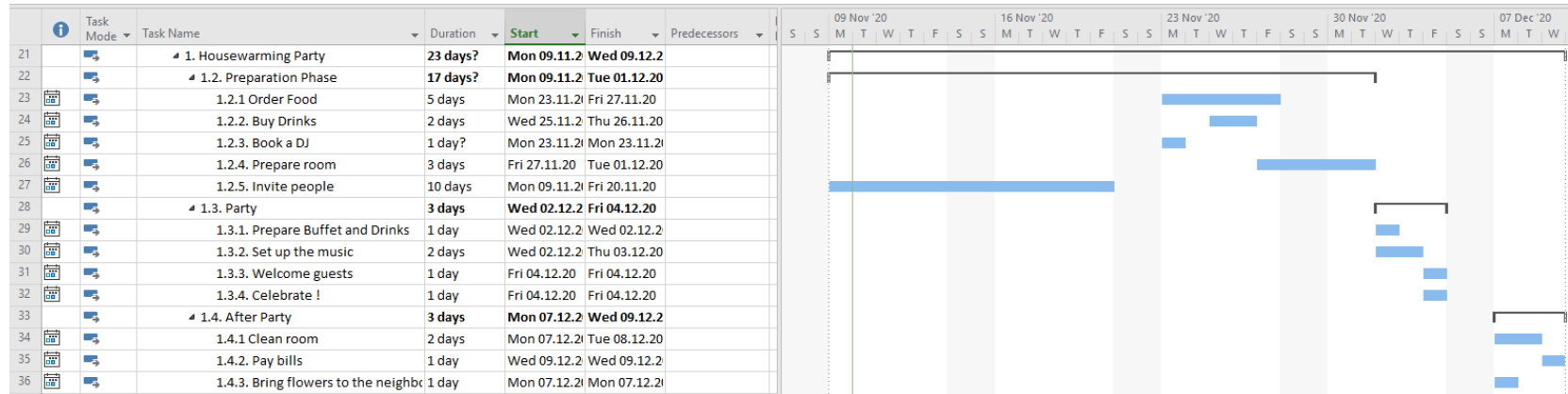


Time Planning

Gantt Chart: A Gantt chart is a type of bar chart that illustrates a project schedule.

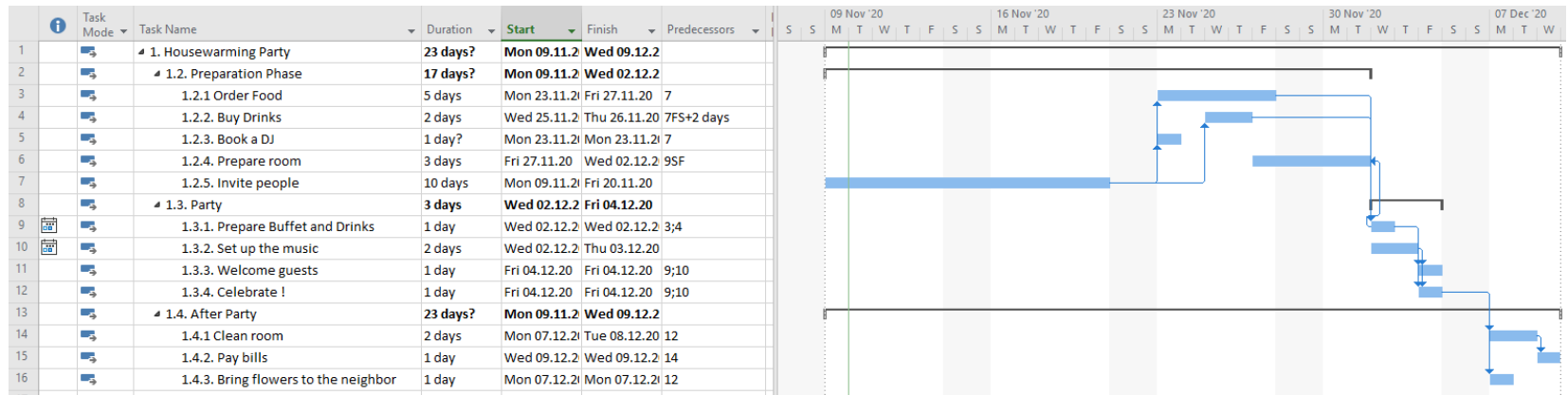
- Gantt charts also show the dependency relationships between activities and the current schedule status.
- Gantt charts visualize the milestones, phases, work packages and activities to be done on the vertical axis
- The time interval is shown on the horizontal axis, visualizing the start and end of the activities, representing the **duration** of the activities planned.
- The **effort** for an activity still needs to be estimated and the needed resource capacity to execute the activity within the given duration needs to be calculated

Gantt Chart



- Shows the milestones, phases, work packages and activities of the project
- Bars represent the duration of the activities

Linked Gantt Chart



- Shows the milestones, phases, work packages and activities of the project
- Bars represent the duration of the activities
- The linked Gantt chart also shows also the dependencies of the activities

Resource Planning

Resources include all people, equipment and material needed to execute the project successfully

