



Das Expertennetzwerk

Project Management Foundations

Syllabus (EN)

**ASQF CERTIFIED PROFESSIONAL FOR PROJECT MANAGEMENT
FOUNDATION LEVEL**

Syllabus Version 3.0

August 2025

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Course Overview

In the past decades, software development has tremendously changed. At the same time, the contextual conditions for project management have changed. This led to a fundamental revision of the CPPM curriculum to ensure that the training will continue to be appropriate to the demands placed on employees and the needs of the industry in the future.

The ASQF working group CPPM took up this challenge and created a revised curriculum that meets the current as well as future challenges of project management. Furthermore, international standards regarding curricula, e.g. K-levels of learning objectives, learning objective coverage and standard times were taken into account.

This document is the English translation of the current German ASQF CPPM syllabus Version 3.0. The ASQF CPPM syllabus has been updated both in German as well as in English, in order to reflect the new ISO 21502:2020(E) and its German translation. In the following text, we sometimes refer to concepts of the older version ISO 21500:2012(E) when we write “formerly known as” for reasons of traceability and understanding.

Focus

This version of the curriculum provides participants with the following features and benefits:

- Consistent terminology

The same understanding for the same things avoids misunderstandings and prevents errors and losses. The course is based on standards and current international norms, especially ISO 21502:2020(E), and uses uniform terminology for terms and scope.

- Basic understanding of the complexity of modern projects

In today's project management - especially in larger projects - the interaction of many different components and stakeholders on several levels is necessary. The course provides a basic understanding of this complexity, explains the essential interrelationships and passes on rules for cooperation and behavioral approaches to better deal with difficulties.

- Tasks and roles of project management (with regard to lateral leadership)

The omnipotence of the project leader/project manager in one person, which was common in the past, is generally no longer in line with today's project reality. The increasing size of projects and the reduction of hierarchies in organizations lead to a redistribution of responsibility from top to bottom and on multiple shoulders. Therefore, the new curriculum distinguishes between project management tasks and project management roles that are important for implementation.

- Special features of project management in sequential and agile project management frameworks

Agile methods have found their way into SW development in many cases. On the one hand, entire organizations adopted scaled agile development frameworks such as SAFe or LeSS¹. In other organizations, SW development teams follow agile principles without being part of a larger agile context. On the other hand, there are still many projects that follow at least partly some sequential project management framework, e.g. V-model. Even in those cases, agile concepts and methods are sometimes used (e.g. time-boxing or planning poker). The syllabus treats both approaches equally. The most important characteristics, advantages, and disadvantages, as well as the preferred areas of application are presented and compared in the individual project phases.

- Soft Skills

Non-technical competencies, the so-called soft skills of the project contributors play an essential role in the success of a project. The curriculum addresses this topic and sensitizes the course participants accordingly. The competencies required for project management are explained. The basic principles and methods of good team management as well as essential aspects of social competence are explained.

Target Group

The course is designed for people who have assumed or are about to assume (partial) responsibility in a team and in an organization. In lean hierarchies and agile teams, this can affect almost everyone involved in the project. The course aims to teach each project member the basics of project management and to enable them to take responsibility for the project, the team and the organization so that they may significantly contribute with regards to scope and economic success.

Benefit

The curriculum is designed as a basic course for modern project management that sufficiently and comprehensively describes the essential aspects and fields of activity. It

- conveys the important terms,
- teaches the elements and tasks of project management,
- sensitizes the participants to the difficulties and problems that can arise,
- provides suggestions for project management in practice.

At many points, practical help is provided or references to further literature or courses are given. The ASQF CPPM course enables the participants to take on practical experience in project management after the course.

In general, knowing a why/how/what will enable each employee to do better and more effectively what is beneficial to the project, to the team, to the organization and ultimately to him/herself.

¹ SAFe stands for Scaled Agile Framework. It guides larger organizations to apply agile principles and practices on a larger scale. Large-Scale Scrum (LeSS) pursues the same idea, scaling up Scrum from one team to a larger group of teams. Both frameworks are beyond the scope of this syllabus.

For any organization, it is important that there is a common basic understanding of project management tasks and that there is consistent terminology. Standards facilitate collaboration, reduce interface problems, and lead to better and faster results. Teaching this is one of the central goals of the curriculum.

Content

The course is designed primarily as an introductory course in software project management, but the curriculum uses the more general term project management.

In addition to classic project management activities, such as project organization, procedures for initiating, planning, monitoring and controlling the project, through to project acceptance and closing, management frameworks in software development, as well as quality and risk management are covered with a focus on software projects.

An essential success factor in project implementation are human beings and the handling of the "human resource". In the individual chapters, specific situations and challenges regarding this topic are addressed.

Throughout the course, 2 levels are presented:

- The technical aspects, such as tasks, processes, and interfaces;
- Personal aspects, i.e. roles, the demands placed on people and dealing with existing circumstances, e.g. conflicts.

Learning objectives and cognitive levels of knowledge

Learning objectives support business goals. Each section of the curriculum is assigned to a cognitive level:

- K1: know
- K2: understand

In addition to knowing basic elements, the curriculum emphasizes understanding how the various components interact and the overall complexity of project management. Therefore, most of the learning objectives are assigned to level K2.

The level also influences the teaching duration and the type of possible examination questions.

1 Overview and Introduction [90]

Terms

Process

Project

Project Life Cycle

Project Management

Project Phase

Stakeholder

Learning Objectives

CPPM LO 1.1 (K1) Know success and failure factors of projects

CPPM LO 1.2 (K1) Know important terms of project management

CPPM LO 1.3 (K1) Know integrated project management practices

CPPM LO 1.4 (K1) Know management practices for a project

CPPM LO 1.5 (K1) Know project management tasks

CPPM LO 1.6 (K1) Know competence requirements for project managers

1.1 Introduction [10]

Problems with Software Projects

A large proportion of all software development projects do not run successfully (Yin et al., 2021). In many cases, projects are far beyond their original cost and schedule or are terminated prematurely. Frequently, delivered software products do not deliver the functionality, quality or usability required by the client, so that additional expenses and deadline postponements are necessary due to costly changes and bug fixes.

Project Success and Failure Factors

When analyzing the reasons for software project failure, individual software projects cannot be considered in isolation.

Most of the problems can be assigned to one of the following areas:

- Deficiencies in the process, e.g., inadequately defined process steps, interface problems, missing or insufficient coordination and agreements
- Lack of technical skills, e.g. insufficient knowledge of requirements management or of quality assurance
- Communication problems and weak leadership, e.g. lack of conflict management, vague goals, unclear decision-making authority.

In many cases, several reasons occur simultaneously. Interpersonal aspects almost always play a role.

1.2 Important Project Management Terms [15]

- Project

ISO DIN 21502:2020(E): “A project is a temporary endeavor to achieve one or more defined objectives. [...] Projects are temporary and focus on retaining or adding value or capability, for a sponsoring organization, stakeholder, or customer.”

Hint: Many organizations use the term "project" for reoccurring product version development. Each version is seen as a temporary endeavor to add value to an existing product.

- Project Classification

Projects can be classified according to different aspects, e.g. according to the type of project: pure software projects, integrated hardware/software projects, research projects, development projects, rationalization projects, maintenance projects, individual projects and multi-projects, etc.

Each project type can be further characterized by additional parameters: Scope, complexity, risk, etc.

An important classification feature is the selected project management framework – namely classical/sequential or agile.

- Project Life Cycle

ISO 21502:2020(E): “A project life cycle is a defined set of phases from the start to the end of a

project.”

- Project Phases

ISO 21502:2020(E): Projects can be divided into project phases. The number and names of a project’s phases depend upon the type of project being undertaken, desired governance, and the anticipated risk. The phases can reflect the delivery approach or project management framework being taken, and should have a defined start and end, as well as specific milestones that relate to the decisions, key deliverables, outputs or outcomes.

- Process

ISO 21500:2012(E): A process consists of a series of interrelated procedures. Software development process refers to the set of activities performed to create a software system. Input data are stakeholder requirements, output data are the created software system as well as further achievements of the project team. Project management processes determine how the activities selected for the project are managed and controlled.

- Project Management

ISO 21502:2020(E): Project Management can be defined as “coordinated activities to direct and control the accomplishment of agreed objectives. [...] Project management integrates practices to direct, initiate, plan, monitor, control and close the project, manage the resources assigned to the project and motivate those individuals involved in the project to achieve the project’s objectives.”

- Project Manager

ISO 21502:2020(E): “The project manager is accountable to the project sponsor or project board for completing the project’s defined scope, and for leading and managing the project team. [...] The project manager can be assisted by a project management team, with members undertaking specific roles, such as scheduling, cost control and quality assurance.”

In this syllabus, when referring to specific individuals, the term project manager is used, meaning the person responsible for project management, or parts thereof. In agile environments, every team member may be involved in project management functions.

- Stakeholder

ISO 21502:2020(E): “person, group or organization that has interests in, or can affect, be affected by, or perceive itself to be affected by, any aspect of a project.”

Identification of stakeholders and the analysis and management of stakeholder goals and requirements is an essential prerequisite for successful project management.

1.3 Software Project Management Overview [30]

Project management activities often interact with each other, e.g., a change in the project budget usually affects the schedule. Successful project management requires active consideration of these interactions. ISO 21502:2020(E) describes guidelines for project management and these are the basis for this chapter.

1.3.1 Integrated Project Management Practices

The following integrated project management practices (formerly known as “Process Groups”) include the pre- and post-project activities and should integrate and tailor selected project management practices (see next section) into a cohesive approach to achieve the project’s objectives, according to ISO 21502:2020(E):

1. **Pre-project activities** – includes the processes required to identify and evaluate the benefits, objectives, investment, sponsor and manager of a project, as well as resources for a project;
2. **Overseeing a project** – includes the processes within the sponsoring organization required to be involved in key decisions, periodic reporting, reviews, audits, escalations and interventions;
3. **Directing a project** – includes the processes required to enable the project to continue to be relevant and justifiable in the organizational context;
4. **Initiating a project** – includes the processes required to justify, plan the project, define the project organization, governance and management framework, project team, and identify stakeholders;
5. **Controlling a project** – includes the processes required to monitor and measure performance against an agreed plan, including authorized changes;
6. **Managing delivery** – includes the processes required to define the required outputs and outcomes, and to plan and implement their delivery enabling the project’s success;
7. **Closing or terminating a project** – includes the processes required to confirm the completion of the project’s scope, to note activities not completed, to enable post-projects benefit realization, and to manage the demobilization of any remaining resources and facilities;
8. **Post-project activities** – includes the processes required to verify that the outcomes are sustainable, expected benefits are being realized, and lessons learned are captured.

1.3.2 Management Practices for a Project

According to ISO 21502:2020(E), project management is carried out through the application of management practices (formerly known as “Topic Groups”) that are listed below:

1. **Planning** – the planning practices define the requirements, deliverables, outputs and outcomes.
2. **Benefit** – the benefit management practices assist the sponsoring organization and the customer in realizing the desired benefits of a project;
3. **Scope** – the scope management practices ensure that only formally approved work being incorporated into the project;
4. **Resources** – the resources management practices determine the resources needed to deliver the scope of the project in terms of quality, quantity and optimum usage.
5. **Schedule** – the schedule management practices enable work to be undertaken in a timely manner and to reduce slippage to an acceptable level.

