



Das Expertennetzwerk

# **Project Management Foundations**

## **Syllabus (EN)**

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

Syllabus Version 2.0

June 2022

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## Authors (English Version)

Prof. Dr. Johannsen Andreas	TH Brandenburg
Kastner Norbert	ASQF e.V.
Kostal Horst	Process Fellows GmbH
Dr. Kramer Anne	Smartesting Solutions & Services
Dr. Stokar von Neuforn Daniela	Training and Transfer Management UG

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## Motivation, Focus and Target Group

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 ASQF CPPM syllabus Version 2.0.

### 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, e.g. ISO 21500, 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 process models

Agile methods have found their way into SW development in many cases. However, the sequential process models, e.g. V-model, are still widely used. 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. Reference is made to these in the individual chapters. The basic principles and methods of good team management as well as essential aspects of social competence are explained.

- 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, the majority of the learning objectives are assigned to level K2.

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

## 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.

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.

# 1 Overview and Introduction [90]

## Terms

**Process**

**Project**

**Project Life Cycle**

**Project Management**

**Project Phase**

**Stakeholder**

## Learning Objectives

CPPM LZ 1 (K1) Know success and failure factors of projects

CPPM LZ 2 (K1) Know important terms of project management

CPPM LZ 3 (K1) Know project management topic groups

CPPM LZ 4 (K1) Know core processes of project management

CPPM LZ 5 (K1) Know project management tasks

CPPM LZ 6 (K1) Know competence requirements for project managers

### 1.1 Course Overview [5]

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

The focus of this curriculum is to teach the basics of project management for software development projects. In addition to classic project management activities, such as project organization, procedures for project Initiating, planning, monitoring and control, through to project acceptance and closing, process models and procedure models 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 content tasks, the process and the interfaces.
- The roles, the demands on the people and dealing with existing circumstances, e.g. conflicts.

## 1.2 Introduction [10]

### Problems with Software Projects

A large proportion of all software development projects do not run successfully. 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 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 requirements management or quality assurance
- Communication problems and weak leadership, e.g. lack of conflict management, unclear decision-making authority.

In many cases, several reasons occur simultaneously. Human weaknesses are almost always involved.

## 1.3 Important Project Management Terms [15]

- Project

ISO DIN 21500: “A project consists of a unique set of processes consisting of coordinated and controlled activities with start and end dates, performed to achieve project objectives. Achievement of the project objectives requires the provision of deliverables conforming to specific requirements.”

A project may be subject to several constraints.

- 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 type of process model - classical/sequential or agile.

- Project Life Cycle

ISO DIN 21500: “The project life cycle spans the period from the start of the project to its end. The phases are divided by decision points, which can vary depending on the organizational environment.”

- Project Phases

A grouping of logically and temporally linked project activities (work packages), usually separated through milestones. Typical project phases are project Initiating, one or more Implementing phases and project Closing.

- Process

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 DIN 21500: “Project management is the application of methods, tools, techniques and competencies to a project. Project management includes the integration of the various phases of the project life cycle ....

Project management is implemented through processes. The processes selected for performing a project should be aligned in a systemic view. Each phase of the project life cycle should have specific deliverables. These deliverables should be regularly reviewed during the project to meet the requirements of the sponsor, customers and other stakeholders.”

*Hint: In the German syllabus, a synonym for project management exists, i.e. the term “Projektleitung”. It is defined according to DIN 69 901.*

*Andreas:*

In agile environments, every team member may be involved in project management functions.

- Project Manager / Project Leader

In German, both terms are used synonymously. Its specific use in job descriptions depends on the organization and culture of the particular company.

In this syllabus, when referring to specific individuals, the term project manager is used, meaning the person responsible for project management, or parts thereof.

- Stakeholder

ISO DIN 21500: “Person, group or organization that has interests in, or can affect, be affected by, or perceive itself to be affected by, any aspect of the project.”

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



## 1.4 Software Project Management Overview [60]

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 DIN 21500 describes guidelines for project management and these are the basis for this chapter.

### 1.4.1 Project Management Topic Groups

The following topic groups describe the relevant processes of project management (ISO 21500):

- Integration – includes the processes required to identify, define, combine, unify, coordinate, control and close the various activities and processes related to the project;
- Stakeholders – includes the processes required to identify and manage the project sponsor, customers and other stakeholders;
- Scope – includes the processes required to identify and define the work and deliverables, and only the work and deliverables required;
- Resource – includes the processes required to identify and acquire adequate project resources such as people, facilities, equipment, materials, infrastructure and tool;
- Time – includes the processes required to schedule the project activities and to monitor progress to control the schedule;
- Cost – includes the processes required to develop the budget and to monitor progress to control costs;
- Risk – includes the processes required to identify and manage threats and opportunities;
- Quality – includes the processes required to plan and establish quality assurance and control;
- Procurement – includes the processes required to plan and acquire products, services or results, and to manage supplier relationships;
- Communication – includes the processes required to plan, manage and distribute information relevant to the project.