During resource planning the project manager

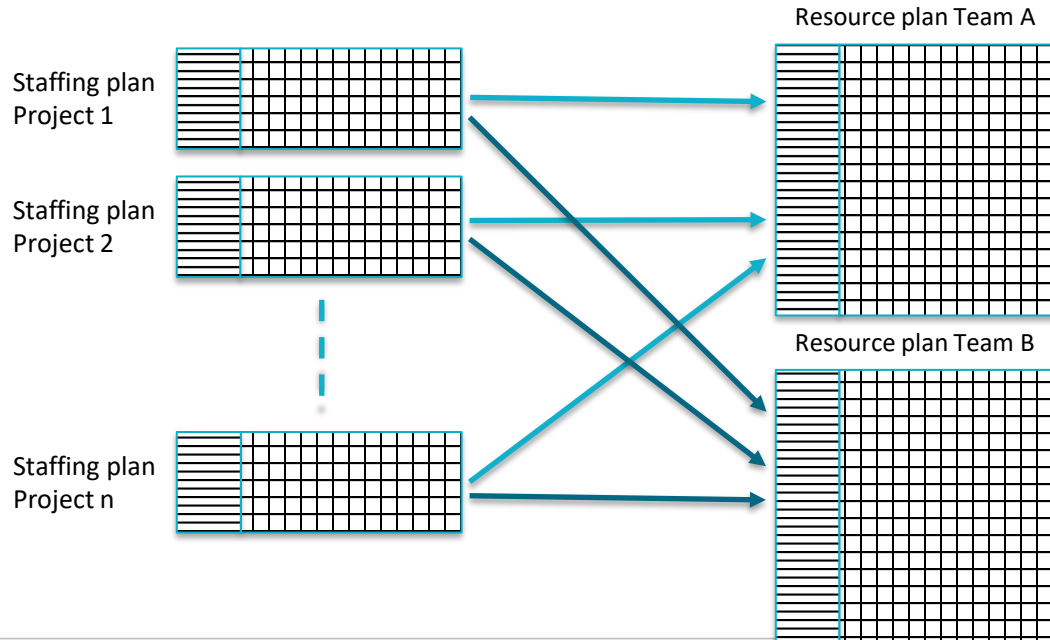
- identifies the resource demand, including the needed quantity and the timing of resources within the project
- needs to clarify the availability of resources for the project
- creates a resource plan which is aligned and connected to the time plan for the project

Challenges for Resource planning are:

- Dependency of time plan and effort estimation: how much resources are needed to finish an activity in the planned duration in the time plan
- Resources are always limited, needed in several projects at the same point in time
- Uncertainty: Efforts for planning resources are based on estimates
- External influences on the project: Vacations, Illness, additional projects, job changes, ...

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Resource leveling in project portfolios



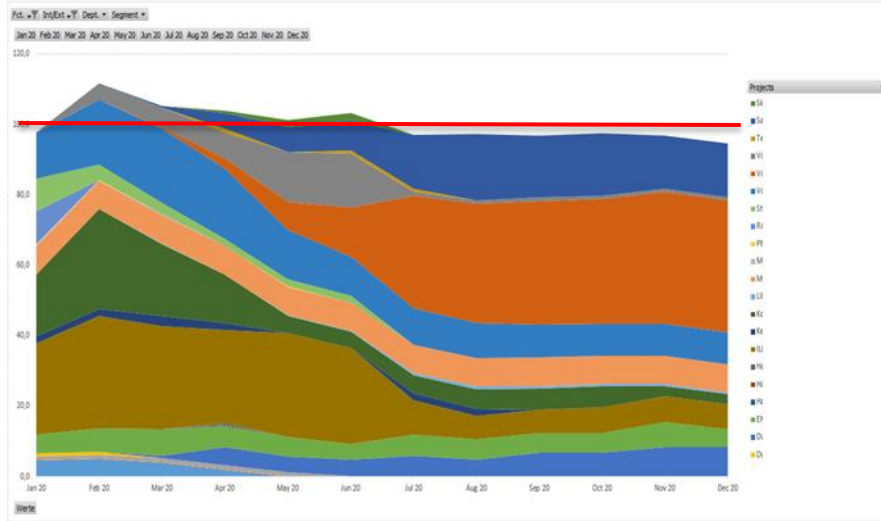
Resource leveling in project portfolios

- The staffing plan of a project is using team members from different development teams in the organization. These teams are usually involved in several projects and have a limited number of team members with the specific skill sets.
- Based on the effort estimates and the time planning each project creates the needed resource staffing plan, including the needed capacity, skill set and time, when and how long the resources are needed
- The staffing plan is included as a resource demand in a resource allocation system
- The resource allocation system includes the allocation of team members for different projects and allows to analyze over-and under-allocation of the different team members

Resource leveling in project portfolios

- The resource allocation system shows the available capacity and shows the actual allocation of team members on **running** and **planned** projects
- During an alignment meeting the project manager and the line manager of the team discuss and match the resource demand of the project with available resources in the team
Important aspects:
 - Skill profile
 - Availability in time
 - Teamwork aspects
- If demand cannot be staffed with existing team members at the requested time, adjustments need to be done
 - Transferring team members from other projects with lower priority to the project
 - Sharing of team members between projects with reduced capacity per project
 - Shift of activities in the project plan to a period, where skilled team members are available
 - Staffing of activities with skilled team members from other teams or external companies (contractors)

Project portfolio view



The project portfolio shows

- the team size planned on different projects over time
- the available capacity and the load situation
- when new projects could be started
- the impact of project shifts and helps to analyze the effects of this

Cost Planning

Cost planning is needed to calculate the overall cost of the project. It can be done after the resource planning is aligned and finished

The project cost planning has to include all cost categories needed for the project

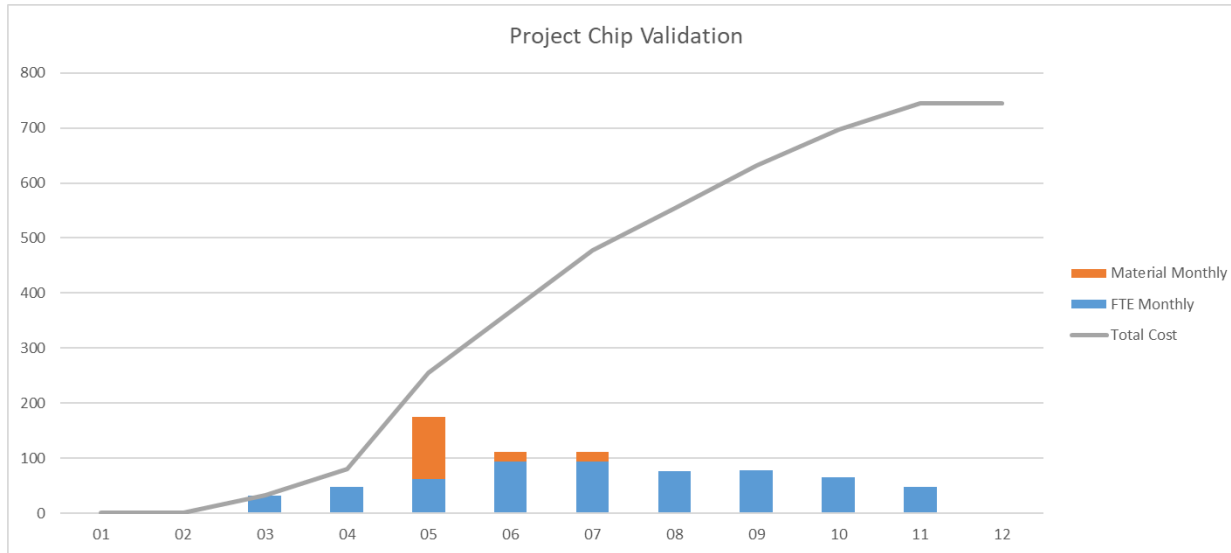
- Human Resource cost (Typically based on cost center cost)
 - Cost center costs include all costs connected to employees of the company (e.g. Salary costs, bonus payments, travel costs, depreciation of office buildings incl. energy, IT, phone, software licenses, ...)
- Material cost
 - e.g. PCB, Wafers, Equipment
 - Subcontracting Cost
 - Tools