6. **Cost** – the cost management practices establish the financial controls to be used throughout the project life cycle to facilitate delivery of the project within the approved budget.
7. **Risk** – the risk management practices increase the likelihood of achieving the project’s objectives.
8. **Issues** – the issues management practices resolve issues such that there is no negative impact on the achievement of the project’s objectives.
9. **Change control** – the change control practices control changes to the project and deliverables and to formalize acceptance or rejection of these changes.
10. **Quality** – the quality management practices plan and establish quality assurance and control.
11. **Stakeholders** – the stakeholder engagement practices enable the needs, interests and concerns of stakeholders to be identified, understood and addressed.
12. **Communications** – the communication management practices enable stakeholder interactions that are effective and likely to contribute to project success.
13. **Organizational & societal change** – the practices for managing organizational and societal change identify the need for organizational change; they plan and implement the activities needed to undertake the changes to enable the project’s desired outcomes.
14. **Reporting** – the reporting practices provide the current status, forecast and analysis of the project.
15. **Information** – the information and documentation management practices enable relevant and reliable information (physical and digital) to be available to those undertaking work and making decisions, including knowledge management, auditing and compliance.
16. **Procurement** – the procurement practices plan and acquire products, services or results, and manage supplier relationships.
17. **Lessons Learned** – The purpose of learning lessons is to benefit from experience, to avoid repeating mistakes and to disseminate improved practices to benefit current and future project teams (following the spirit of continuous process improvement).

The application of the concepts and management practices described above can vary in emphasis for a given project depending on the project’s context and the project management framework used.

1.4 Project Management Tasks [15]

Project management is responsible for successful completion of a project and takes responsibility for the project activities and the results of the project. In addition, it forms the interface to the customer and is responsible for contract negotiations in the project.

Project management has to fulfill both process-related and role-based tasks:

- Process-related tasks of project management include the following activities:
 - Maintain contact and conduct negotiations with the customer
 - Lead the project team
 - Define the project organization
 - Plan work packages and milestones
 - Create the project plan
 - Define and monitor reporting activities
 - Continuously communicate, e.g. through meetings
 - Select methods and tools for the project
 - Monitor project planning
 - Monitor costs
 - Perform risk management
 - etc.
- Role-oriented project management tasks include all tasks related to the following roles:
 - Relationship manager, e.g., representative, leader, contact maintainer, motivator
 - Information provider, e.g. observer, informant, spokesperson
 - Decision maker, e.g. entrepreneur, problem solver, resource allocator, negotiator

1.5 Competence Requirements for Project Managers [15]

High demands are placed on a project manager's personality, social skills, specialist knowledge, methodological and organizational competence. In balancing the interests of the customer, the interests of the project team and the interests of the organization, the project manager must master the classic triangle of tension between deadlines, costs and scope. General management skills, such as leading, communicating, negotiating, and problem solving, form the basis of project management skills (see also Human Resource Management).

The required competencies for project managers can be broken down into the following levels of responsibility and are the foundation for successful project management.

- Autonomy – great autonomy and assumption of responsibility;
- Influence – strong influence on the team, the client side and the company;
- Complexity – multiple complex activities in technology, finance and quality;
- Entrepreneurial skills – responsibility for the company and risk minimization

The actual level of competency required depends on the specific organizational and project environment.

2 Project Organization [45]

Terms

Project Organization

Learning Objectives

CPPM LO 2.1 (K1) Know the difference between organizational structure and process organization

CPPM LO 2.2 (K2) Understand the different types of organizational structures and their influence on the project

CPPM LO 2.3 (K1) Be able to name important aspects of process organization

CPPM LO 2.4 (K2) Understand the significance of the process organization for the course of the project

2.1 Goals of Project Organization [5]

Project organization enables cooperation within a project by providing a set of rules with regard to responsibilities, tasks and rights of the persons involved. The project organization shall regulate both the static aspects (organizational structure) and the dynamic aspects (process organization) of the project. A good project organization ensures short decision-making paths and clear responsibilities.

2.2 Organizational Structure [20]

An organizational structure defines the responsibilities, authorities, and mutual relationships between departments and between employees.

At company level, there are different forms of organizational structure. In order to ensure effective and efficient interaction with the organization of a company, organizational solutions must be found for each project. This involves setting up organizational units that are necessary for project execution, as well as coordinating their relationship and interaction with the parent organization of the company.

Some typical project organization solutions are listed below. In practical project work, intermediate forms or combinations of the listed alternatives can also be usefully employed:

- **Project execution within the parent organization:**

No project-specific organizational units are created. Rather, projects are carried out within the structure of the existing organization.

- **Staff project organization (influence project organization):**

Decision-making authority is reserved for line management and project staff members remain

within their organizational structure. The project manager has more of an advisory and preparatory position than a managerial one.

- **Matrix Project Organization:**

The matrix project organization is based on a division of responsibilities between line management and the project organization.

- **Pure project organization (autonomous project organization):**

A temporary organizational unit is formed for the duration of the project; all resources are transferred to the disciplinary responsibility of the project manager.

2.3 Process Organization [20]

The definition of the project process organization depends on the organizational structure of the company and the type of project, e.g., customer project or development project. Important aspects of process organization are:

- Definition of the project's interfaces to the outside world, e.g., to subcontractors (contracts, responsibilities, processes, communication) (see “Project Initiation”)
- Organization of the infrastructure for project execution, e.g. workplaces for the project team (e.g. team proximity, depending on the size of the project team) (see “Project Planning”)
- Clarification of information and reporting (see “Project Initiation”)
- Determination of project communication within the team (see “Project Initiation” and “Human Resource Management”)

Especially in larger projects, various project committees are set up. These look at the projects with different objectives and detail. Problems can be escalated from within the projects and discussed in the defined project committees. Project committees are installed according to the hierarchy levels in the project and in the company, e.g. project meeting, project manager meeting or steering committee.

Roles must also be defined within the project team, e.g., project manager, quality manager, architect, developer, tester, change manager, configuration manager, system administrator.

Responsibilities, tasks, and rights must be defined and agreed for both project roles and project committees and rights must be defined and agreed.

3 Project Management Frameworks in SW Development [180]

Terms

Product Backlog

Project Management Framework

Process Tailoring

Sprint

Story Points

Learning Objectives

CPPM LO 3.1 (K2) Understand the difference between sequential and agile project management frameworks

CPPM LO 3.2 (K1) Know typical representatives of sequential and agile project management frameworks

CPPM LO 3.3 (K1) Be able to name the essential characteristics of sequential project management frameworks

CPPM LO 3.4 (K1) Be able to name the essential characteristics of agile project management frameworks

CPPM LO 3.5 (K2) Understand the advantages and disadvantages of sequential and agile project management frameworks

CPPM LO 3.6 (K1) Know the main criteria for defining a project management framework

CPPM LO 3.7 (K2) Understand the need for process tailoring

CPPM LO 3.8 (K2) Understand principles of agile system development

CPPM LO 3.9 (K2) Understand basic ideas of agile system development according to Scrum

CPPM LO 3.10 (K1) Know the three basic concepts of agile development

CPPM LO 3.11 (K2) Understand roles and tasks in Scrum

CPPM LO 3.12 (K1) Know the five events of Scrum

CPPM LO 3.13 (K2) Understand the importance of the "Sprint Planning Meeting"

CPPM LO 3.14 (K2) Understand the meaning of the "Daily Scrum"

CPPM LO 3.15 (K2) Understand the meaning of the "Sprint Review"

3.1 Overview of Project Management Frameworks [60]

The quality of a software product is decisively influenced by the quality of the creation process. For this reason, many models and frameworks deal with the organization of project processes.

Project management frameworks compile methods and elements of software development including project management into processes and project phases of a standardized project flow in order to achieve the often-challenging project goals as efficiently and effectively as possible.

There are two fundamentally different classes of project management frameworks: sequential and agile ones.

Sequential Project Management Frameworks

Sequential project management frameworks divide activities into phases that are processed sequentially. Typical representatives are the waterfall model and the V-model.

The **Waterfall Model** is a sequential, linear model that is organized in several phases, e.g. requirements analysis, system design, implementation, integration and system testing. As in a waterfall, the phase results are always used as binding specifications for the next lower phase. Each phase has predefined starting and ending points with clearly defined results. The name "waterfall" comes from the frequently chosen graphic representation of the five to six phases arranged as a cascade.

The **V-Model** is an extension of the waterfall model. In addition to the development phases, the V-Model also defines the procedures for quality assurance (testing) in phases. On the left side, the process starts with a functional specification, which is expanded in ever greater detail to a technical specification and implementation basis. At the bottom tip, implementation takes place, which is then tested on the right-hand side against the corresponding specifications of the respective left-hand side.

Agile Project Management Frameworks

"Agile framework" is a generic term for a flexible and lean development process. Agile software development focuses on delivering working software in small, iterative cycles, with close collaboration between teams and stakeholders, and a strong emphasis on flexibility and responding to change.

The "Agile Manifesto", which came into being in 2001, can be seen as the initial spark for agile software development. The authors of the Agile Manifesto value:

- Individuals and interactions more than processes and tools
- Working software more than comprehensive documentation
- Collaboration with the customer more than contract negotiation
- Responding to change more than following a plan.

Although the authors recognize the importance of the values mentioned on the right, they acknowledge the values on the left to be of significantly higher importance.

Agile frameworks assume that significant parts of the requirements and solution approaches are

unclear at the beginning. This ambiguity can be eliminated by creating intermediate results. These intermediate results can be used to find the missing requirements and solution techniques more efficiently than in the context of a long and abstract clarification phase.

The most commonly applied agile project management framework is Scrum, but other project management frameworks such as Kanban and Extreme Programming (XP) are also based on agile principles (Wysocki 2019). **Kanban** is originally a method of the production process control, with which the activities in software projects – the so-called "Work in Progress" (WiP) – are steered based on six principles. Kanban in its pure form has no iterations. In contrast, **Extreme Programming** is an agile and iterative software project management framework, which consists of values, principles and practices (Beck 1999).

The **Scrum** approach is empirical, incremental and iterative. Scrum consists of only a few rules. These rules define five events, three artifacts and three roles that make up the core of Scrum.

In addition to the iterative product development, planning in Scrum is also developed iteratively and incrementally. The long-term plan (the product backlog) is continuously refined and improved. The detailed plan (the Sprint Backlog) is only created for the next iteration (the next Sprint). This focuses the project planning on the essentials.

The respective advantages and disadvantages as well as areas of suitability of the two rough approaches are summarized in the following table:

Approach	Advantages	Disadvantages	Suitability range
Sequential	Reduction of complexity by separating subtasks of the project into phases Focus on external as well as hierarchical control options	User feedback only after delivery of the system, leading to high costs of error correction Separation of specification and implementation High planning expenditure, but still low transparency on project progress / value add	If requirements can be or must be clearly defined in advance.
Agile	Early user involvement, relatively high fulfillment of user requirements Relatively short development times to potentially shippable product. Approach that delivers	Only successful if agile principles are understood and internalized by all management levels	If the requirements cannot be described clearly in advance. If compatible with the organization's leadership principles.

	executable software within few iterations. Approach in which changing requirements can be accommodated through iterative design.		
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Many of the approaches and methods from the agile world are also applied today in projects with a sequential approach, such as many of the practices of Extreme Programming.

3.2 Company-Specific Software Development Processes [20]

Process tailoring is the adaptation of the project management frameworks to specifics of the company, of the project and other factors (see below) to ensure the most suitable project process possible. Possible factors to which the generic project management frameworks should be adapted are:

- Conditions of the industry sector
- Market conditions and regulations
- Competitive conditions
- Company mentality
- Willingness to take risks
- Development potential

Another main topic deals with the question of when agile project management frameworks should be chosen and when sequential frameworks seem suitable – considering contextual factors of the industry and the market and competitive situation of the company (see list above).

3.3 Agile Project Management Frameworks (Example of Scrum) [100]

3.3.1 Principles

Agile project management is fundamentally characterized by the fact that communication and interaction of the people involved are put in the focus of all involved methods.