### 1.4.2 Project Management Process Groups

Process management is carried out through processes, each of which consists of a series of interrelated operations.

A process-oriented approach to project management involves the following process groups (ISO 21500):

- Initiating – the initiating processes are used to start a project phase or project, to define the project phase or project objectives and to authorize the project manager to proceed with the project work;
- Planning – the planning processes are used to develop planning detail;
- Implementing – the implementing processes are used to perform the project management activities and to support the provision of the project's deliverables in accordance with the project plans;
- Controlling - the controlling processes are used to monitor, measure and control project performance against the project plan;
- Closing – the closing processes are used to formally establish that the project phase or project is

finished, and to provide lessons learned to be considered and implemented as necessary.

### 1.4.3 Project Management Tasks

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, select methods and tools for the project, monitor project planning, monitor costs, perform risk management, etc.

- Role-oriented project management tasks include:
  - 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

### 1.4.4 Competence Requirements for Project Managers

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 quality. 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 LZ 7 (K1) Know the difference between organizational structure and process organization

CPPM LZ 8 (K2) Understand the different types of organizational project structures and their influence on the project

CPPM LZ 9 (K1) Be able to name tasks of process organization

CPPM LZ 10 (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 organizational aspects for the process organization are:

- Definition of the project's interfaces to the outside world, e.g., to subcontractors (contracts, responsibilities, processes, communication) (see Project Initiating)
- 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 Initiating)
- Determination of project communication within the team (see Project Initiating 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 should 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 Process Models and Frameworks in SW Development [180]

### Terms

**Process Model**

**Process Tailoring**

### Learning Objectives

CPPM LZ 11 (K2) Understand the difference between sequential and agile process models and frameworks

CPPM LZ 12 (K1) Know typical representatives of sequential and agile process models and frameworks

CPPM LZ 13 (K1) Be able to name the essential characteristics of sequential process models and frameworks

CPPM LZ 14 (K1) Be able to name the essential characteristics of agile process models and frameworks

CPPM LZ 15 (K2) Understand the advantages and disadvantages of sequential and agile process models and frameworks

CPPM LZ 16 (K1) Know the main criteria for defining a process model and framework

CPPM LZ 17 (K2) Understand the need for process tailoring

CPPM LZ 18 (K2) Understand principles of agile system development

CPPM LZ 19 (K2) Understand basic ideas of agile system development according to Scrum

CPPM LZ 20 (K1) Know the three key agile elements

CPPM LZ 21 (K2) Understand roles and tasks in Scrum

CPPM LZ 22 (K1) Know phases in Scrum

CPPM LZ 23 (K2) Understand the importance of the "Sprint Planning Meeting"

CPPM LZ 24 (K2) Understand the meaning of the "Daily Scrum"

CPPM LZ 25 (K2) Understand the meaning of the "Sprint Review"

### 3.1 Overview of Process Models and 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.

Process models and 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 process models and frameworks: sequential and agile ones.

## Sequential Process Models and Frameworks

Sequential process models and 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 process model that is organized in several phases, e.g. requirements analysis, system design, Implementing, 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 procedure 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, the Implementing takes place, which is then tested on the right-hand side against the corresponding specifications of the respective left-hand side.

## Agile Process Models and Frameworks

“Agile process model” or “agile framework” is the generic term for a flexible and lean development process. Agile development tries to get by with little bureaucracy, few rules and mostly an iterative approach.

The "Agile Manifesto", which came into being in 2001, can be seen as the initial spark for agile process models and frameworks. 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 process models and 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.

A common agile process model and framework is Scrum. In the further course of this course, we will focus on Scrum. But Kanban and Extreme Programming (XP) are also used today as agile process models and frameworks. **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 has no iterations. In contrast, **Extreme Programming** is an agile and iterative process model and framework, which consists of values, principles and practices.