To be able to track the costs of the project the distribution of the cost over time is needed. (e.g. monthly or quarterly granularity)

Cost Planning Table

										Cost											
all in kEuro										2021	2021	2021	2021	2021	2021	2021	2021	2021	2021	2021	2021
Month										01	02	03	04	05	06	07	08	09	10	11	12
Total Cost monthly													32	48	175	111	111	77	65	48	
Total Quarterly													32		334			266			113
Total Yearly																					745
FTE Monthly													32	48	62	94	94	77	78	65	48
FTE Quarterly													32		204			248			113
FTE Yearly																					598
Material Monthly															113	18	18				
Material Quarterly															130			18			
Material Yearly																					148
Total Cost													32	80	255	366	478	554	632	697	745
										FTE Input											
										Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21
										2,0			3,0		4,0	6,0	6,0	5,0	5,0	4,0	3,0
Location	Dept.	Cost Cent	Cost Type	Skill	Int/Ext	Res. Mng.	Project #	Project Name	Name	Spalte1	Spalte2	Spalte3	Spalte4	Spalte5	Spalte6	Spalte7	Spalte8	Spalte9	Spalte10	Spalte11	Spalte12
Graz	Hardware Development	1000001	Time Writing	PJM	I	AM	PJ-123456	Chip Validation	Project Manager			0,5	1	1	1	1	1	1	1	1	1
Graz	Hardware Development	1000001	Time Writing	VAL	I	AM	PJ-123456	Chip Validation	Validation Eng. 1			0,5	1	1	1	1	1	1	1	0,5	
Graz	Hardware Development	1000001	Time Writing	VAL	I	AM	PJ-123456	Chip Validation	Validation Eng. 2									0,5	1	0,5	
Graz	Hardware Development	1000001	Time Writing	PCB	I	AM	PJ-123456	Chip Validation	PCB Expert			0,5			1	1					
Graz	Software Development	1000002	Time Writing	SW	I	BN	PJ-123456	Chip Validation	Software Eng. 1			0,5	1	1	1	1	1	1	1	1	1
Graz	Software Development	1000002	Time Writing	SW	I	BN	PJ-123456	Chip Validation	Software Eng. 2					1	1	1	1	1	0,5		
Graz	Software Development	1000002	Time Writing	SWT	I	BN	PJ-123456	Chip Validation	Software Test Eng.						1	1	1	1			
Graz	Hardware Development	1000001	Material	n.a.	n.a.	MATERIAL COST	PJ-123456	Chip Validation	Scope					112500							
Graz	Hardware Development	1000001	Material	n.a.	n.a.	MATERIAL COST	PJ-123456	Chip Validation	PCB					17500	17500						

Cost Planning Graph



Monthly granularity for

- Human resources
- Material

Consolidated Graph for the overall cost of the project

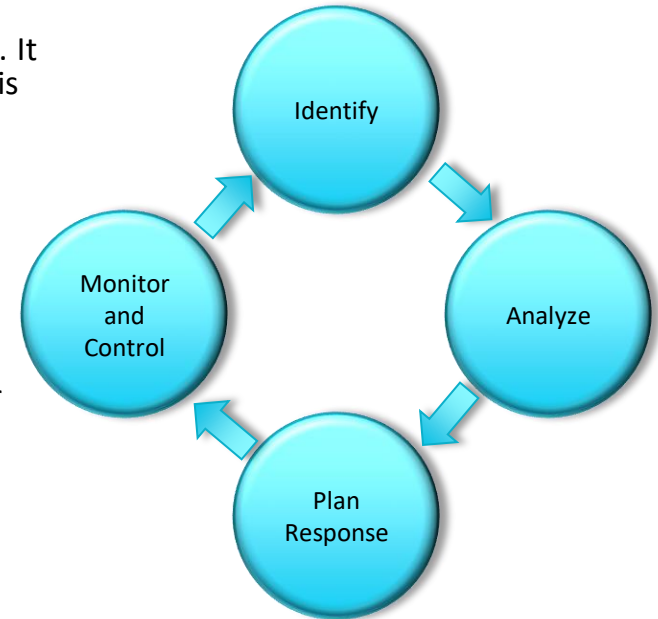
Risk Management

Risk management is a continuous activity during the complete project life cycle. It starts already in the project definition phase and will be done until the project is released and closed.

To execute risk management a risk management process is used, which is a framework for iterative planning, tracking and reacting to risks.

Risks are identified, described and analyzed in terms of

- **Probability** How likely the event is to happen
- **Impact** How strong a risk could affect the project cost, schedule or quality
- **Time Frame** Within which the impact might occur
- **Risk Exposure** is a combination of probability and severity



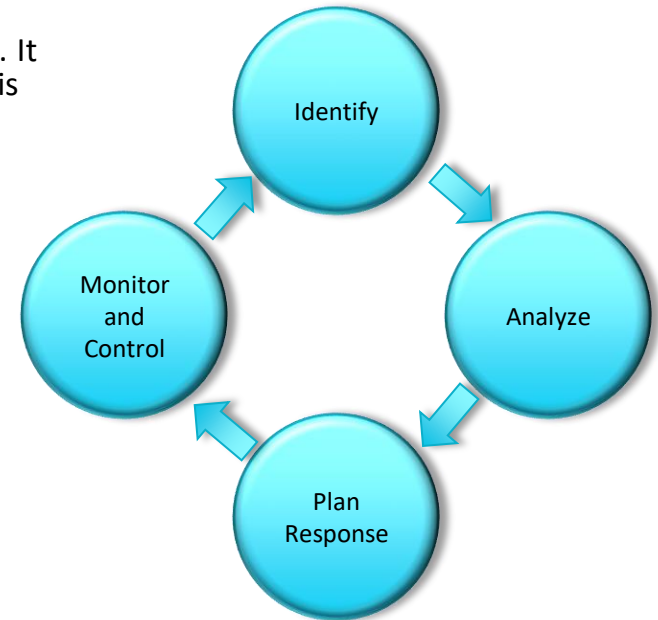
Risk Management

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To execute risk management a Risk management process is used, which is a framework for iterative planning, tracking and reacting to risks.