All agile project management frameworks today share the guiding principles that were mainly and most clearly defined for eXtreme Programming (XP). These include:

- Rapid feedback
- Expect simplicity
- Incremental change
- Accept change
- Quality work
- Open communication

(See references for more details on Extreme Programming).

3.3.2 Underlying Concepts of Scrum

In this section, three basic concepts of Scrum are described.

- **Transparency:** The emergent project process and work must be visible to those performing the work as well as those receiving the work.
- **Inspection:** The Scrum artifacts and the progress toward agreed goals must be inspected frequently and diligently to detect potentially undesirable variances or problems.
- **Adaptation:** If any aspects of a process deviate outside acceptable limits or if the resulting product is unacceptable, the process or the materials being produced must be adjusted.

3.3.3 Scrum Roles

The goal is to form project teams that organize themselves independently. Scrum knows only three roles: the Product Owner, the Developer, and the Scrum Master.

- Product Owner

The Product Owner has the task of defining and prioritizing the development goal (“What shall be developed”) and managing the project budget. All backlog items are recorded in the so-called Product Backlog. However, the product owner does not distribute backlog items to individual team members.

- Developer

The "Developer" role includes all persons involved in the development. Developers select their backlog items from the prioritized product backlog and commit to completing them by a certain date (“How it will be developed”).

- Scrum Master

The Scrum Master has the task of constantly checking compliance with the Scrum approach and rules. He or she should not be the Product Owner. In particular, he/she must prevent the Product Owner from making too many detailed planning specifications or from exerting influence on the estimates and work of the team. The Scrum Master is a servant leader as well as "protector" of the developers and acts as “master of ceremonies” for the Scrum process.

3.3.4 Scrum Events

According to Scrum, products are developed in iterations, so-called Sprints. Each sprint focuses on a part (“shippable increment”) of the overall functionality. They have a constant duration of usually 2 to 4 weeks.

During each sprint, the following four events take place:

- Sprint Planning

In a sprint planning meeting, a decision is made as to which items from the Product Backlog shall be processed in this Sprint (definition of the Sprint Backlog). Those items are translated into tasks and their related effort is estimated. This effort estimation is often done either in a second planning meeting, in a separate part of the first meeting or continuously during the sprint.

- Daily Scrum

The Daily Scrum is a 15-minute meeting of the developer team and the Scrum master, in which progress towards the Sprint goal is inspected, necessary adjustments of the product backlog and the planning are triggered, and impediments are addressed.

- **Sprint Review**

The shippable increment is presented to the customer or – if not available – to the product owner and, if possible, to other key stakeholders. The purpose of the Sprint Review is to inspect the achieved outcome of the Sprint and determine future adaptations

- **Sprint Retrospective**

A sprint retrospective is held to analyze what can still be improved and to plan ways to increase quality and effectiveness. The focus of this meeting lies on team dynamics and continuous improvement, not on product quality.

4 Project Initiation [90]

Terms

Project Definition

Learning Objectives

CPPM LO 4.1 (K2) Understand the importance of project initiation

CPPM LO 4.2 (K1) Know the objectives and activities of project initiation

CPPM LO 4.3 (K2) Understand the need for negotiation, facilitation and communication skills during project initiation

CPPM LO 4.4 (K1) Know content of project definition

CPPM LO 4.5 (K2) Understand the importance of documenting the project definition in writing

CPPM LO 4.6 (K2) Understand commonalities and differences in contract design depending on the process model

CPPM LO 4.7 (K2) Understand the importance of requirements analysis

4.1 Initiating the Project [35]

A new project is usually based on a customer inquiry, a new or modified business scenario, or a need that has arisen internally.

ISO 21502:2020(E): “The purpose of initiating a project is to plan the project, define the project organization, mobilize the project team, define project governance and management, identify stakeholders and verify the project is justified.” Exactly which processes are required for initiating a project depends on the project organization and the intended project management framework. At a minimum, there must be agreement that there is a need for action and that an investment is required.

From this moment on, project initiation begins, the goal of which is – according to the above definition – to

- Identify and evaluate opportunities and risks and to make a decision for or against the further implementation of a project

Typical decision criteria for a project are financial aspects and feasibility, but also strategic considerations e.g. regarding market shares and legal requirements. Developing prototypes and checking technical feasibility help to obtain clarity about the objective and feasibility and to better assess risks (see also chapter 10 "Risk management").

- Obtain necessary information for the start of project implementation

In close consultation with the customer (internal/external), the project objectives are clarified. Concrete requirements are derived from the project goals either during project initiation or later

in the planning phase and, depending on the process model, documented in the form of a requirements specification (sequential) or as user stories for the first release (agile). Since it can always be assumed that the requirements will change during the course of the project, a change process should be defined and agreed upon at the beginning of the project, especially in sequential project management frameworks.

- Clarify contractual issues with customers / partners / suppliers / service providers

In addition to the financial aspects, the following points should be contractually regulated:

- Milestones and Content of delivery
- Reporting, communication channels and contact persons
- How to deal with changes
- Definition of serious deviations and how to deal with
- Definition of the process model
- Procurement of necessary resources

Project success and acceptance strongly depend on the determination of the project goals and a clear project delimitation. A frequent problem in projects is that the goals are not (sufficiently) explicitly described and, as a result, participants in the project envision different goals. Therefore, it is important to define within the project delimitation what is part of the project and what is not and how early feedback shall be collected / provided. This is typically part of a document that should be signed-off by stakeholders, and has different names in practice, such as “project charter”. We call this document “project definition document” (see below).

For the project manager, project initiation is characterized by negotiations on all levels: with customers, partners, service providers and suppliers, but also within the own company (“I need your employee”). In addition, it is the project manager's responsibility to facilitate and document workshops, if necessary, and to communicate the results in all directions:

- inwards (kickoff event)
- upwards (management presentation)
- outwards (to customers, partners, suppliers / service providers)

It is important to create an open, fault-tolerant project culture from the beginning. Projects in which errors are covered up and deviations are communicated as late as possible are difficult to control.

As a result of project initiation, a project order is issued.

4.2 Project Definition [25]

An important part of the project order is the project definition, i.e. the written definition of the following contents:

- Project motivation: the business motives why the project should be carried out, e.g. profitability, business case;

- Quantifiable project goals (success criteria in the triangle of scope, cost, and time) that must be met for the project to be considered successful;
- List of stakeholders;
- Development plan: Description of the planned approach to achieve the requirements and objectives (roles and tasks), list of deliverables to be produced (e.g., code, manual, installation instructions, but also planning documents and development documentation), planned process model, major milestones, rough schedule, rough budget;
- Specification of requirements for the product to be developed (more or less detailed);
- Preconditions and assumptions, e.g. regarding the availability of resources, the technical design of interfaces, and the opportunities and risks in general;
- Project organization, project team, whereby this can initially be a core team (more on this in Chapter "Human Resource Management").

The project definition can be part of a contract. It certainly adds value regardless of the selected project management framework.

The project definition is determined in close consultation with all stakeholders, e.g., in a workshop. The project manager should therefore have knowledge of facilitation techniques (facilitation cards, point polling, basic rules of brainstorming, creativity techniques if necessary) in order to be able to visualize issues and analyze and resolve conflicts if necessary.

4.3 Contract Design [15]

The binding regulation of cooperation is an essential success factor for the project. At project initiation, the basic form of cooperation with project participants must be clarified and the appropriate form of contract selected — whether through awarding to general contractors, engaging subcontractors, suppliers, and/or external personnel, or establishing cooperation within a consortium. The clear definition of duties, authorities, decision-making processes and escalation paths is crucial.

Depending on the project and the project management framework, the contract design can have different focuses and document types. A classic form of contract is the requirements specification (the client's wishes) and the functional specification (the contractor's binding commitment). The disadvantage of this contract form is that changes are usually not provided for. Agile project management frameworks and service-oriented industries focus on contractually defining the following points:

- Coordinated (!) approach, especially with regard to the prioritization of business opportunities, epics, story maps, user journeys and user stories
- Communication channels and forms
- Dealing with changes and deviations

In order to achieve a certain degree of planning security, constraints and boundary conditions must

also be defined in agile projects (e.g. the basic system architecture).

Regardless of the project management framework, it is important to clarify and agree on the client's obligation to participate.

4.4 Requirements Analysis [15]

The elicitation and analysis of requirements for the system to be created is an important part of project initiation. Unclear and missing requirements pose significant risks in later project phases.

While the list of stakeholders should be known at the end of project initiation, the requirements are usually not yet fully described at this point and are only concretized during project planning.

The process for requirements analysis varies from company to company and project to project. However, the following success factors are common to all project management frameworks:

- Requirements must be sufficiently clear, documented, and agreed upon.
- Requirements must be clearly prioritized.
- Stakeholders must be sufficiently involved (as input providers and reviewers).
- The entire product life cycle must be considered (also maintenance, uninstallation, etc.).
- Interfaces and delimitation must be clarified.

The project manager can delegate stakeholder and requirements analysis to a dedicated requirements engineer, but must continuously monitor the progress of activities and mediate if necessary.

5 Project Planning [240]

Terms

Activity

Critical Path

Deliverable

Milestone

Task

User Story

Work Breakdown Structure (WBS)

Work Package

Learning Objectives

CPPM LO 5.1 (K1) Know the steps of project planning.

CPPM LO 5.2 (K1) Know the content of milestone planning

CPPM LO 5.3 (K1) Know the structure and content of a work breakdown structure

CPPM LO 5.4 (K1) Be able to name non-functional delivery objects

CPPM LO 5.5 (K2) Understand the significance of the work breakdown structure for further planning activities

CPPM LO 5.6 (K2) Understand the relationship between effort and cost estimation in SW projects

CPPM LO 5.7 (K1) Know areas of application for size estimation

CPPM LO 5.8 (K1) Know principle and content of expert estimates

CPPM LO 5.9 (K1) Be able to name methods of expert estimation

CPPM LO 5.10 (K2) Understand rules for successful expert estimation

CPPM LO 5.11 (K1) Know the principle and content of analogy estimations

CPPM LO 5.12 (K1) Be able to name methods of analogy estimation

CPPM LO 5.13 (K1) Be able to name advanced estimation methods

CPPM LO 5.14 (K2) Understand the importance of estimation and the involved challenges, especially regarding cost estimation

CPPM LO 5.15 (K2) Understand the importance of the activity schedule

CPPM LO 5.16 (K2) Understand the concept of the critical path

CPPM LO 5.17 (K1) Know forms of personnel resource planning

CPPM LO 5.18 (K2) Understand the importance of project planning for milestone schedules and controlling

CPPM LO 5.19 (K1) Know basic rules of successful activity scheduling

CPPM LO 5.20 (K2) Understand the specifics of activity scheduling in sequential project management frameworks

CPPM LO 5.21 (K2) Understand the specifics of activity scheduling in agile project management frameworks

CPPM LO 5.22 (K2) Understand differences in cost planning in sequential and agile project management frameworks

CPPM LO 5.23 (K1) Know the content of the project plan

5.1 Determine Project Content and Milestone Plan [10]

Project planning is a continuous activity that starts at project initiation when the project definition is created. During the project, this project definition or parts of it are revised and further detailed as the understanding of the project content increases. The activities and artefacts described in this chapter are closely related to the management practices “Planning”, ‘Costs’ and “Schedule” of ISO 21502:2020(E) and form the basis for subsequent controlling.

Many projects require overarching scheduling, often in the form of a milestone plan. The milestone plan is established from the project goals and compared with predefined milestones, if existing.

A **milestone** is an event of particular importance in project management, e.g.