The **Scrum** approach is empirical, incremental and iterative. Scrum consists of only a few rules. These rules define five activities, 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	<p>Reduction of complexity by separating subtasks of the project into phases</p> <p>Focus on external as well as hierarchical control options</p>	<p>User feedback only after delivery of the system</p> <p>Separation of specification and implementation costs time</p> <p>Acceptance by users rather low</p> <p>High planning expenditure</p>	<p>Due to extensive experience, suitable for development of large, complex systems if requirements can be clearly defined in advance.</p>
Agile	<p>Early user involvement, relatively high fulfillment of user requirements</p> <p>Relatively short development times to first system versions.</p> <p>Approach that gets to executable software relatively early.</p> <p>Approach in which changing requirements can be accommodated through iterative design.</p>	<p>No emphasis on deeper analysis and documentation</p>	<p>If the requirements cannot be described clearly in advance,</p> <p>if hierarchical-centralized project monitoring can be dispensed with, and</p> <p>if work can be done on the basis of a self-controlled reporting system within the defined roles.</p>

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 process models and frameworks to specifics of the company and the project in order to ensure the most suitable project process possible. Possible factors to

which the generic process models should be adapted are:

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

Another main topic deals with the question of when agile procedures should be chosen and when the sequential procedure seems suitable – taking into account contextual factors of the industry and the market and competitive situation of the company. The table above briefly summarizes this.

### 3.3 Agile Process Models and 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 process models share the guiding principles that were originally 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 Basic Elements

In this section, the elements are presented using Scrum as an example: Three essential agile elements according to Scrum are:

- **Iterations** (in Scrum: **Sprints**): the overall system to be developed is developed in individual iterations, each with a part of the overall functionality. Sprints in Scrum have a constant duration of usually 2-4 weeks.
- **User Stories**: User Stories are used for requirement specification by the later users of the system
- The **Planning Game**: between the later users and the developers, the tasks prioritized in this iteration are identified and estimated from the user stories in a playful way before the start of each iteration.



### 3.3.3 Roles

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

- Product Owner

The Product Owner has the task of defining the development goal and managing the project budget. All task packages are recorded in the so-called Product Backlog. However, the product owner does not distribute task packages to individual team members.

- Team

The "Team" role includes all persons involved in the development. The team selects its own work packages and commits to completing them by a certain date.

- Scrum Master

The Scrum Master has the task of constantly checking compliance with the Scrum approach. He or she must 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.

### 3.3.4 Phases

The phases of the Agile process model and framework according to Scrum are:

- Sprint Planning

In a sprint planning meeting, a decision is made as to which user stories from the Product Backlog are to be processed in this Sprint (definition of the Sprint Backlog).

- Sprint

During a Sprint lasting 2 to 4 weeks, the activities of the previous day, the current day and the hindering environmental factors are briefly exchanged within the team in the so-called "Daily Scrum".

- Sprint Review

At the end of the sprint, the newly developed functionalities are presented to the product owner, and a sprint retrospective is held to analyze what can still be improved. The result of the Sprint is always a shippable increment, the sum of all Product Backlog entries completed during the current and all previous Sprints.

## 4 Project Initiating [90]

### Terms

### Learning Objectives

- CPPM LZ 26 (K2) Understand the importance of project initiating
- CPPM LZ 27 (K1) Know the objectives and activities of project initiating
- CPPM LZ 28 (K2) Understand the need for negotiation, facilitation and communication skills during project initiating
- CPPM LZ 29 (K1) Know Content of project definition
- CPPM LZ 30 (K2) Understand importance of putting project definition in writing
- CPPM LZ 31 (K2) Understand commonalities and differences in contract design depending on the process model
- CPPM LZ 32 (K2) Understand the importance of requirements analysis

### 4.1 Initializing 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.

A project starts when the performing organization completes the processes required to mandate a new project; ISO 21500]. Exactly which processes are required depends on the project organization and the intended process model. 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 initiating begins, the goal of which is 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 Implementing

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

- 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.

For the project manager, project initiating 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 moderate 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 Initiating, 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;
- Quantifiable project goals (success criteria in the triangle of cost, time, quality) 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 9 "Human Resource Management").

The project definition can be part of a contract.

The project definition is determined in close consultation with all stakeholders, e.g., in a workshop. The project manager should therefore have basic knowledge of moderation techniques (moderation 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. In the initiating phase, the basic form of cooperation with project participants must be clarified and the appropriate form of contract selected: Awarding to general contractors, involvement of subcontractors and/or external employees, cooperation in consortia. The clear definition of duties, authorities, decision-making processes and escalation paths is crucial.

Depending on the project and the process model, 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. In contrast, the focus in agile process models and in service-oriented services is on the contractual definition of the following points:

- Coordinated (!) approach, especially with regard to the prioritization of work packages
- 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 process model, 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 Initiating. Unclear and missing requirements pose significant risks in later project phases.

While the list of stakeholders should be known at the end of project initiating, 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 process models:

- Requirements must be sufficiently clear, documented and agreed.
- Requirements must be clearly prioritized.
- Stakeholders must be sufficiently involved (as input providers and reviewers).
- The entire product life cycle must be taken into account (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**

**Milestone**

**Task**

**User Story**

**Work Breakdown Structure (WBS)**

### Learning Objectives

CPPM LZ 33 (K1) Know the steps of project planning.