Risk management Process includes the

- **Identification** of relevant risks for the project
- **Analysis** of risks identified
- **Plan risk response**
- **Monitor and control** the risks



Identification of Risks

The goal is to identify as many risks relevant to the project as possible. As the process is iterative, new risks can be identified in ANY phase of the project.

Different methods are used to achieve this:

- Brainstorming / Brainwriting
- Expert Interviews
- Historical data (Lessons learned, Risk registers from other projects)
- 5 Why methodology / Ishikawa diagram
- Risk breakdown structure (connected to WBS)

Analysis of Risks

Risk analysis is a systematic approach to understanding risks by determining the characteristics of identified risk events

- Probability 0/ 0% (not happening) – 1 / 100% (for sure happening)
- Impact 0/ 0% (no impact) – 1 / 100% (extreme impact)
- Risk Exposure = Probability * Impact

The Risk Exposure rating describes the overall severity of the risk and can be used to prioritize the risks in the project.

Risk evaluations are subjective and depend on the individual project team composition. (Risk Adverse vs Risk accepting) Therefore the project team must agree on definitions how to evaluate the risks.

Risk Exposure

Exposure		Impact		
		Low 0,1 - 0,3	Medium 0,4 - 0,6	High 0,7 - 0,9
Probability	High 0,7 - 0,9	Significant Risk	Major Risk	Major Risk
	Medium 0,4 - 0,6	Minor Risk	Significant Risk	Major Risk
	Low 0,1 - 0,3	Minor Risk	Minor Risk	Significant Risk

Risk Analysis

Project Name RISK ANALYSIS SHEET				Risk Response Indicator (RRI)		3	
Risk Response Strategy: risk neutral							
Project /Subproject	Phase / Risk Source	Risk No.	Risk	Risk Category	Probability low: 0,1 - 0,3 med.: 0,4 - 0,6 high: 0,7 - 0,9	Impact low: 0,1 - 0,3 med.: 0,4 - 0,6 high: 0,7 - 0,9	Initial Risk Exposure
	Planning	1	Product Requirements not frozen or unclear, Validation plan will not be complete	Project Mgmt	0,7	0,5	0,35
	SW Impl.	2	Parameter measurement storage in requirements database very complex, never done before in the company in this way	Technical	0,5	0,6	0,3
	Measurement Phase	3	Measurement results not valid, because equipment was not calibrated.	Quality	0,1	0,7	0,07
	HW Impl.	4	Test board PCB damaged during bring-up	Techical	0,6	0,9	0,54

Risk response planning

Risk response planning is the function of deciding what, if anything, should be done with a risk

Risk response planning steps:

- Go through the list of prioritized risks
- Assign owners to individual risks
- Analyze different risk response strategies for the individual risks
- Select a primary option

Risk response strategies

- **Accept the risk**
Accept the consequences of a risk occurring without further action. The risk will be handled as an issue if it occurs. No further resources are expended in managing the risk. Generally these risks are not significant enough to justify any effort.
- **Transfer the risk**
Transfer some or all the responsibility for dealing with a risk to another organization. This does not remove the risk from the project, so it needs to be tracked.
- **Create Risk reserve**
Set aside money, in case the risk occurs

Risk response strategies

- **Use insurance**
Where the identified risk is covered by an insurance agreement, use this to cover the cost of the risk occurrence
- **Control the risk**
 - **Risk Mitigation**
Proactively take steps to reduce the risk by either lowering the probability or reducing the impact of the risk
 - **Risk Contingency planning**
Developing a plan to define the actions to be taken if a risk consequence occurs. This is needed, when no sufficient mitigation can be defined.

Risk Response

Initial Risk Exposure	Risk Mitigation Plan (risk response action recommended by the team)	est'd Cost [kEur]	by when	Who	Revised Risk Analysis		
					Probability low: 0,1 - 0,3 med.: 0,4 - 0,6 high: 0,7 - 0,9	Impact low: 0,1 - 0,3 med.: 0,4 - 0,6 high: 0,7 - 0,9	Risk Exposure
0,35	Mitigate: Plan review with design team and review with Validation expert from other department		30.Apr	PJM	0,2	0,5	0,1
0,3	Transfer: Ask external SW company with proven Track record to program this routine	25		SW Eng	0,3	0,6	0,18
0,07	Accept the risk				0,1	0,7	0,07
0,54	Mitigate: Buy 3 spare boards	10		PCB Exp	0,4	0,9	0,36

Risk Analysis and Response

Project Name RISK ANALYSIS SHEET				Risk Response Indicator (RRI) 3							Revised Risk Analysis			
Risk Response Strategy: risk neutral														
Project /Subproject	Phase / Risk Source	Risk No.	Risk	Risk Category	Probability low: 0,1 - 0,3 med.: 0,4 - 0,6 high: 0,7 - 0,9	Impact low: 0,1 - 0,3 med.: 0,4 - 0,6 high: 0,7 - 0,9	Initial Risk Exposure	Risk Mitigation Plan (risk response action recommended by the team)	est'd Cost [kEur]	by when	Who	Probability low: 0,1 - 0,3 med.: 0,4 - 0,6 high: 0,7 - 0,9	Impact low: 0,1 - 0,3 med.: 0,4 - 0,6 high: 0,7 - 0,9	Risk Exposure
	Planning	1	Product Requirements not frozen or unclear, Validation plan will not be complete	Project Mgmt	0,7	0,5	0,35	Mitigate: Plan review with design team and review with Validation expert from other department		30.Apr	PJM	0,2	0,5	0,1
	SW Impl.	2	Parameter measurement storage in requirements database very complex, never done before in the company in this way	Technical	0,5	0,6	0,3	Transfer: Ask external SW company with proven Track record to program this routine	25		SW Eng	0,3	0,6	0,18
	Measurement Phase	3	Measurement results not valid, because equipment was not calibrated.	Quality	0,1	0,7	0,07	Accept the risk				0,1	0,7	0,07
	HW Impl.	4	Test board PCB damaged during bring-up	Techical	0,6	0,9	0,54	Mitigate: Buy 3 spare boards	10		PCB Exp	0,4	0,9	0,36