- The existence of delivery objects (i.e. “deliverables”, see below),
- acceptance and testing,
- decision on the further progress of the project.

Milestones have an important function. Among other things they

- reduce the risk of undesirable developments,
- support an orderly transition between project phases,
- enable continuous goal orientation and a sense of achievement among employees, and
- synchronize collaboration.

The milestone plan will include the main milestones (e.g., start project execution, agreed requirements, agreed system architecture, coordinated deliveries and others), as well as supporting, internal milestones depending on the circumstances.

A **deliverable** can be seen as a unique and verifiable element that is required to be produced by a project, work package or milestone. Deliverables define the required outputs and outcomes of a project, and correlate to either tangible or intangible objects that have to be delivered by the project.

5.2 Create Work Breakdown Structure [30]

The work breakdown structure (WBS) is used to create a picture of a project based on its deliverables. The purpose of the work breakdown structure is to identify all delivery objects and to prevent components and work packages from being overlooked.

A **work package** can be defined as a group of activities that have a defined scope, deliverable, timescale, and cost.

The criterion for a deliverable in the sense of a WBS is that activities are determined from it in the subsequent planning steps, which in turn generate efforts and must therefore be taken into account in time planning and progress monitored. For this reason, work packages should also be included that do not have a purely functional character, such as

- project management
- quality assurance
- configuration management, etc.

With respect to the "technical" parts, the WBS already reflects a very rough and preliminary architecture.

The result of this planning is a hierarchical, graphical work breakdown structure (WBS), whose components are referred to as work packages or components at the lowest level.

Agile projects use different terms but follow the same idea of breaking down larger work packages into smaller items. Typically, a product backlog with items is created, which will be continually updated and detailed. Epics are detailed in user stories and represented as story maps. However, story maps **often** focus on specific user journeys and serve to organize user stories by features and priorities. They do not represent the entire scope of a project. This is precisely why a WBS can also be valuable in agile environments, especially as it can be created at an early stage and helps to create an initial estimate of the expected effort for the project.

The WBS should be created in a workshop with a meaningful group of participants and requires a downstream review.

It is important that each component has a unique identifier to which all other documents (e.g., activity schedule) refer. All assumptions and conditions that led to the creation of the WBS should be documented.

5.3 Effort and Cost Estimation [75]

At the lowest level, the WBS provides the work packages from which the activities are derived, which must be estimated and planned in detail. As the smallest unit, the planned activities, form the basis for project controlling later.

Agile projects perform effort estimations at user story level, but refine them during sprint planning. Then, the team determines the necessary tasks, which may lead to an updated estimate.

In Scrum, the effort is not seen as a constant that only depends on the duration of the sprint and the team size. Rather, the productivity is seen as a variable that has to do with the velocity of work within the team. Mike Cohn introduced the term "velocity" in 2005 as "the amount of work a team can tackle during a single sprint." Many see this as the key metric in Scrum (Cohn, 2005).

By far the largest cost factor in software development is personnel costs. Therefore, the intention in

sequential projects is to estimate the effort required to process the work packages as exactly as possible. Based on the estimated effort the costs are then determined. Costs for technical equipment, materials, training, etc. can usually be determined relatively precisely. However, agile projects accept that an exact upfront estimation of efforts is often not possible without spending a lot of time and effort. Therefore, other methods such as “story points” are used (see section “Estimation by Analogy” below).

It is important to distinguish between cost estimation and project pricing. The latter is a business decision – for example, in the case of a strategic project, such as the first in a new business segment, a company might choose to bid below the estimated cost.

Size estimates provide coarse-grained results and require a countable mass to determine the "size" of the product, such as number of lines of code, modules, masks, input fields, etc. The estimate of effort resulting from the size estimate should be based on sound historical data from similar projects.

Depending on the quality of the database, size estimates provide estimates of appropriate quality in a relatively short time. Especially in large projects, they can provide values for milestone planning or preparation of proposals with reasonable effort.

In principle, effort estimates can be performed in two different ways:

- Expert estimates
- Estimation by analogy

Expert Estimates

Established methods for this are the Delphi method, informal expert estimation, and three-point estimation. They are based on the fact that experienced personnel determine the effort for known technologies on the basis of experience.

In order to obtain reliable estimates, which are used e.g. for time planning, the estimation takes place on the activity level.

The following rules apply:

- The smaller an activity is, the more accurate the estimate, but the effort to estimate increases if there are many very small activities. A trade-off must be made here. With regard to later project controlling (see "Project Controlling"), values of a few days have proven to be useful.
- Estimates are only estimates.
If there are many small activities, the errors will average out.
- Estimating requires experience.
Uncertainties and risks must be reflected in the estimated values (e.g., in the form of buffers).
The quality of the estimates should be reflected regularly to ensure reliable values in the medium term.
- Where possible, estimates should be made by the subsequent person in charge.
- The estimates should never be performed by one person alone.

If at least two experts have made the estimates, they must agree on a value for each activity (estimation workshop).

Expert estimates are preferably used when no historical, statistical material is available.

Expert estimates are the tool of choice in agile project management frameworks (e.g. Scrum), often using planning poker cards.

Estimation by Analogy

These estimates must be based on data from the past. Based on those historical data, analogies can be drawn and expected efforts determined.

Established methods for this are the multiplier method and the percentage method. Here, only partial steps are estimated, and the missing data is calculated according to the method.

In an Agile environment, T-shirt size estimation is a popular technique that resembles the analogy-based multiplier method. Rather than estimating each work item in isolation, the team agrees on the relative size of the epics, user stories, or features. The multiplier for the T-shirt sizes XS, X, M, L and XL is then derived from the historical empirical values.

Strictly speaking, even planning poker relies on an empirical multiplier. The expert estimate yields the number of story points that are presumably required to implement a work item. To convert this effort estimate into working hours, it must be multiplied by the average number of hours required per story point, which depends on the velocity of the team.

5.4 Cost Determination [15]

The cost of activities is determined by multiplying the estimated effort with the associated labor cost rates.

Often, an estimate of the total volume must be available when preparing a proposal, which leads directly or indirectly to the price of the offer.

These estimates may then have to be prepared in a very short time with incomplete information. This is where size or top-down estimates can help.

In any case, it must be kept in mind that a detailed estimate at activity level is only possible right before scheduling. At that moment, deviating values should be expected.

5.5 Establish Activity Schedule [90]

Sequential Project Management Frameworks

Based on the work breakdown structure, the activities required to achieve the project goals are

derived from its work packages. The result is an activity schedule that includes all activities of the project. The activity schedule should be compatible with the WBS, ideally in the same hierarchical structure as the WBS.

The individual activities should be described so well that they are unambiguous for the project team members. Furthermore, all assumptions and general conditions should be documented. If necessary, the work breakdown structure is updated based on the knowledge gained and the effort estimate for the activities is refined once again.

The dependencies (relationships) between the activities are determined and documented.

Furthermore, the personnel resource planning must be carried out. For this purpose, it must be determined how many persons of the various qualifications are available from when to when and to what extent. The workload of the individual employees should ideally be 100% (taking all activities into account, i.e. including non-project activities, vacation, training, etc.). Another aim of the personnel resource planning should be to have low fluctuations. In agile project management frameworks, one speaks of stable teams over the entire project duration.

The personnel resource plan can be defined informally or formally, depending on the requirements of the project. Its level of detail depends on the complexity of the project and the management framework.

Note that the duration of an activity may differ from the determined effort if the activity is not scheduled full time, or planned wait times occur. However, it is the duration that determines the activity schedule.

Whenever possible, the goal should be:

- Only one employee per activity (e.g. only one name per task card)
- Only one activity per employee in a period

If these rules are followed, subsequent controlling will be easier.

Critical Path

Based on effort estimates, staff scheduling and dependencies between activities as well as their duration, it is possible to determine activity start and finish dates and the milestone dates.

If the end or milestone dates are not acceptable after the activities have been arranged in the schedule, the planning must be optimized accordingly (e.g. by condensing or parallelizing activities). Project planning is therefore an iterative process.

As a rule, the activity schedule should be drawn up with the help of a project management tool. Bar charts (Gantt charts) are the tool of choice for presenting activity schedules.

The result is a documented activity schedule that includes dependencies, durations, resources and deadlines.

Each project phase or entire project has a **critical path**, that is a sequence of activities that determine the earliest possible completion date for that project or phase. All activities along the critical path have no buffer time, which, in other words, also means that any delay on the critical path results in a delay in the overall project duration. Project management should control related risks arising from the critical path.

In sequential models, activity scheduling is done in advance and often for the entire course of the project. This automatically leads to the problem that

- changes must be expected, which means that a certain part of the planning effort has to be repeated.
- it is not possible to predict whether late-scheduled, critical activities have to be processed in a phase in which a high load of non-plannable events has occurred.

This is countered by agile project management frameworks.

Agile Project Management Frameworks

In the agile world, there is no detailed upfront time planning. Rather, the closer we get to the delivery of an increment, the more detailed the planning becomes.

Work packages (often epics, features, or user stories) are only roughly estimated by the agile teams to enable release planning. The detailed estimation and planning then takes place at the start of each iteration (e.g. sprint in Scrum). In this case, the activities/tasks to implement a user story/feature/epic are created by the team and estimated in detail only for user stories of the actual sprint. Within the sprint, there is no scheduling of tasks, because it is the team's responsibility to prioritize the tasks within the sprint.

This avoids unnecessary effort for rescheduling and critical components can be processed at an early stage – as far as possible – through prioritization.

5.6 Establish Cost Planning [15]

Sequential Project Management Frameworks

In the course of cost planning, the project manager creates a time-based cost plan for the entire project based on the previous cost estimates and schedule. This cost plan serves as the basis for tracking costs during the project. It makes the course of the costs over the project duration transparent.

Agile Project Management Frameworks

Since there is no detailed upfront cost plan in agile frameworks, release planning and sprint results serve to make transparent what can still be implemented within a residual budget.

5.7 Establish Project Plan [5]

The project plan is the collection of the results of the various planning processes. Care should be taken to ensure that the various documents are consistent and may thus serve as a basis for project tracking.

In addition to the planning documents addressed in this section, the project plan includes the planning documents of the other sections (software quality assurance plan, risk mitigation plan, etc.). Finally, the project plan should include planning for communication, informally or better yet, in the form of a communication plan.

The project plan should be subject to review and may require formal approval. It is distributed to all affected parties. The project plan can be structured in a variety of ways and is continually updated throughout the project. The project plan is subject to configuration management.

6 Implementing and Controlling a Project [210]

Terms

Change Control Board (CCB)

Burndown Chart

Change Request

Milestone Trend Analysis (MTA)

Push System

Pull System

Status Report

Learning Objectives

CPPM LO 6.1 (K2) Understand the importance of project controlling

CPPM LO 6.2 (K1) Be able to name the components of project controlling

CPPM LO 6.3 (K2) Understand the importance of a reliable project progress monitoring

CPPM LO 6.4 (K2) Understand differences in progress data collection in sequential and agile approaches

CPPM LO 6.5 (K1) Be able to name the different forms of reporting

CPPM LO 6.6 (K2) Understand the importance of progress reporting

CPPM LO 6.7 (K2) Understand the importance of audience-focused meetings and their advantages

CPPM LO 6.8 (K1) Know phases of a meeting

CPPM LO 6.9 (K2) Understand areas of application of milestone trend analysis

CPPM LO 6.10 (K2) Understand areas of application of earned value analysis

CPPM LO 6.11 (K2) Understand the meaning and impact of change

CPPM LO 6.12 (K1) Know levels of change management in sequential project management frameworks

CPPM LO 6.13 (K1) Know the activities of change management in sequential project management frameworks

CPPM LO 6.14 (K2) Understand specifics of change management in agile project management frameworks

6.1 Importance of Project Controlling [15]

Project management means always knowing the project status and how it is likely to develop.