CPPM LZ 34 (K1) Know the Content of milestone planning

CPPM LZ 35 (K1) Know the structure and Content of a work breakdown structure

CPPM LZ 36 (K1) Be able to name non-functional delivery objects

CPPM LZ 37 (K2) Understand the significance of the work breakdown structure for further planning activities

CPPM LZ 38 (K2) Understand the relationship between effort and cost estimation in SW projects

CPPM LZ 39 (K1) Know areas of application for size estimation

CPPM LZ 40 (K1) Know principle and Content of expert estimates

CPPM LZ 41 (K1) Be able to name methods of expert estimation

CPPM LZ 42 (K2) Understand rules for successful expert estimation

CPPM LZ 43 (K1) Know the principle and Content of analogy estimations

CPPM LZ 44 (K1) Be able to name methods of analogy estimation

CPPM LZ 45 (K1) Be able to name advanced estimation methods

CPPM LZ 46 (K2) Understand the importance of estimation and the involved challenges, especially with regard to cost estimation

CPPM LZ 47 (K2) Understand the importance of the activity schedule

CPPM LZ 48 (K1) Know forms of personnel resource planning

CPPM LZ 49 (K2) Understand the importance of project planning for milestone schedules and controlling

CPPM LZ 50 (K1) Know basic rules of successful activity scheduling

CPPM LZ 51 (K2) Understand the specifics of activity scheduling in sequential process models

CPPM LZ 52 (K2) Understand the specifics of activity scheduling in agile process models

CPPM LZ 53 (K2) Understand differences in cost planning in sequential and agile process models

CPPM LZ 54 (K1) Know the content of the project plan

## 5.1 Determine Project Content and Milestone Plan [10]

At the beginning of project planning, the project definition created in the Initiating phase is revised and further detailed. This step serves to identify gaps in the understanding of the project content.

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,
- 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, start of implementing and others), as well as supporting, internal milestones depending on the circumstances.

## 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.

The criterion for a delivery object 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 the time planning and their 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.

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.

The work breakdown structure can serve as input for the preparation of an effort estimation. If estimates at the lowest level become necessary for this purpose, it must be noted that these estimates only provide very imprecise values (see "Effort and Cost Estimation"). This fact must be reflected in assumptions and exclusions in the offer.

### 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.

The work packages from the WBS can be used to determine the resources required in terms of employees, development environment and materials.

By far the largest cost factor in software development is personnel costs. Therefore, the effort required to process the work packages must be estimated 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.

Cost estimation should not be confused with project pricing, which is a business decision (e.g., in the case of a strategic project, such as the first project in a new business segment, it may well be decided to bid the project 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, fields, etc. The estimate of effort resulting from the size estimate should be based on good quality and maintained historical data.

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 three fundamentally different ways:

- Estimation by experts
- Estimation by analogy
- Advanced methods



## 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 process models (e.g. Scrum)

## Analogous Estimation

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.

## Advanced Methods

Function Point Analysis and Cocomo are based on statistical data from past projects. Efforts are calculated on the basis of mathematical models. This is particularly useful for recurring tasks in large projects.

However, careful collection and maintenance of the statistical data is mandatory for these estimation techniques.

## 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]

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 process models, 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 task and the process model.

In sequential projects, however, a low-fluctuation schedule is not an end in itself. The resource plan can also be aligned with the planned feature growth, if it is not possible the other way around. 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 critical path.

In general, it should be noted 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, whenever possible, the goal should be:

- Only one employee per activity
- Only one activity per employee in a period

If activities exist whose processing must be completed by several employees, the activities should be broken up. This enables downstream and conclusive project control.

## Sequential (Classic) Process Models

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.

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 from the beginning, 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 process models.

## Agile Process Models

In the agile world, there is no detailed upfront time planning.

Work packages (often stories or user stories) are only roughly estimated by the agile teams to enable release planning. The detailed estimation and planning then always takes place at the start of a short iteration (e.g. sprint in Scrum). In this case, the activities (often tasks) are created by the team and estimated in detail only for user stories of the next 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 Process Models and 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 Process Models and Frameworks

Since there is no complete schedule in agile models, 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 Project Implementing and Controlling [210]

### Terms

**Change Control Board (CCB)**

**Earned Value Analysis (EVA)**

**Milestone Trend Analysis (MTA)**

**Push System**

**Pull System**

**Status Report**

### Learning Objectives

CPPM LZ 55 (K2) Understand the importance of project controlling

CPPM LZ 56 (K1) Be able to name the components of project controlling

CPPM LZ 57 (K2) Understand the importance of a reliable project progress monitoring