Monitor and Control Risks

Update Risk management and project plans regularly

Look for triggers that indicate possible risk occurrences

Trigger new risk identification and risk review sessions regularly during project runtime

Reaction

Update the risk management plans whenever a risk event occurs

Update project documents to reflect risk event occurrence

Close risks if appropriate

Filling a risk register only at the beginning of the project and not maintaining a risk register does not help to management risks

Project handbook

During the planning phase all the data of the project will be collected in a project handbook. The project handbook ensures, that all relevant information needed to execute the project is documented and stored in one place

Project Approval Gate Meeting

The project approval meeting is used to assess the results of the project planning phase and to approve the start of the implementation phase of the project.

Prior to the Gate Meeting typically checklists define, which tasks need to be finished before the Gate meeting and which documents, plans and results have to be presented

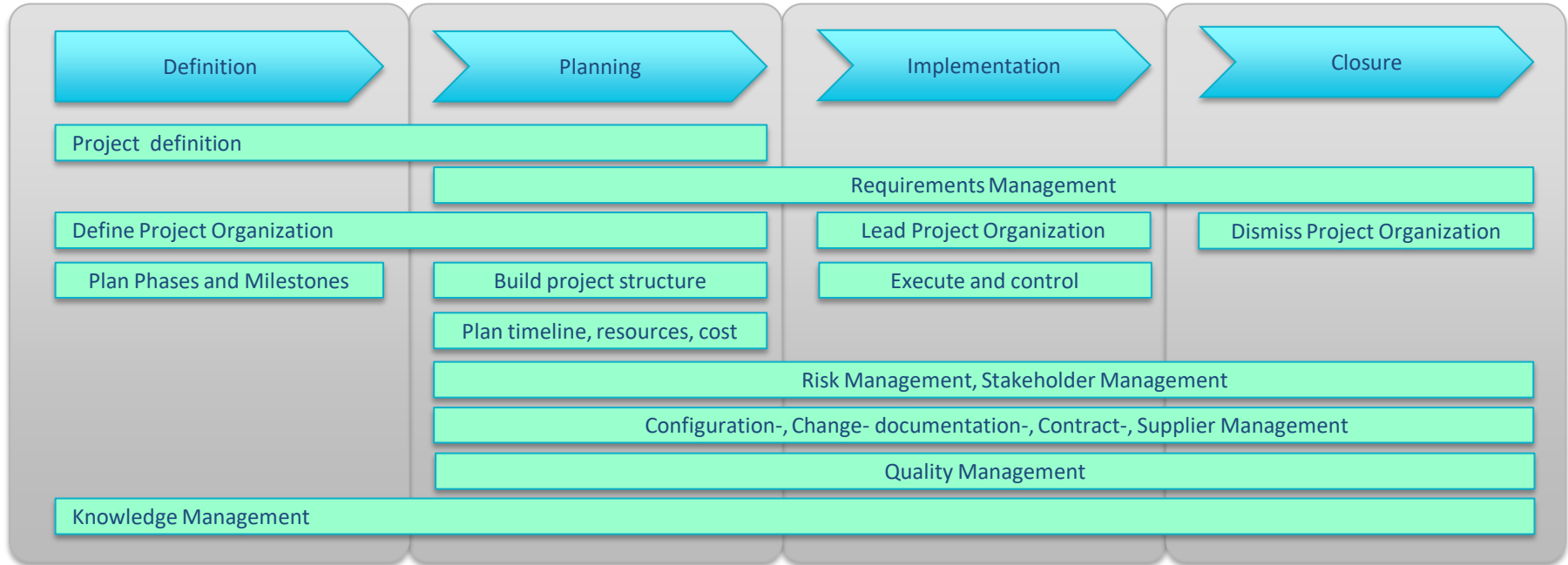
During the meeting, the project manager presents the created data to the project owner and the stakeholders of the project approval board.

The presentation typically includes

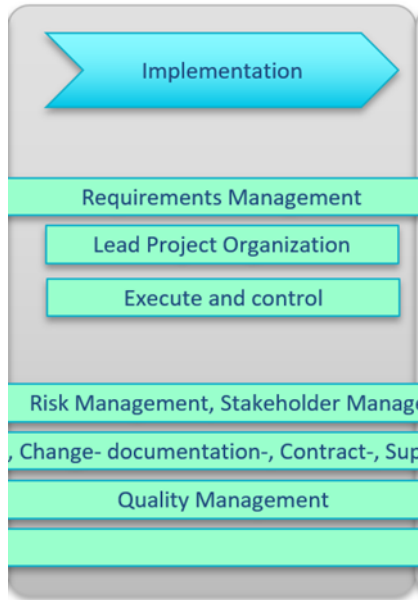
- Project goals
- Project planning, including time, resource and cost planning, Key Milestones
- Key customer deliverables (prototypes, sample plans, other deliverables, ...)
- Business Case and market data
- Risk Register and top risks with mitigation / contingency plans
- Technical concepts, production plans, ...

If the project fulfils the needed project goals, including the business case, and the work created in the planning phase has achieved the needed quality, that gate will be passed, and the Project Implementation Phase can start

Typical Activities



2.3. Project Implementation Phase



Project execution and controlling

Risk management

Change Management

Quality management

Project controlling

Project controlling is a core task in project management. It includes all activities that are necessary to implement the project according to plan.

The goal of project controlling is to ensure that the project goals are achieved in the desired quality, while adhering to the planned deadlines and costs. The project management is responsible for project controlling.