After the preliminary work in planning, project controlling is the instrument to monitor the progress of the project, to detect deviations from the original planning and to initiate appropriate measures (e.g. also escalations).

Within project controlling, the achieved results and consumed resources (budget, time), as well as new influences are recorded and verified. If serious deviations are detected, a new, revised or corrected planning is necessary. If the actual state proves to be acceptable, no action is necessary.

6.2 Implementing a Project [20]

The allocation of resources to activities differs between sequential and agile project management frameworks, both in the timing and in the process itself.

Sequential Project Management Frameworks

Sequential models are "push" systems.

Employees are assigned to activities by means of planning practices and ideally at the beginning of the project. It is thus crucial to understand employee qualifications and availability at this early stage.

The assignment should be agreed upon with the concrete person in charge later. The degree of completion is documented.

Agile Project Management Frameworks

Agile frameworks generally operate as 'pull' systems, meaning that the processing of tasks is a collective team responsibility. Tasks enter an iteration without being pre-assigned and are then 'pulled' by individual team members when they are ready to work on them.

Responsibility for meeting iteration goals rests with the entire team. Completed activities/tasks are documented.

6.3 Tracking the Progress [45]

The progress of the project must be constantly tracked, and cost compliance monitored. For this purpose, a reporting and information system is required in which the key performance indicators (progress against plan, problems, completion of work) are collected by the project managers, if necessary, across different levels in the project. The project manager condenses this information and in turn reports to the stakeholders as part of reviews.

In general, the recording of the actual values of the activities should follow the following rules:

- The recording should take place promptly, as deviations can then be reacted to quickly.
- Recording should be as efficient as possible so as not to burden processes and employees.
- Short activities allow progress to be measured reliably, as it is not necessary to use a percentage of completion here. In this case, only completed activities are evaluated.
- The recording should provide reliable values. If there is no culture of transparency or tolerance for errors, data may be glossed over. Measures are delayed as a result.

Sequential Project Management Frameworks

In sequential frameworks, the progress of activities can be recorded at high frequency by using a tool in which the employees themselves can mark the start and end of an activity. If this is not available, it

is done by verbal queries.

Recording of remaining effort is required when longer or critical activities are involved.

Deviations from the existing time planning lead to rescheduling, which may cause considerable additional effort and risk.

Agile Project Management Frameworks (Example: Scrum)

Scrum does not specify that the progress of all activities/tasks should be recorded on a daily basis. However, it requires that the team inspects progress toward the sprint goal. Again: transparency and inspection are essential in Scrum. Inspection of progress should be achieved in the Daily Scrum, and also by status updates on the (haptic or tool-based) Scrum board.

Most Scrum-Teams use the "sprint burndown" (open vs. done tasks within a sprint) as a daily metric to track their status. For each task the remaining effort can be estimated if it is not completed on the respective day in order to support transparency. However, this is not mandatory. In any case, it should not take long, as the focus in Scrum is on value-adding activities.

6.4 Progress Reporting and Information Exchange [40]

One of the project manager's tasks is to report regularly on the progress of the project.

The exact number, frequency, and manner of meetings, reviews, and reports will be determined by company processes or contractual arrangements (see "Project Initiation").

Writing Reports

Creating reports is the first component of information exchange in the context of project controlling.

Formal status reports address external stakeholders in order to provide optimally condensed information in their language and vocabulary.

Conducting Regular Meetings

Regular meetings must be held to share information, monitor progress, monitor budgets, discuss problems, and capture lessons learned. For larger projects, this usually involves several meetings at different levels and with varying frequency.

A distinction should be made between

- Project internal status meetings;
- Internal project reviews;
- Formal status reviews or milestone reviews at selected milestones involving customers, product management and higher management;
- Project steering group or steering committee: the highest decision-making body in the project organization, usually with top management participation.

Meetings are necessary, but they are inherently non-productive activities if they are purely organizational in nature. They must therefore be well prepared and conducted as efficiently as possible.

This should be reflected in the group of participants and in the duration. All meetings should represent the following three stages

- Preparation
Invitation, subject area, agenda
- Execution
Punctuality, efficient flow, full attention of all participants, cooperation, making decisions, assigning responsibilities for tasks
- Follow-up
Meeting minutes, distribution of minutes, archiving of minutes, follow-up of tasks

Especially in status meetings with the steering committee or management, care should be taken to ensure that this is done in a way that is understandable to the audience. Explanations at activity level should be avoided here, as this is not the focus of the participants.

Special Features of Agile Project Management Frameworks (Example: Scrum)

The sprint review is a fixed event in Scrum at the end of each Sprint, where the results of the sprint, especially the shippable increment, are formally presented to the customer or the Product Owner as representative of the customer. During the Sprint, the necessary transparency concerning progress may be obtained by publishing the daily results on a board that can be viewed by everyone.

Moreover, Scrum makes explicit statements about the expected Scrum events and artefacts in terms of type, duration, group of participants, and documentation (“Definition of Done”).

6.5 Trend Systems [45]

Well-known trend systems for project control are

- the Milestone Trend Analysis (MTA) for sequential project management frameworks:
The MTA offers a strong cost/benefit ratio and is historically used in sequential project management frameworks. It provides a graphical overview of project progress based on milestone forecasts and can be integrated into status reporting.
- the Release Burndown Chart for agile project management frameworks:
The Release Burndown Chart is used in many Scrum projects, although it is not described in the official Scrum Guide or prescribed by agile project management frameworks (see e.g. scrum.org). However, it can contribute to track progress towards a release goal. It visualizes the amount of remaining work over time and helps identify trends or deviations in the team's velocity and delivery pace.

6.6 Change Management [45]

6.6.1 Sequential Project Management Frameworks

In sequential models, changes are a deviation from the initially analyzed and agreed requirements. This means that additional effort is required due to

- repeated analysis
- rescheduling
- possible rework. Regressions should be expected, which can have effects on tests.
- additional errors, as well-coordinated processes may be undermined.

For these reasons, the effort required for changes should not be underestimated!

According to ISO 21502:2020(E), a **change request** is a documentation that defines a proposed alteration to a project. It is the central document of the project management practice “change control” (see above) to control changes to the project and deliverables and to formalize acceptance or rejection of these changes.

It is therefore imperative that this change control process for recording, evaluating and tracking changes is established as part of change management.

Changes will almost certainly occur. Therefore, a well implemented change management is a basic requirement for proper project execution. There are two levels of change management:

- The project scope (e.g., requirements changes, milestone schedule changes, cost changes) changes:
 - The proposed change is usually documented as a change request. This change request is then analyzed for its impact on existing agreements.
 - The change is accepted or rejected. The decision is reviewed by the Change Control Board and documented.
 - For the adopted change, impacts on plans, work products, and activities are identified, documented, communicated, and tracked to completion.
 - The project definition and time-related cost plan are updated as appropriate.
- Errors found during verification result in changes to components that have already been implemented or planned. The errors can be discovered by the project's own verification, or by the customer.
 - The change resulting from the error is implemented within the scope of the change management.

6.6.2 Agile Project Management Frameworks

In principle, agile models do not distinguish between user stories or tasks that result from requirements or from changes. This is possible because the iterations are short. The length of the iterations is therefore also strongly dependent on the environment: In environments with a high rate of change, the sprints will be shorter. However, even agile projects may have to follow formal change

management processes due to company guidelines or regulatory requirements.

7 Project Acceptance and Closing [30]

Terms

Learning Objectives

- CPPM LO 7.1 (K1) Know the purpose and procedure of project acceptance
- CPPM LO 7.2 (K1) Know the purpose and procedure of project closing
- CPPM LO 7.3 (K1) Know typical activities of closing or terminating a project
- CPPM LO 7.4 (K2) Understand the significance of project acceptance for project controlling

7.1 Project Acceptance [15]

Project acceptance serves the purpose that the client (i.e. the commissioner of the project) formally declares acceptance of the project results. As a rule, acceptance by the project client or clients presupposes the correct and complete implementation of the given requirements. In general:

- Project acceptance must be planned at an early stage (time, responsible persons, resources, location, procedures).
- Project acceptance can only be carried out if clear acceptance criteria exist (contracts, with strong dependency to defined requirements).
- Project acceptance can be carried out in stages (e.g. "acceptance without defects", "Acceptance despite minor defects" to "No acceptance due to major defects"). Any additional measures that may be required must be defined and added to the activity plan.
- Project acceptance is closely interwoven with change management (see "Implementing and Controlling a Project").

Contractually agreed measures have to be implemented, e.g. payment of suppliers.

7.2 Closing a Project [15]

Every project should be officially closed. Especially in the case of longer projects, this can also be done in stages at the level of the project phases, so that the results of each individual project phase are approved. Each defined project phase, but especially the project as a whole, is officially closed. Therefore, the explanations here apply not only to project completion, but also to phase completion.

The term project (or phase) completion covers the following activities:

- When closing the project, the project manager must ensure that the project documentation is complete and up-to-date, and archived for later projects.
- All project participants reflect on the course of the project, e.g. in a project completion workshop, in the sense of a final review ("lessons learned"). This also includes an analysis of

the cooperation within the team and with the project environment.

- The project is recalculated by the project manager.
- The project manager evaluates the effectiveness and efficiency of the processes and identifies potential for improvement (if necessary, in advance with the team, see point above).
- The project manager undertakes a review of the project risks.
- The "lessons learned" are archived and made usable for future projects.
- The project manager and the team member themselves complete the entries in the skills database.

Often, the minutes of the project completion workshop (or review) constitute a final report. If no project completion workshop is held, the goals achieved in the project should be evaluated by the project manager and the client. They should be documented in a comprehensible way in a project completion report.

In agile project management frameworks, each sprint is “closed” in the sense that

- The Definition of Done is checked for the user stories that are delivered,
- the team velocity is recomputed to improve future planning activities, and
- lessons learned are identified during sprint retrospective.

8 Quality Assurance [60]

Terms

Learning Objectives

- CPPM LO 8.1 (K2) Understand the process-oriented approach to quality assurance
- CPPM LO 8.2 (K1) Be able to describe the content of a quality assurance plan
- CPPM LO 8.3 (K2) Be able to describe methods of quality assurance for processes
- CPPM LO 8.4 (K1) Understand the project manager's tasks regarding quality assurance for processes
- CPPM LO 8.5 (K2) Understand the specifics of quality assurance for products in agile projects

8.1 Quality Assurance Aspects [20]

In this syllabus, “quality assurance” is understood to be the sum of all quality assurance measures that are carried out throughout the life of a project to ensure that the quality objectives are met.

Quality is ensured through appropriate development processes and cannot be subsequently "tested into" it.

Quality assurance, even for agile projects, must be planned, executed, controlled and documented in the quality assurance plan. This quality assurance plan contains, among other things:

- Roles and responsibilities (responsibility and authority of QA personnel)
- applicable standards and procedures
- criteria for evaluating quality
- tasks / quality assurance measures
- required resources, time schedule and budget (if applicable)
- work results

A distinction is made between:

- Measures for checking process quality (i.e. conformity of the processes with the rules) and
- Measures for checking the quality of the work products (i.e. fulfillment of the requirements and specifications for the respective products)

If deviations are found, they are documented, reported, measures are initiated and these are tracked until completion. The earlier quality assurance measures are implemented, the more cost-effectively deviations can be corrected.

It is the project manager's job to instill in the team a basic understanding of the importance of quality assurance processes (and not just to train them in the use of tools and templates). When assembling the project team, suitable testers should also be selected and scheduled early on. On the one hand, developers should not test their own work, and on the other hand, not every developer is a good tester, since testers require different soft skills.