CPPM LZ 58 (K2) Understand differences in progress data collection in sequential and agile approaches

CPPM LZ 59 (K1) Be able to name the different forms of reporting

CPPM LZ 60 (K2) Understand the importance of progress reporting

CPPM LZ 61 (K2) Understand the importance of audience-focused meetings and their advantages

CPPM LZ 62 (K1) Know phases of a meeting

CPPM LZ 63 (K2) Understand areas of application of milestone trend analysis

CPPM LZ 64 (K2) Understand areas of application of earned value analysis

CPPM LZ 65 (K2) Understand the meaning and impact of change

CPPM LZ 66 (K1) Know levels of change management in sequential process models

CPPM LZ 67 (K1) Know the activities of change management in sequential process models

CPPM LZ 68 (K2) Understand specifics of change management in agile process models

### 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 Project Implementing [20]

The allocation of resources to activities differs between sequential (classic) and agile process models both in the timing and in the process itself.

### Sequential Process Models and Frameworks

Sequential models are "push" systems.

Here, employees are assigned to activities during planning at the beginning of the project. Therefore, the knowledge of the availability and the qualification of the employees is already decisive for the planning at this point in time.

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

### Agile Process Models and Frameworks

Agile models are generally "pull" systems, which means that the processing of activities (here tasks) is a team matter. Tasks initially go into an iteration without assignment and are then "pulled" by individual team members only when they take tasks to implement 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 Process Models and Frameworks

Even in sequential models, 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 Process Models and Frameworks (Example: Scrum)

Scrum clearly specifies that the progress of the activities (here tasks) should be recorded on a daily basis. This is done informally in the brief daily meetings (daily standups), as well as formally through status updates on the board (haptic or tool-based).

In Scrum, the maximum size of tasks is clearly defined. For each task the daily remaining effort is estimated if it is not completed on the respective day.

## 6.4 Progress Reporting and Information Exchange [40]

One of the project manager's tasks is to report regularly in writing 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 Initiating).

### 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, attention of all (no notebooks), 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 addressees. Explanations at activity level should be avoided here, as this is not the focus of the addressees.

### Special Features of Agile Process Models and Frameworks (Example: Scrum)

A fixed component here is the sprint review, in which the results of the past sprint are formally presented to the stakeholders. The necessary transparency is created by publishing the results on a board that can be viewed by everyone.

Scrum makes explicit statements about the expected quality of the meetings in terms of type, duration, group of participants and efficiency.

## 6.5 Trend Systems [45]

Well-known trend systems for project control are

- the milestone trend analysis (MTA)  
It has a very good cost/benefit ratio and can be used in the project status report to provide a graphical overview of the project progress based on the milestones.
- the Earned Value Analysis (EVA)  
It is mainly used for cost tracking in larger projects. Problems here are the inaccurate recording of the actual state, as well as the prerequisite of linear cost progressions.

## 6.6 Change Management [45]

### 6.6.1 Sequential Process Models

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!

It is imperative that a mechanism for recording, evaluating and tracking changes be established.

Since changes are always to be expected, a functioning change management is a basic requirement for proper project execution. There are two levels of change management:

- The project Content (e.g., requirements changes, milestone schedule changes, cost changes) changes:
  - The proposed change is analyzed for its impact on existing agreements.
  - The change is decided 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. 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 Content of the change management.

### 6.6.2 Agile Process Models

In principle, agile models do not distinguish between user stories 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.

## 7 Project Acceptance and Closing [30]

### Terms

### Learning Objectives

- CPPM LZ 69 (K1) Know the purpose and procedure of project acceptance
- CPPM LZ 70 (K1) Know the purpose and procedure of project closing
- CPPM LZ 71 (K1) Know typical activities of the project closing phase
- CPPM LZ 72 (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 "Project Implementing and Controlling").

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

### 7.2 Project Closing [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:

- The project manager must ensure that the project documentation for the project closing phase is complete and up-to-date, and can be found in an archive 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.

## 8 Quality Assurance [60]

### Terms

#### CAPA

### Learning Objectives

CPPM LZ 73 (K2) Understand the process-oriented approach to quality assurance

CPPM LZ 74 (K1) Be able to describe the Content of a quality assurance plan

CPPM LZ 75 (K2) Be able to describe methods of quality assurance for processes

CPPM LZ 76 (K1) Understand the project manager's tasks with regard to quality assurance for processes