Goals of project controlling

- Securing the achievement of the project objectives
- Determination of the current project progress
- Determination of critical plan deviations (target/actual comparison), analysis of causes and evaluation of consequences for the project
- Planning and implementation of project management measures
- Social project controlling
- Documentation of the results of the project controlling in a project status report

Core areas of Project controlling

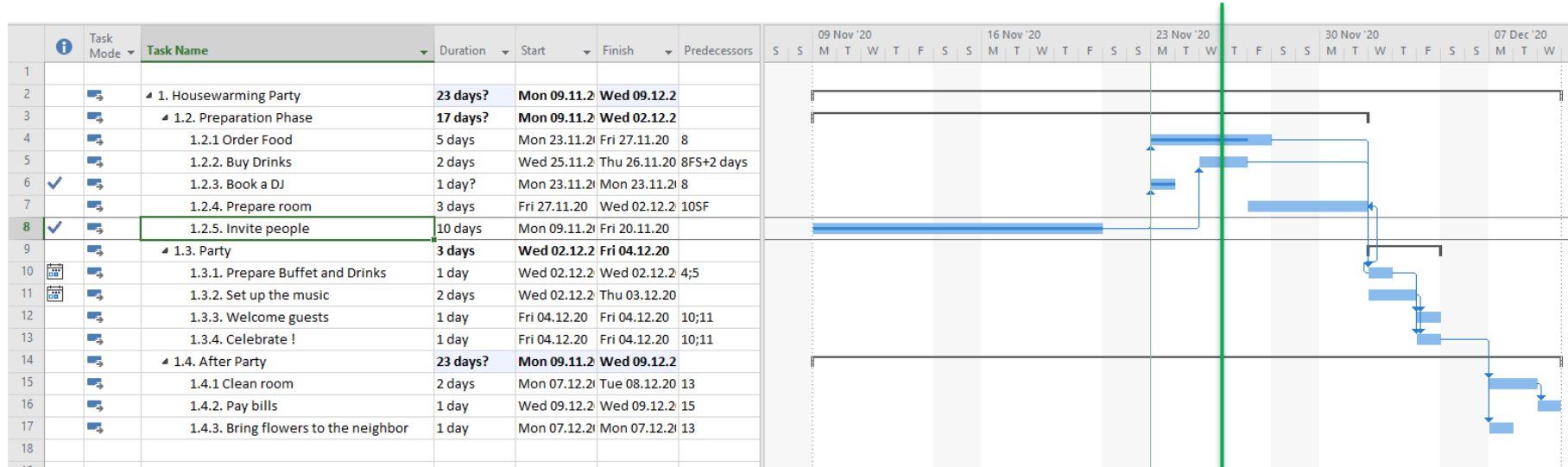
Project controlling is an integral part of project management over the entire duration of the project. Project controlling includes all activities that are necessary to realize the project according to plan. Project preparations and project plans, which are created in the planning phase of the project, serve to determine the desired course of the project as precisely as possible and to think ahead.

During active and effective project control, the target specifications of the project planning are compared in regular cycles with the actual values achieved during the project, which are introduced by the experts responsible for implementation and results. The target/actual comparison refers both to the project object and to the course of the project.

Project controlling includes

- Progress control in task execution
- Cost monitoring
- Milestone Trend Analysis

Progress control in task execution



Cost Monitoring

		Cost											
PLAN	all in kEuro	2021	2021	2021	2021	2021	2021	2021	2021	2021	2021	2021	2021
	Month	01	02	03	04	05	06	07	08	09	10	11	12
	Total Cost monthly	0	0	32	48	175	111	111	77	78	65	48	0
	Total Quarterly			32			334			266			113
	Total Yearly												745
	Planned cost cumulat	0	0	32	80	255	366	478	554	632	697	745	745
	FTE Monthly	0	0	32	48	62	94	94	77	78	65	48	0
	FTE Quarterly			32			204			248			113
ACTUAL	FTE Yearly												598
	Material Monthly	0	0	0	0	113	18	18	0	0	0	0	0
	Material Quarterly			0			130			18			0
	Material Yearly												148
ACTUAL	all in kEuro	2021	2021	2021	2021	2021	2021	2021	2021	2021	2021	2021	2021
	Month	01	02	03	04	05	06	07	08	09	10	11	12
	Total Cost monthly	0	0	15	43	97	246	111	77	78	65	48	0
	Total Quarterly			15			386			266			113
	Total Yearly												780
	Actual cost cumulated	0	0	15	58	155	401	512	589	667	732	780	780
	FTE Monthly	0	0	15	38	85	115	94	77	78	65	48	0
	FTE Quarterly			15			238			248			113
ACTUAL	FTE Yearly												614
	Material Monthly	0	0	0	5	12	131	18	0	0	0	0	0
	Material Quarterly			0			148			18			0
	Material Yearly												166

Planned costs:

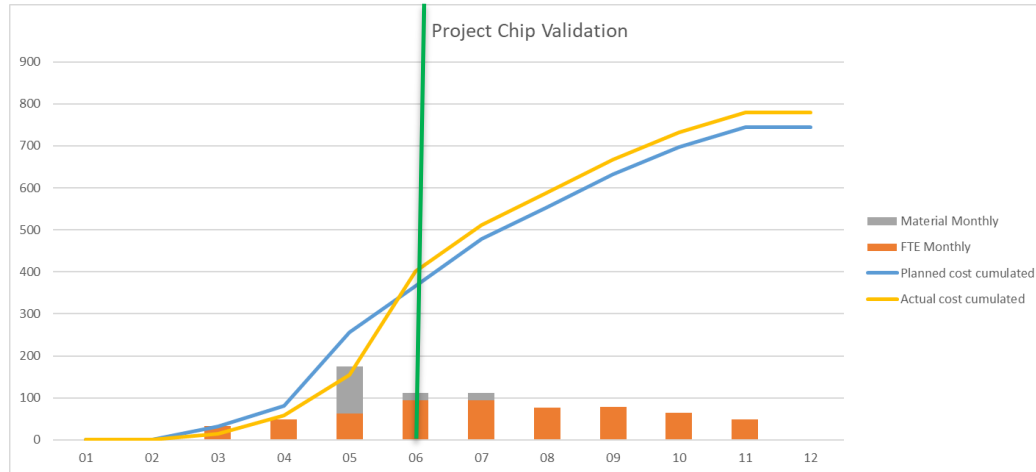
- Resource and material costs planned during the project planning phase