8.2 Quality Assurance for Processes [25]

Common methods of quality assurance for processes are:

- Milestone reviews – used to monitor whether the processes defined for the project have been adhered to.
- Metrics – used to monitor data that can be used to make statements about process quality. Well-chosen metrics are an efficient way to get a quick overview. Poorly chosen metrics can cause undesirable behaviors that harm process quality in the long run (e.g., if error messages are not documented).
- Audits – determine how well a quality process and its associated quality control are serving their purpose and whether there is a need for improvement or correction.
- Process validations – verify that a defined process is capable of continuously producing products to the desired quality. Process validations are mandatory in many safety-critical industries.

Deviations result in corrective actions and preventive actions, which are intended to eliminate the cause of the error and subsequently prevent its recurrence.

The quality assurance of processes is usually planned and carried out outside the project, but affects project managers directly as information providers and participants, e.g. in audits. In the project, the project manager has the task of communicating processes, methods and tools to the team and monitoring compliance and their correct use.

8.3 Quality Assurance for Products [15]

Quality assurance for products should be understood as a risk control measure in the project and not as an onerous duty to prove that the contract has been fulfilled. Testing does not replace requirements management, but presupposes it.

The organization of quality assurance for products depends on the process model. In sequential project management frameworks, the roles are clearly separated. In larger projects, there are independent test teams under the leadership of a test manager. In this way, the independence of testing from development is organizationally underlined.

In agile projects, the successful execution of all required tests should be an integral part of the acceptance criteria of an iteration (Definition of Done, or DoD for short). Agile projects also tend to have a higher degree of test automation.

Even in agile projects, the independence of the test should be maintained, which is definitely a challenge for the project organization. It is also important to firmly integrate testers of all test levels into the team (i.e., also the integration and system test).

9 Risk Management [90]

Terms

Learning Objectives

- CPPM LO 9.1 (K1) Remember that risk management is an iterative process
- CPPM LO 9.2 (K1) Be able to name risk management activities
- CPPM LO 9.3 (K1) Know the main causes of risks
- CPPM LO 9.4 (K2) Be able to classify risk management in sequential and agile project management frameworks
- CPPM LO 9.5 (K1) Know methods and success factors of risk identification
- CPPM LO 9.6 (K2) Understand methods of risk assessment
- CPPM LO 9.7 (K1) Know types of countermeasures
- CPPM LO 9.8 (K1) Know documentation of risks and countermeasures
- CPPM LO 9.9 (K2) Understand importance and tasks of risk controlling
- CPPM LO 9.10 (K1) Know importance of soft skills in risk management
- CPPM LO 9.11 (K1) Understand the concept of Safety Integrity Level (SIL) in safety critical areas

9.1 Core Idea of a Risk Management Process [30]

Risk management is an ongoing process that iteratively passes through the activities of identification, assessment, control and tracking. Risk management therefore has a beginning, but only an end for discontinued products. At the end of the project, responsibility passes to the successor project or product line.

Risks are divided into product risks and project risks. Both must be considered as part of the risk management of a project.

Main causes of project risks are too tight schedules, lack of resources and/or skills, lack of expertise and especially late and frequent changes. Each change, e.g., in requirements, introduces new risks that the project manager should control. The handling of change-related risks differs between sequential and agile project management frameworks. In sequential project management frameworks, the analysis of the impact of a change and the assessment of the associated risk are carried out as part of change management. In agile project management frameworks, the entire development process is designed for changes. At each iteration, the remaining work packages are reprioritized, which can mitigate project risks.

Regardless of the project management framework chosen, project managers should have internalized the process idea and, for example, not allow any unauthorized shortcuts during changes.

9.2 Activities of the Risk Management Process [50]

9.2.1 Risk Identification

The potential risks are identified and documented, using various methods (e.g., brainstorming sessions, interviews, checklist-based methods, diagramming techniques). Risk identification can be done iteratively at different project levels (at milestones, for subprojects, for sub areas e.g. production) and/or with different groups of people (project team, stakeholders external to the project, independent experts).

Success factors are a systematic approach, the involvement of experts and the integration of risk identification into the change process.

The result is a risk list that contains the risk itself as well as triggers (i.e., symptoms or warning signs that announce the occurrence of the risk).

9.2.2 Risk Assessment

The probability of occurrence and the severity of the impact are investigated and documented, and the risks are prioritized.

The probability is usually documented qualitatively, e.g. in the form of levels such as low - medium - high, with each level corresponding to a probability interval. Interpretation aids are important to better understand the levels and intervals.

The severity is usually also documented qualitatively in levels (low / medium / high). Interpretation aids are equally necessary, e.g. in the form of an impact matrix in which each level is defined in terms of impact on key project objectives such as cost deviations, schedule deviations and quality deterioration.

Prioritization is done by combining probability and impact. The result can be used to classify risks into risk classes that determine how the risk should be managed further. The assessment should be reviewed and updated periodically in the project.

The result of the risk assessment is a list of prioritized risks.

9.2.3 Risk Control

Countermeasures are planned for the risks, documented, responsible persons are determined and measures are initiated. Different types of measures are possible:

- Avoidance: avoidance of risks through a changed approach
- Transfer: Transfer to a third party (e.g. subcontractor)
- Mitigation: Early action is taken to reduce either the probability of occurrence or the severity of the impact is reduced.
- Acceptance: The risk is accepted, e.g. because no countermeasures are possible or they are too uneconomical. In this case, there are two main options:

- A contingency plan is prepared.
- A reserve (in the form of money, time, resources, etc.) is planned.

The results are documented in the risk action plan, which is usually integrated into the risk list.

9.2.4 Risk Monitoring

Risks must be tracked. The assessment of probability of occurrence and severity of impact, including the evaluation criteria, must be revisited periodically. New risks must be identified and evaluated periodically. All defined countermeasures must be tracked.

Risk management is one of the core tasks of the project manager and requires special soft skills. Facilitation skills (for the numerous workshops), as well as clear communication of the risks and the measures taken are particularly important. Concealing or ignoring risks jeopardizes the success of the project.

Analogous to the corrective and preventive measures mentioned in Chapter 8 "Quality Assurance," an organization can learn for the future from risks that have occurred, e.g., by creating or expanding checklists for risk identification.

9.3 Risk Management in Safety-Critical Domains [10]

The EN ISO 9001:2015 standard propagates a risk-based approach to quality assurance. This idea is continued in safety-critical industries with the concept of **Safety Integrity Levels** (SIL for short; see also IEC 61508). Depending on the risk, the functions of the product to be developed or its subcomponents are classified in one of the following five levels: non-safety-critical, SIL 1, SIL 2, SIL 3, SIL 4. However, only the product risks, i.e. potential hazards for the environment, users or third parties, are considered.

Projects in safety-critical industries are subject to stricter controls (e.g. regular audits). The higher documentation load and stringency in process compliance must be planned (time, budget, personnel) and controlled by the project manager. In addition, these projects require a high level of employee motivation, which the project manager must promote and maintain.

10 Human Resource Management [240]

Terms

Social Competence

Learning Objectives

CPPM LO 10.1 (K1) Know the goal of human resource management in an organization

CPPM LO 10.2 (K1) Know the key players of human resource management in an organization

CPPM LO 10.3 (K1) Know the tasks of human resource management in an organization

CPPM LO 10.4 (K1) Know the three levels of human resource management in an organization

CPPM LO 10.5 (K1) Know the three core activities of human resource management as cross-cutting task in a project

CPPM LO 10.6 (K1) Know HR tasks of project managers within integrated project management practices

CPPM LO 10.7 (K2) Understand the interaction between company-wide human resources management and project-related human resources management

CPPM LO 10.8 (K1) Know the different activities of project-related HR management in relation to team support

CPPM LO 10.9 (K2) Understand the importance of the project manager's interpersonal skills to project success

CPPM LO 10.10 (K2) Understand the importance of the team member's interpersonal skills to project success

CPPM LO 10.11 (K1) Be able to name four essential aspects of social competence

CPPM LO 10.12 (K2) Understand the importance of the team member's interpersonal skills to project success

CPPM LO 10.13 (K2) Understand the role and challenges of communication in projects

CPPM LO 10.14 (K2) Understand the positive and negative effects of verbal and non-verbal communication in a project.

CPPM LO 10.15 (K2) Understand how to communicate effectively in a leadership role

CPPM LO 10.16 (K1) Know the definitions of motivation and demotivation

CPPM LO 10.17 (K1) Know the difference of intrinsic and extrinsic motivation

CPPM LO 10.18 (K2) Understand how the project manager influences the intrinsic and extrinsic motivation of the team members

CPPM LO 10.19 (K2) Understand the importance of recognition and appreciation as the number one motivating factor

CPPM LO 10.20 (K1) Know the core aspects of leadership in project management, especially in terms of goal achievement, orientation, and team motivation

CPPM LO 10.21 (K2) Understand different leadership styles

CPPM LO 10.22 (K1) Recognize that leadership is a reciprocal and dynamic process requiring

continuous development, adaptability, and self-reflection

CPPM LO 10.23 (K2) Understand, how project management depends on the selected project management framework

CPPM LO 10.24 (K1) Know methods and tools for successful team leadership

CPPM LO 10.25 (K2) Understand the importance of facilitation for successful meetings

CPPM LO 10.26 (K2) Explain Tuckman's Model of Group Development

CPPM LO 10.27 (K1) Name typical options for action of the project manager depending on the group development phases by Tuckman

CPPM LO 10.28 (K2) Illustrate tasks and skills of the project manager depending on his/her role in the project

10.1 Human Resource Management in the Organization [20]

10.1.1 Definition and Goal of Human Resource Management in an Organization

Human resource management in the organization means leadership, management and control, development, and administration of the workforce as an independent management task. It is an important factor in the context of enterprise policy.

Its **goal** is employee satisfaction, low workforce costs and an increase in the competitive strength of the company.

10.1.2 Key Players in Human Resource Management in an Organization

The official representatives of human resource management in an organization are:

- C-level management (i.e. all “chief executives”)
- Works council
- Managers (i.e. also the project manager)
- Operating departments of human resource management

10.1.3 Tasks of Human Resource Management in an Organization

Human resource management tasks include:

- HR Policy Design – Defines the organization’s identity and strategic direction as an employer
- Human resource planning – ensures workforce capacity and skills match organizational objectives
- Staff deployment – optimizes employee placement for performance and engagement
- Recruitment and Onboarding – integrates new hires effectively into the organization’s culture and workflows
- Administrative HR functions – maintains operational and legal foundations for HR processes
- HR Development – fosters continuous growth for employees and leaders

10.1.4 Levels of Human Resource Management in an Organization

Human resource management basically has an integrative function in the organization, which refers to three management levels:

- Strategic human resource management – as a part of the overall corporate strategy
- Tactical human resource management – is oriented towards groups of jobs (e.g. career plans)
- Operational human resource management – deals with individual measures

All three levels are closely interrelated.

10.2 Human Resource Management in the Project [30]

People make the project. They are the most important success factor in any project, regardless of the project management framework. In fact, projects rather fail because of socio-cultural problems and less often due to technical reasons.

The way in which human resource management can be implemented in the project depends on the organizational form of the project (e.g. in parent organization, influence, matrix, autonomous, see chapter “Project Organization”), as well as on the project management framework chosen. Scrum and other agile project management frameworks do not explicitly address the question of human resource management. The integration of agile approaches often represents a major challenge to the company’s organization and human resources management.