CPPM LZ 77 (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 (CAPA), 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 or 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 process models, 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 LZ 78 (K1) Remember that risk management is an iterative process
- CPPM LZ 79 (K1) Be able to name risk management activities
- CPPM LZ 80 (K1) Know the main causes of risks
- CPPM LZ 81 (K2) Be able to classify risk management in sequential and agile process models
- CPPM LZ 82 (K1) Know methods and success factors of risk identification
- CPPM LZ 83 (K2) Understand methods of risk assessment
- CPPM LZ 84 (K1) Know types of countermeasures
- CPPM LZ 85 (K1) Know documentation of risks and countermeasures
- CPPM LZ 86 (K2) Understand importance and tasks of risk controlling
- CPPM LZ 87 (K1) Know importance of soft skills in risk management
- CPPM LZ 88 (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 process models. In sequential process models, 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 process models, 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 process model, 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 a 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. Moderation 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 LZ 89 (K2) Understand the importance of human resource management for successful project management

CPPM LZ 90 (K2) Understand the interaction between company-wide human resources management and project-related human resources management

CPPM LZ 91 (K1) Understand tasks of project managers in different project phases related to human resource management

CPPM LZ 92 (K1) Know typical activities of human resources management in the different project phases

CPPM LZ 93 (K1) Be able to name the advantages of effective human resources management in projects

CPPM LZ 94 (K1) Know the four phases of team support

CPPM LZ 95 (K2) Understand the importance of phase-related tasks and activities of the project manager in team support

CPPM LZ 96 (K2) Understand the importance of the project manager's interpersonal skills to project success

CPPM LZ 97 (K1) Be able to name four essential aspects of social competence

CPPM LZ 98 (K1) Know the roles and tasks of the project manager with regard to teamwork

CPPM LZ 99 (K2) Understand the importance of sound knowledge of methods and tools for successful team management

CPPM LZ 100 (K2) Be able to explain and illustrate Tuckman's Model of Group Development

CPPM LZ 101 (K1) Be able to name typical options for action of the project manager depending on the team building phase

CPPM LZ 102 (K2) Understand the roles of team members according to M. Belbin

CPPM LZ 103 (K2) Be able to give examples of tasks and skills of the project manager depending on his/her role in the project

CPPM LZ 104 (K2) Understand the importance of intrinsic and extrinsic motivation and how they can be influenced by the project manager

CPPM LZ 105 (K2) Understand the importance of recognition and appreciation as the number one motivating factor

CPPM LZ 106 (K2) Understand the positive and negative effects of verbal and non-verbal

communication.

CPPM LZ 107 (K1) Know requirements for the project manager and his competencies

CPPM LZ 108 (K1) Know requirements for the team members and their competencies

CPPM LZ 109 (K1) Know aspects of successful leadership work

## 10.1 Human Resource Management – Introduction [5]

This chapter applies to all process models and frameworks, even if Scrum and other agile models do not explicitly incorporate human resource management. When managers or developers work with agile methods, they often experience that these approaches pose major challenges to the company organization and human resources management.

## 10.2 Human Resource Management in the Organization [25]

### 10.2.1 Human Resource Management = Human Capital Management

Human resource management means leadership, management and control, development and administration of the workforce as an independent management task (human resource management), as an unconventionally acting factor in the context of the enterprise policy.

Its **goal** is employee satisfaction, low workforce costs and an increase in the competitive strength of the company. The official representatives of human resource management are:

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

### 10.2.2 Tasks of Human Resource Management

Tasks include:

- Personnel policy – vision work, development of mission statement and personnel strategy, as well as management guidelines and personnel marketing
- Deployment – job design, day-to-day operations and management, team shaping, information policy, knowledge management, management guidelines
- Administration – administration, data management & maintenance, system development, legal framework, company agreement, personnel controlling
- Planning – demand planning, staffing and transfer, job description, time management, compensation model
- Procurement – recruiting, selection (selection criteria & methods), hiring (employment contracts, start-up support)
- Development – career models & leadership development, training, design of learning settings, skill profiles

### 10.2.3 The Function of Human Resource Management in the Company

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 – is oriented towards the goals of the organization
- Operational human resource management – deals with individual measures e.g. with drawing up requirement profiles for specific positions
- Tactical human resource management – as a link between the strategic and operational levels – is oriented towards groups of employees or jobs (e.g. career plans).

All three levels are closely interrelated.

### 10.2.4 Tactical Human Resource Management

Tactical human resource management is most relevant to projects. It shapes the temporary planning of e.g. a work group in the company (e.g. in the project). At this level, the organization of individual teams or groups is shaped and the answer to the following questions is provided: How can the individual teams/groups themselves work efficiently and productively? How can the strengths of a group be optimally used to achieve the best possible results?

Tactical planning plays an important role for both the overall company and the management level.

## 10.3 Human Resource Management in the Project [30]

The most important **success factor in a project is the human being**. Projects often fail because of problems of a socio-cultural nature and not because of technological aspects. This means that the issues critical to success in the management of complex software projects are not only related to design, implementation or methodological problems, but that it is precisely the handling of people-related issues that is crucial for successful project management.