Actual cost:

Costs booked to the project by

- Resources writing their hours spent on project (tasks)
- Material costs for goods received in the project
- Future months keep the planned costs to show the actual projection of the project budget

Cost Graph Planned and Actual Costs



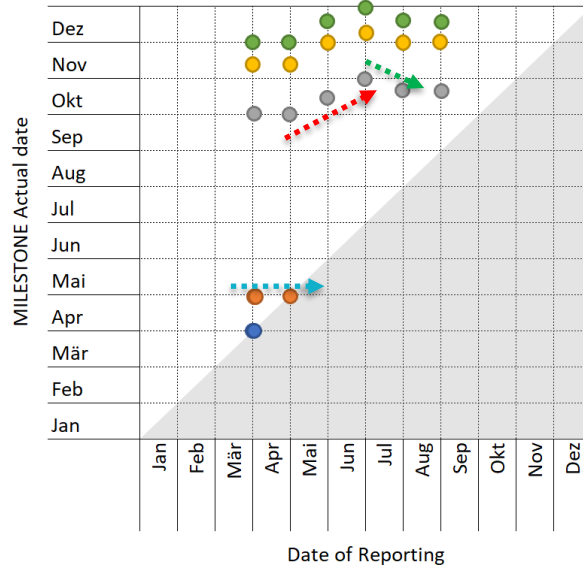
Planned and actual costs cumulated show,

- how much money was planned to be spent in the project (Cumulative planned cost)
- how much money has been spent in the actual execution of the project. (Actual cumulated cost)

Milestone Trend Analysis (MTA)

Project: Chip Validation

- Milestones
- M5 Close
 - M4: Release
 - M3: Measurement
 - M2: Approval
 - M1: Start



MTA is a methodology to visualize the progress of the project and the actual planning forecast on important project milestones

The Diagram consists of a reporting timeline on the x-axis and the actual planned dates of the remaining milestones, based on the project progress shown on the y-axis of the diagram

Horizontal lines: milestone date stable, on track

Rising Upwards: milestone slips and will be achieved later

Falling Downwards: milestone is pulled in, will be achieved earlier

Change Management

When executing a project changes will happen with high likelihood. They can be caused by

- New or changed customer requirements
- Problems in the implementation of the planned product concept
- New or changed components or technologies
- Changes in the environment

Sometimes changes are needed and useful to achieve project goals at all or to make the final product more competitive and better. On the other hand can changes which are introduced in an uncontrolled way create severe issues in project execution and can cause delays.

Therefore a **change management process** and a **change management board** are used to introduce changes in a controlled way into the project

Change Management Board

The Change Management Board is a group of project team members, which comes together for the CCB Meeting.

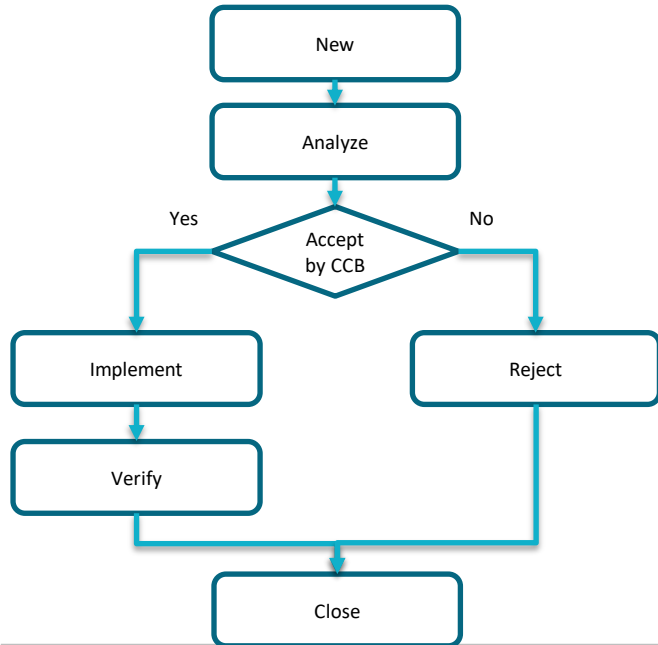
The input to the CCB Meeting is the list of change requests including one or more possible solutions how to implement them.

In the CCB meeting these change requests are presented, explained and then the possible solution(s) are discussed and assessed on their impact (Time, cost, effort, risk,...) for the project.

The Change Management Board selects and accepts the best solution for the change request or can also reject the change request by deciding not to implement anything.

The change request itself, possible solutions, the impact analysis and the decision are documented and stored in a central project database for change requests (e.g. Teamforge, Jira, ...)

Change Management Process

**New**

A new change request will be filed by any team member

AnalyzeThe change request will be analyzed by a **domain expert**, a possible solution for the change request will be prepared. This includes the technical solution, the needed effort, the risk**Accept**

The CCB decides, if the solution will be implemented or rejected

Implement

The agreed solution will be implemented

Verify

The implemented solution will be verified

Reject

The change request will not be implemented, based on the risks, the effort or the proposed technical solution

Close

A successfully verified or rejected change request can be close

Project Release Gate Meeting

The project Release Gate Meeting is used to assess the results of the project implementation phase and to approve the start of the closure phase of the project.

Prior to the Gate Meeting typically checklists define, which tasks need to be finished before the Gate meeting and which documents, plans and results have to be presented.