10.2.1 Human Resource Management as a Cross-Cutting Task

During the project, **human resource management appears as a cross-cutting task** with three core activities:

- **Selection of staff:** Human resource management in the project has the task of ensuring that the planned and sufficiently qualified people are deployed in the required time. It is a matter of getting the "right people" at the "right place", "at the right time" and "in the right number"
- **Staff leadership:** keeping task-oriented and interpersonal aspects in focus, and providing guidance, involvement, and motivation to team members with respect to overall project goals. The project manager must be able to act as a leader in different situations (e.g., with management, interested parties, etc.). This requires leadership and communication skills. Note, that there is a difference between management and leadership. In short: Management strives to do things right; leadership strives to do the right things.
- **Know-how management:** Know-how management is about having solid expertise and applying it effectively in a project. It is the task of the project manager to identify, link and exchange knowledge based on sound communication, to discover and close knowledge gaps, to make the knowledge usable and transparent, to work with it and to "know who knows".

Project management acts as an interface to the organization's human resource management.

10.2.2 Human Resource Management Activities During the Project

Throughout the course of a project, Human Resource Management encompasses a spectrum of interrelated activities designed to ensure that the right people, with the right skills, are effectively engaged, supported, and developed to achieve both project and organizational objectives.

HR Activity	Description
Staffing Analysis	Systematically evaluates and documents team competencies to inform targeted individual, team, and organisational development.
Staffing and Recruitment	Secures required personnel in a timely and cost-effective manner, in alignment with defined project needs.
Personnel Assignment Management	Aligns individual qualifications and expertise with specific project tasks to maximise performance.
Personnel Change Management	Coordinates workforce adjustments, including onboarding, role transitions, and redeployment, to maintain operational continuity.
Personnel Cost Management	Plans, monitors, and controls HR-related expenditures to support financial precision and informed decision-making.
Personnel Development	Designs and delivers structured learning, growth, and advancement opportunities in line with strategic goals.
Staff Leadership	Provides clear direction, fosters motivation, and sustains effective communication to maintain team cohesion and engagement.

10.2.3 Project Manager and HR Expert – Successful Cooperation

Systematic cooperation of the project manager with the human resources experts from the line organization is necessary to obtain information about the project employees, to use it appropriately and to document it.

The typical division of labor is as follows:

- The project manager formulates requirements e.g. skills/abilities that the team needs for the task.
- The responsible HR department of the company organization provides the necessary information.
- Ideally, the project manager selects the personnel.
- The project manager names deficits if his requirement profile cannot be met.

Both together (project manager and personnel expert) look for solutions - training/replacement of the person, external support/freelancer.

10.2.4 Human Resource Management and Team Support

Independent of the integrated management practices outlined in section 10.3.2, it is possible to divide project-related HR management tasks into four activities of team support:

- **Team Building** – constituting the team and its structures.
These activities focus on getting the team ready to go. In sequential project management frameworks, the project manager assembles the team, sets the goal, and defines the project organization. In agile frameworks, those tasks are distributed between the product owner, the Scrum Master and the team.
- **Team Management** – leading and guiding the team.
These activities focus on supporting and steering the team in its work. They require high interpersonal skills of all parties. In agile project management frameworks, the responsibility for this is often less clear, as the team acts independently. To be successful, all must assume this leadership task. However, the Scrum master is guiding the team, not enforcing, but in an enabling manner.
- **Team Developing** – development of personal and professional competencies.
A continuous improvement process is supported by sound communication. In sequential project management frameworks, the project manager has the task to lead and develop the team. In agile frameworks, the Scrum Master helps the team to establish wikis, participate in guilds, or find other forms of skill development.
- **Team Closing** – assessment/evaluation, reintegration, team dissolution.
These activities focus on the appreciation of the work done. In sequential project management frameworks, the project manager evaluates project success, teamwork, ensures updating the employee profiles, accompanies and motivates employees, and celebrates successes. In agile frameworks, review and retrospective are performed after each sprint, but the HR aspects are often neglected. When an agile project ends, responsibility for the team members usually returns to the line manager. The scrum master will typically support team closing.

The goal of team support is to increase team performance and thus project success. For this to succeed, the roles and tasks of team members must be defined and coordinated, and communication and cooperation within the team must be clearly regulated.

10.3 Success Factor – Social Competence [30]

Definition of "social competence" (Waters & Sroufe 1983):

By social competence, we mean the availability (potential) and application (performance) of cognitive, emotional, and motor behaviors that lead to a long-term favorable balance of positive and negative consequences for the agent in specific social situations.

"Social competence" strongly depends on the context and the requirements of the specific situation. It requires a set of social skills that belong to the "soft factors", i.e. to the skills that cannot be verified with objective criteria. Therefore, they are called "soft skills."

Both the soft skills of the project manager and the soft skills of the team members have an enormous influence on the success of the project.

10.3.1 Requirements for the Project Manager

For the project manager, soft skills are one of the most important prerequisites for assuming a leadership position (see also Wong 2018). After all, leading means empowering and guiding other people. On the other hand, it is also desirable for each individual team member, because without social competence, teamwork, i.e., optimal team performance, is rather impossible.

The critical success factors of the project manager include the following competencies:

- Behavioral competence (social competence) —plays a fundamental role because projects are social systems.
- Methodological skills – knowledge, facility and use of appropriate and targeted project management methods
- Expertise – which enables the project manager orientation in project matters
- Knowledge of the industry, which also has a positive influence on the project activities.

10.3.2 Requirements for Team Members

Skills of the individual project member influence the project success just as strongly as the personality of the project manager.

Team members should be team players and flexible. They should be able to deal with complexity, show proactive initiative and be open-minded with respect to other cultures or new topics.

10.3.3 Four Essential Aspects of Social Competence

- **Dealing with oneself:** self-esteem that allows reflection, criticism, learning from mistakes
- **Dealing with other people:** show genuine interest in the other person, to be able to perceive and understand others, to accept foreign opinions and positions.
- **Aspects of cooperation**
- **Aspects of leadership**

Soft skills can be trained and learned, provided the general readiness to learn exists. Training can only be effective if one's own needs are recognized.

10.4 Success Factor – Communication [60]

10.4.1 Role and Challenges of Communication

Communication is the exchange of information between two or more persons. It is an elementary necessity of human existence and creates social bounds.

Communication works through speech, facial expressions, gestures, written exchanges, media etc.

Typical communication channels are:

- People - communication takes place informally and formally.
- Media - communication proceeds pictorially/visually, acoustically, in writing.

Communication is inherently difficult because it involves both sending and receiving messages, and misunderstandings can occur at either stage. The sender must clearly express the intended message, while the receiver interprets it through their own lens—shaped by experience, expectations, emotions, and context. Even small variations in language, tone, or nonverbal signals can cause misinterpretations, particularly when communication crosses cultural or technological boundaries.

10.4.2 Impact of Verbal and Non-verbal Communication of a Project Manager

Communication is verbal as well as non-verbal! In other words: One cannot NOT communicate!

For the project manager this means:

- Whatever the project manager says, does or omits, is communication and has effects accordingly.
- Statements of the project manager are perceived against the background of his role as a leader.
- In the worst case, the project manager's communication leads to misunderstandings, confusion and ultimately to demotivation of the employees.

Therefore, the project manager should also consciously exercise his/her role as a leader when communicating.

10.4.3 Successful Communication as a Leader

Therefore, the project manager – in their role as a leader – should:

- Conduct conversations mindfully and purposefully to build connection, common ground, and orientation,
- Focus on solutions rather than blaming people in difficult situations,
- Express thoughts diplomatically rather than sharply—especially when they are still getting to know the people and the context,
- Offer praise and recognition regularly, and
- Foster a culture of respectful and constructive 360° feedback.

These points, as well as properly expressed criticism, are part of the daily leadership tasks.

10.5 Success Factor – Motivation [40]

10.5.1 Motivation versus Demotivation

The term **motivation** refers to the inner driving force and willingness of a person to act in a certain way. Motivation presupposes that the person moves in an environment that is characterized by reliability, credibility, predictability, and goodwill and in which he or she is socially integrated. The motives of human action are usually characterized by goals, e.g., the desire to satisfy certain needs. For example, the prospect of a career jump may motivate an employee to take over the management of a project. However, the goals set must also be attainable.

Demotivation is a blockage (restriction) or loss of drive and willingness to act. Demotivated feeling and acting limits the form, direction, strength, and duration of the individual's commitment to organizational goals or roles.

10.5.2 Intrinsic and Extrinsic Motivation.

When a person is **intrinsically** motivated, even performing an action has a motivating effect because the action is perceived as exciting, interesting, valuable, and enriching.

Intrinsically motivated employees get involved out of curiosity, because they enjoy their work, because they want to be the best, or because their job allows them to act out their spontaneity. This form of "intrinsic motivation" has a long-term effect.

The needs of an intrinsically motivated person include: Success, appreciation, interesting work content, more responsibility, growth.

Extrinsic motivation acts from the outside. A person performs his or her action to achieve positive consequences (e.g., bonus) and avoid negative consequences (e.g., punishment). The action is a means or instrument to achieve or prevent a particular end. It is less interesting than the end associated with it.

Extrinsically motivated employees become involved in order to obtain, for example, better pay, a promotion, or better working conditions.

The needs of an extrinsically motivated person include: Security, stability, freedom from anxiety, friendship, belonging.

“Leaders set direction, align people towards the set direction, motivate and inspire people to move in the direction set by them.” Leading is thus avoiding demotivation and means creating development opportunities for employees" (see Agarwal, 2023, p. 123). Consequently, the main task of a project manager is to keep the team motivated.

10.5.3 The Project Manager as Motivator

The project manager serves as a role model and can influence the motivation and commitment of the project team members both positively and negatively. His or her attitude, experience, behavior

(e.g., professional demeanor) and leadership style are crucial.

Difficulties such as lack of information, unreliability, lack of integration of team members, delays, unclear or constantly changing priorities, work overload, or the constant questioning of decisions are part of everyday life. As a result, motivation decreases which results in delays in deadlines, loss of quality, and a decline in team performance.

During the project, many project managers focus on the implementation of the project content and overlook their role as motivator and enabler. In fact, one of the project manager's main tasks is to identify motivational and demotivational factors and respond accordingly. To do this, it is important to understand human motivational mechanisms.

10.5.4 Appreciation as Most Important Motivating Factor

The most important motivating factor is appreciation coupled with praise and recognition. Appreciation is a positive basic attitude toward other people and has nothing to do with an achievement, a result or a desired behavior. It should be a matter of course in dealing with each other, because unconditional appreciation is an existential need of all people.

The project manager should recognize how much appreciation exists in the project and where it can be improved.

Praise and appreciation refer to special behavior or outstanding performance. However, praise and recognition alone are not enough to ensure that project members are motivated and committed to working on the project. Motivation requires appreciation as a basis.

10.6 Success Factor – Leadership [30]

In project management, leadership means purposefully guiding teams to achieve shared goals. Particularly in agile environments, leadership must be situational, servant-oriented, and empowering. It builds on general leadership principles but must be adapted to complex and dynamic project situations. A practical, flexible, and people-centered approach is key.

10.6.1 Core Aspects of Successful Leadership

Core aspects of successful leadership are:

- **Vision**
A clear, shared vision creates meaning, direction, and motivation.
- **Structure**
Reliable frameworks, goals, and transparent decisions provide orientation — even in agile project management frameworks through roles and timeboxes.
- **Communication**
Open, respectful, and goal-driven communication strengthens collaboration; agile methods support this through daily routines and feedback loops.
- **Environment Design**

Leaders create learning-friendly, self-organized teams and focus on enabling rather than controlling.

- **Role Modeling**

Integrity, enthusiasm, and authenticity build trust—essential in servant leadership.