The way in which human resource management can be implemented in the project depends on the organizational form of the project.

### 10.3.1 Human Resource Management as a Cross-Cutting Task

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

- Selection of staff,
- Staff leadership and
- Know-how management.

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

### 10.3.2 Staff Selection

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".

### 10.3.3 Staff Leadership

Staff leadership means

- keeping task-oriented and interpersonal aspects in focus,
- providing guidance, involvement, and motivation to team members with respect to overall project goals.

Staff leadership is one of the most important human resource management tasks in the project and requires the project manager to have a high level of leadership and communication skills. These skills are required throughout the entire duration of the project – especially when changes are required, when the project faces problems or the way to proceed is unclear.

The project manager must also be able to act as a leader in many other situations (e.g., with management, interested parties, etc.).

#### Management versus Leadership:

Management strives to do things right; leadership strives to do the right things.

### 10.3.4 Know-How Management

Know-how management means possessing and being able to apply well-founded knowledge in the project. It is the task of the project manager to identify, link and exchange knowledge on the basis of sound communication, to discover and close knowledge gaps, to make the knowledge usable and transparent, to work with it and to "know who knows". Systematic knowledge management supports communication within the team and ensures that future projects benefit from the know-how gained (lessons learned).

### 10.3.5 The Relevance of Human Resource Management in the Project

Regulated processes for planning and selecting project team members (e.g., via skills profiles or required certificates) prevent conflicts between the HR department, other divisions and the project manager. They reduce the need for coordination between the responsible unit in the corporate organization and the project.

Targeted staff selection takes into account the different skill requirements in the team and ensures results in terms of efficiency and productivity in the project. Staff turnover during the project is

significantly reduced, employees are more motivated and more qualified assessment of project staff is possible. There are fewer frictional losses.

The introduction of suitable team management structures is one of the organizational tasks in the project. In international projects or project teams with intercultural staffing, socio-cultural and legal influencing factors must also be taken into account (diversity management).

The management of "human resources" (Human Resource Management (HRM) has a high relevance in all phases of project management. Selection of staff , staff leadership and know-how management influence every project phase.

### 10.3.6 Human Resource Management Activities During the Project

The following table shows human resource management activities (viewed holistically) during the project.

Phase	Tasks of the project manager on the factual level	Activities of the HR management in the project
Initiating	Composition of the project team, definition of the project organization	Staff leadership
Planning	Identification of required resources and creation of the personnel resource plan (We speak of "resource" as long as no concrete employee has been named yet. As soon as a person occupies the "resource", it is an "employee").	<p><b>Staffing requirements determination/planning</b> – ensuring that the required number of people with the required qualifications are available to the project at the appropriate location within the planned time frame.</p> <p><b>Staffing</b> – ensure that the previously defined staffing needs are met (cost effectively and according to the requirements) and that the staff is available</p> <p><b>Staffing analysis</b> – determine and evaluate competencies of the existing project team and communicate them to the appropriate unit. This information is the basis for evaluable personal development, team development and organizational development</p> <p><b>Personnel change management</b> – coordinate measures for realizing the need for change in the workforce (build-up / release)</p> <p><b>Personnel assignment management</b> – determine how specific employees are assigned to specific project activities according to their qualifications</p> <p>Personnel cost management</p> <p>Staff leadership</p>

Implementing and Controlling	Leading and developing the project team	Recruitment <b>Personnel cost management</b> – as part of financial planning, determine the current and future costs of present and future staff requirements and current as well as planned individual measures regarding the personnel <b>Personnel development</b> – plan, implement and evaluate further training, support and development in a targeted manner  Personnel change management  Staff leadership
Closing	Evaluation of team cooperation (see chapter 7), celebrating successes, update of employee profiles, implementation of personnel policy measures (depending on organizational form), support/motivation of employees	Staffing analysis  Personnel development  Personnel change management  Staff leadership

### 10.3.7 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 office 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.

### 10.3.8 Team Support by Human Resource Management in Four Steps

The tasks of HR management in team support are divided into four main phases:

- **Team Building** – constituting the team and its structures.  
The main focus is on a successful project start, because it is crucial for the further course of the project. The project manager has the task of assembling the team and defining the project organization.
- **Team Management** – leading and guiding the team.  
This phase requires high interpersonal skills of both the project manager and the team. The project manager has the task of estimating the resource needs and creating the personnel resource plan.
- **Team Developing** – development of personal and professional competencies through training/education.  
A continuous improvement process is supported by sound communication. The project manager has the task to lead and develop the team.
- **Team Closing** – assessment/evaluation, reintegration, forms of team dissolution.  
In this phase, the appreciation of the work done is most important. The teamwork in the project closes with the assessment of the team members and the evaluation of the project success. The project manager has the task to evaluate the teamwork, to update employee profiles, to implement personnel policy measures, to accompany and motivate employees, to celebrate successes.