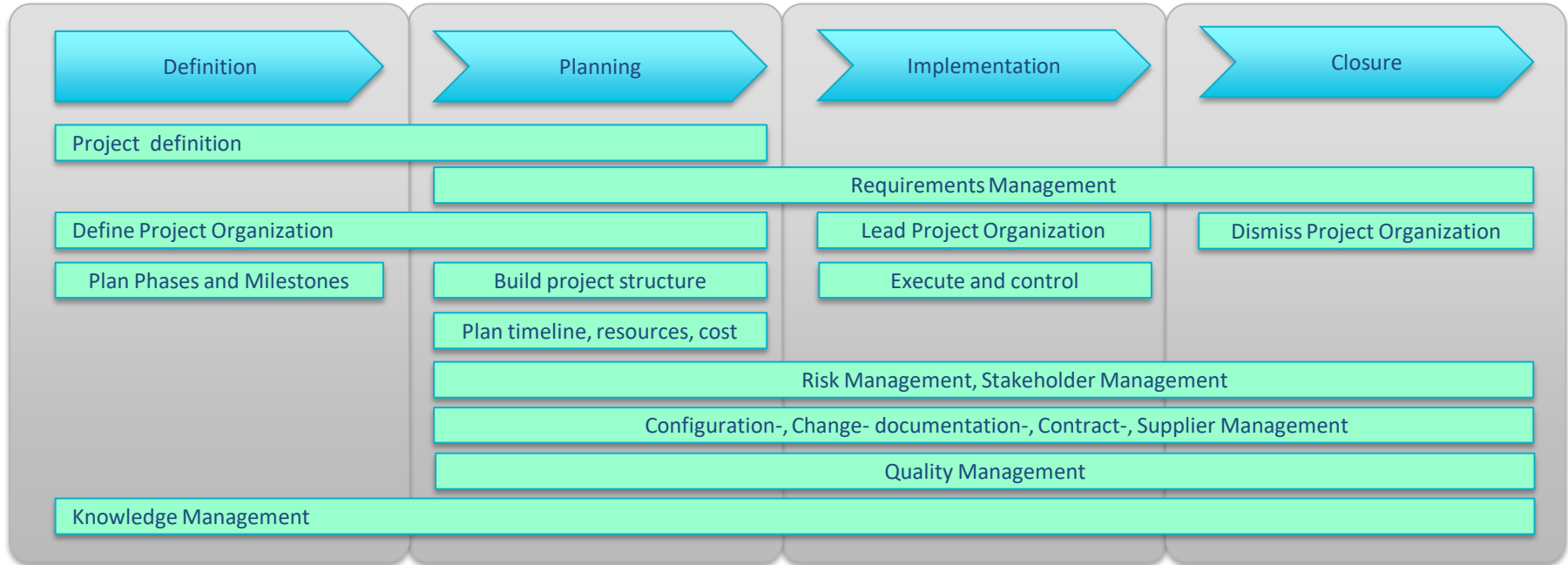
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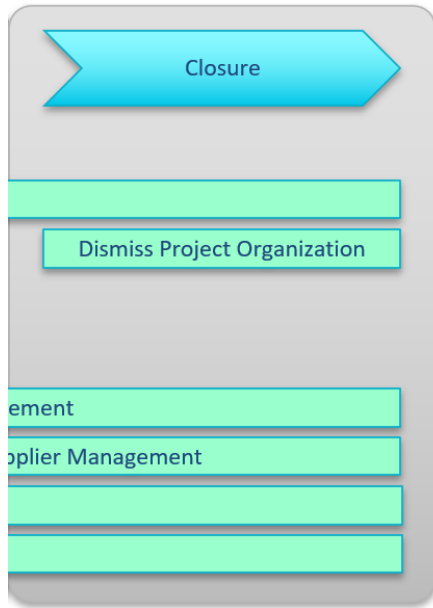
- Overview on the Project deliverables (e.g. the final product, documentation, test results, application boards, ...)
- Quality achieved (e.g. Lab Validation and Qualification results, production ramp up done, Audit results, Functional Safety Audit results, ...)
- Project execution data (e.g. actual project cost, project timeline and slip, ...)
- Business Case and market data
- Hand Over information to maintenance or volume production

If the project fulfils the needed project goals as listed above, the gate will be passed and the project has successfully delivered its defined deliverables. The Project Closure Phase can start

Typical Activities



2.4. Project Closure Phase



Project Analysis

Lessons Learned

Archiving of the project

Dismiss of the team and infrastructure

Project Closure Meeting

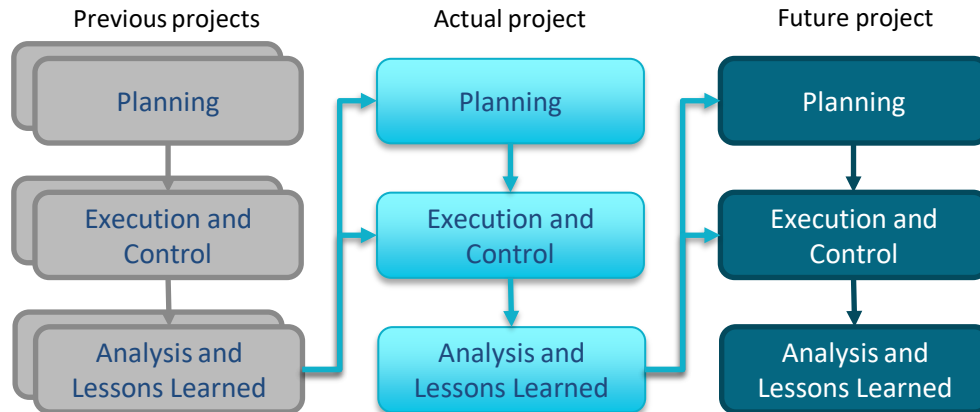
Project Analysis

The project analysis is used to check how well the project was executed.

It includes checks,

- If all open activities have been finished
- If all invoices, costs, etc., have been paid
- How well the project goals have been defined and could be achieved in the project
- How much effort went into different phases or work packages of the project, identifying the biggest deviations and reasons for these.
(e.g. wrong estimates, change requests, missing staffing or competence, ...)
- How stakeholders of the project would evaluate the project execution → Lessons learned

Lessons Learned



Stakeholders of the project (internal and external) are invited to reflect on the execution of the projects and to identify areas for improvement for future projects. The findings are used in future projects but also in the line organization to improve the skill set of the organisation.

Archiving the project and dismissing the team

- Archiving the project data
 - Project documents and project data needs to be archived to ensure that the information is still available, when the project is closed and the product is already in production and use. This is needed for the analysis of problems in the field or during production
- Dismissing the team and Infrastructure
 - Team members are finalizing their work packages and activities, some are moving already to new projects.
 - It is important to keep the motivation in the team to really close the open tasks and documents
- Finally there also should be a **Project Closure Meeting** to formally close the project, ideally combined with some celebration to say thank you for the achieved results.