- **Appreciation**

Listening, respect, and psychological safety foster strong team dynamics.

- **Positive Attitude**

Encouraging self-responsibility and creativity empowers all types of teams.

10.6.2 Leadership Styles

Well-known leadership styles in the context of modern project teams are

- Participative –actively involves team members in decision-making processes and fosters engagement; motivation, and a sense of responsibility within the team
- Situational – the leader adapts the style based on the context, task, and maturity or needs of the team
- Authentic – the leader acts with transparency, consistency, and self-awareness, building trust through honesty and integrity

Leadership is a mutual process requiring versatility and continuous development. There are no universal solutions—effective leadership grows from reflection, learning, and adapting to evolving team and project needs.

10.7 Working in a Team [60]

10.7.1 The Project Manager in “Classic” and Agile Teams

Classically, the focus of a project manager in **sequential** project management frameworks lies on coordination, responsibility for the overall project and team leadership. The project manager:

- makes individual decisions and bears responsibility for them
- together with the team
 - clarifies complicated/conflicting situations
 - solves problems
- needs a sense to choose the appropriate behavior in the given situation

He or she guides and develops the team towards good performance.

In **Agile** frameworks, the roles and responsibilities are shared between the Project Manager (if present), the Scrum Master and sometimes even the Product Owner. The focus lies on operational team management. The person(s) who take(s) on the role of the project manager:

- facilitates an independently acting team as well as reviews and reflection rounds
- supports the team building process in iteration planning

- ensures that the defined processes are adhered to
- enhances both the professional competence and the personal effectiveness of the team members
- together with the team
 - clarifies complicated/conflicting situations
 - solves problems
- also needs a sense to choose the appropriate behavior in the given situation

The whole team is responsible for the success/failure in implementing the results – not the individual team members.

10.7.2 Methods & Tools for Successful Team Leadership

Project management requires methods / a toolbox to support the person(s) in charge in these tasks. For example, they may use the following (:

- Project management tools
- Communications techniques
- Facilitation techniques
- Creativity techniques
- Conflict & problem-solving techniques
- Presentation techniques
- Leadership techniques
- Self-management techniques

Knowing these techniques should be part of the standard repertoire of every manager, and knowing them should be part of the repertoire of every team member.

These methods enable team members to participate in the entire group process, so that they are engaged, solve specific tasks and realize their own interests. In this way, they arrive at results and decisions that are supported and implemented by the entire team in consensus.

10.7.3 Methods & Tools for Successful Meetings

Successful meetings require at first a clear goal setting (already in the invitation), so that people can prepare themselves. Moreover, good facilitation during the meeting re-focusses the group discussion on the goal (if necessary), fosters the creativity of the participants and makes the resulting ideas accessible to all. The following are important for success: the atmosphere, the roles in the group, openness and dealing with differing opinions, visualization, a neutral attitude and methodological competence of the facilitator.

10.7.4 Team Development Phases According to Bruce Tuckman

The use of models such as the team development model according to (Tuckman, 1965) provides interesting insights into teamwork. Using this model, the project manager can recognize group dynamics and moods in the team and understand, reflect, and illuminate the development path of

his team from the beginning to high performance.

Every team goes through five characteristic phases during its development.

The table below depicts the roles and desired behaviors of the project manager within these five phases of team development.

Phase	Identifying features	Role of the PM	Desired behavior
Forming (orientation phase)	Interaction in the team is polite, impersonal. Everyone is eager, but also cautious.	Host	Supports the team members getting to know each other, provides a feel-good and welcoming atmosphere, takes care of a good flow of information among all participants.
Storming (conflict/frustration or power struggle phase)	Conflicts, confrontations and clique formation occur. The impression of hopelessness arises.	Catalyst Conciliator Driver	Encourages discussions of controversial topics, perceives conflicts, creates an open climate, addresses conflicts directly, deals with conflicts constructively, directs the focus to project goals.
Norming (resolution or organizational phase).	New procedures are established and feedback is obtained. A sense of "we" is created. The team establishes manners, rules and standards.	Partner - one of many Guarantor of valid and functioning rules	Allows the team to become more autonomous, uses the participative leadership style, accompanies the team in agreeing its own rules, establishes processes and ensures compliance, develops feedback culture and acts as a role model
Performing (production or performance phase)	The team is: full of ideas, flexible, open, efficient, solidary, helpful	Supporter Advisor	Let the team make decisions, uses delegating style, can step back a bit, has focus on goals, facilitation, development of team members
Adjourning (farewell or resolution phase).	say goodbye team dissolution	Coach Mentor	Appreciates the completed work, enables mutual feedback on the cooperation, closes the project, possibly introduces new projects

10.7.5 Project Management Roles Requiring Social Competence

The following table represents the roles, tasks and required skills of the project manager during the project work:

Role	Task	Suitability / Ability
Coordinator	Clarify goals, distribute work, organize, coordinate with others	obliging and consistent (persistent), diplomatic rather than dominant
Facilitator	let everyone have their say, recognize and solve problems in communication, record intermediate results, pay attention to schedule	visualize, be neutral - hold back with own opinion, keep the red thread, proceed in a structured way, have method competence, control creative processes
Consultant	Clarify relationship problems between team members, technical and methodological issues	Mastering conversation techniques (e.g. active listening, questioning techniques, formulating I-messages), changing views, pointing out alternatives
Conflict manager	Solve role conflicts	Analyze communication structures and problems, understand basic mediation techniques, openness, courage
Representative	Represent team interests (project interests) to others	self-confident, open-minded, reflective, aware of own impact
Negotiator	negotiate resources (time, money, equipment) with the organization	realistic, master negotiation strategies
Presenter/speaker	Present team results and successes to the outside world	visualize, speak and argue - have rhetorical competence, be self-aware
Coach	Support team members in developing their potential and resolving challenges	Offer consistent backup, encourage, empathize, give personal feedback, nurture trust

Projects are social systems, which is why social competence is extremely important in project work.

11 Maturity Models [35]

Terms

Learning Objectives

CPPM LO 11.1 (K1) Be able to name the different maturity models (CMMI, ISO 330xx)

CPPM LO 11.2 (K2) Understand the principle of maturity models.

CPPM LO 11.3 (K2) Understand the principle of maturity levels.

11.1 Overview [35]

Maturity models ensure an independent assessment of the process quality of projects.

Maturity models contain extensive requirements for software development processes. They provide the projects with implementation practices for the processes combined in process groups (e.g., project management, risk management, quality assurance, engineering processes), which in turn specify the point to check during assessments. That way, the quality of the processes can already be ensured during the course of the project by applying the practices, and a smooth assessment process can be guaranteed.

The two best-known maturity models are CMMI and the ISO 330xx series which is a revision of ISO/IEC 15504 (“SPICE”). Both divide the requirements for the projects into maturity levels, which build on each other and make statements about the degree of quality that the individual processes achieve.

In the ISO 330xx series, these levels are called capability levels. The first achievable level is called CL1.

Processes that reach this level provide the evidence required in the practices. If a process wants to reach CL2, it must prove that the evidence was generated according to a planned procedure.

CL3 demonstrates that the processes originated in accordance with an established organizational process.

CL4 and CL5 prove that the organizational processes have been developed further in a planned manner. Maturity models were initially based on sequential approaches, but do not contradict agility. Project management frameworks (also agile) describe HOW something should be done. WHAT is to be created must be taken from a standard, or a maturity model.

Appendix A – Terms

Unless stated differently, the definitions are taken from this syllabus.

Term	Definition	Page
Activity	At the lowest level, the WBS defines the work packages from which the activities are derived, which must be estimated and planned out in detail. As the smallest unit, the planned activities later form the basis for project control.	35
Burndown Chart	A Burndown Chart visualizes the amount of remaining work over time and helps identify trends or deviations in the team's velocity and delivery pace.	43
Change Control Board (CCB)	Change control body that decides or rejects changes and documents the decision made.	43
Change Request	ISO 21502:2020(E): A documentation that defines a proposed alteration to a project.	43
Critical Path	ISO 21502:2020(E): Sequence of activities that determine the earliest possible completion date for a project or phase	35
Deliverable	ISO 21502:2020(E): Unique and verifiable element that is required to be produced by a project	35
Milestone	A milestone is an event of special significance in project management.	35
Milestone Trend Analysis (MTA)	The milestone trend analysis (MTA) is used to provide a graphical over-view of project progress based on milestones in the project status report.	43
Process	ISO 21500:2012(E): A process consists of a series of interrelated procedures. Software development process refers to the set of activities performed to create a software system. Input data are stakeholder requirements, output data are the created software system as well as further achievements of the project team. Project management processes determine how the activities selected for the project are managed and controlled.	16
Process Tailoring	Process tailoring is the adaptation of the project management frameworks to specifics of the company, of the project and other factors to ensure the most suitable project process possible.	25
Product Backlog	A list of backlog items representing the requirements of the software or solution to be developed within the project	25
Project	ISO DIN 21502:2020(E): A temporary endeavor to achieve one or more defined objectives.	16
Project Definition	Single overarching document, that describes the objectives and the management approach of a project, and thus serves as orientation for all stakeholders involved.	31
Project Life Cycle	ISO 21502:2020(E): A defined set of phases from the start to the end of a project.	16
Project Management	ISO 21502:2020(E): Coordinated activities to direct and control the accomplishment of agreed objectives	16

Project Management Framework	Project management frameworks compile methods and elements of software development including project management into processes and project phases of a standardized project flow in order to achieve the often-challenging project goals as efficiently and effectively as possible.	25
Project Organization	ISO 21502:2020(E): "The project organization is a temporary structure that defines roles, responsibilities and authorities in the project. Individuals are assigned by names to specific roles in the project organization."	23
Project Phase	ISO 21502:2020(E): Projects can be divided into project phases. The number and names of a project's phases depend upon the type of project being undertaken, desired governance, and the anticipated risk. The phases can reflect the delivery approach or project management framework being taken, and should have a defined start and end, as well as specific milestones that relate to the decisions, key deliverables, outputs or outcomes.	16
Pull System	In a "pull" system, the processing of tasks is a collective team responsibility. Tasks enter an iteration without being pre-assigned and are then 'pulled' by individual team members when they are ready to work on them. Agile project management frameworks are generally "pull" systems.	43
Push System	In a push system employees are assigned to activities during planning at the beginning of the project. Sequential models are push systems.	43
Social Competence	(Waters & Sroufe 1983): By social competence, we mean the availability (potential) and application (performance) of cognitive, emotional, and motor behaviors that lead to a long-term favorable balance of positive and negative consequences for the agent in specific social situations.	56
Sprint	According to Scrum, products are developed in iterations, so-called Sprints	25
Stakeholder	ISO 21502:2020(E): Person, group or organization that has interests in, or can affect, be affected by, or perceive itself to be affected by, any aspect of a project (...)	16
Status Report	Formal status reports address external stakeholders in order to obtain optimally condensed information in their language and vocabulary.	43
Story Points	A relative unit of measure used by the development team to estimate the effort needed to complete a product backlog item, typically a user story.	25
Task	Activities in agile project management frameworks that are derived by the team from the user stories at the beginning of an iteration.	35
User Story	User stories are used in agile project management frameworks for the specification of requirements by the later users of the system.	35

Work Breakdown Structure (WBS)	ISO 21502:2020(E): Decomposition of the defined scope of a project (...) into progressively lower levels consisting of elements of work	35
Work Package	ISO 21502:2020(E): Group of activities that have a defined scope, deliverable, timescale and cost	35

Appendix B – References

Standards

ISO 21500:2012, Guidance on Project Management (German version DIN ISO 21500:2016)
see chapter 1 and 2

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