The goal of this 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.

The project manager initiates all activities that are suitable for promoting the team's performance and ensuring the project's success (in all project phases).

## 10.4 Success Factor – Social Competence [15]

**Definition of "social competence"** (translated from German – Ulrich Pfingsten, Döpfner 1981):

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.

### 10.4.1 The "7-S-Model"

About 45 years ago, Robert H. Waterman Jr. and Tom Peters, as consultants of McKinsey, conducted research in large companies with the goal of finding out the success factors for companies. They hypothesized that it is not only the financial metrics, but above all the people employed in the companies with their attitudes and value systems that cause success or failure.

In their book "In Search of Excellence," the authors described the "7-S Model" and, among other things, characterized "Hard Factors" (Strategy, Structure, Systems) and "Soft Factors" (Style, Staff, Skills, Shared Values) for the first time.

"Soft" – refers to non-objectively quantifiable variables for which no reliable measurement is possible, in contrast to "Hard Factors" for which numerous objective performance tests are available.

The term "social competence" cannot be categorized and can be understood according to the context and the requirements of the situation.

Social skills belong to the "soft factors", i.e. to the skills that cannot be verified with objective criteria, but which have an enormous influence on the success of the project.

For the project manager, social skills are one of the most important prerequisites for assuming a leadership position. 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 impossible.

#### 10.4.2 Requirements for the Project Manager

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

- Behavioral competence (social competence) – of which almost 2/3 of the possible team influence consists. It 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.

#### 10.4.3 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 possess a high degree of acceptance.

#### 10.4.4 Four Essential Aspects of Social Competence

- Dealing with oneself  
Meaning high self-esteem that allows reflection, criticism and learning from mistakes
- Dealing with other people  
In this context, it is important to show genuine interest in the other person, not only in the resource, to be able to perceive and understand others, to accept foreign opinions and positions.
- Aspects of cooperation
- Aspects of leadership



Social competence can be trained and learned, provided the general readiness to learn, the will to look at the own possibly obstructive behavior patterns and the will to acquire new patterns which are more successful. Training can only be effective if one's own needs are recognized.

## 10.5 Success Factor – Communication [60]

### 10.5.1 Definition of Communication

Communication is the exchange of information between two or more persons.

Communication

- is an elementary necessity of human existence
- is an important social bonding agent
- works through speech, facial expressions, gestures, written exchanges, media etc.

Communication channels are:

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

### 10.5.2 One cannot Not Communicate!

Communication is verbal as well as non-verbal!

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. This means:

- Conducting conversations mindfully and purposefully so that a connection is created (common ground, orientation).
- Formulating some thoughts diplomatically rather than pointedly – especially as long as he/she cannot judge the people and situations.
- To offer praise and recognition on a regular basis.

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

## 10.6 Success Factor – Motivation [15]

### 10.6.1 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. Demotivated action not only causes 'non-doing' or less performance commitment, but also points to commitment in an undesirable direction." (Wunderer & Küpers)

### 10.6.2 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, recognition, 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.

"Leading is above all avoiding demotivation and means creating development opportunities for employees" (according to Reinhard K. Sprenger). Consequently, the main task of a project manager is to keep the team motivated.

### 10.6.3 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, or the constant questioning of decisions are part of everyday life and are reflected in the motivation of project members. As a result, this loss of motivation manifests itself in the project as delays in deadlines, loss of quality, and a decline in team performance. Diffuse goals, unclear priorities, work overload can also be triggers for the lack of motivation. Often the causes are in the structure and organization or in the project's processes (structural problems).

In the course of 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.

#### 10.6.4 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.

Appreciation is very important in project management. 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.

### 10.7 Success Factor – Leadership [30]

In general, leadership is a goal-oriented influence.

Leadership **in project management** should have a directional and guiding effect on the actions/behavior of project employees in order to achieve goals:

- Leadership builds on general leadership principles.
- Leadership situations in projects are complex.
- A practice-oriented leadership approach is suitable for projects.

#### 10.7.1 Aspects of Successful Project Leadership

Leading ...

- **with vision** – which gives a meaning, is comprehensible, inspires, motivates, carries along, ...
- **through structure** – goals, framework, decisions
- **through communication** – humor, conflict resolution, persuasion, feedback
- **as a maker** – creating a learning environment, maintaining a network, actively making assumptions, learning from mistakes

- **as a role model** – enthusiasm, integrity, being authentic/congruent, sustainable, providing a meaningful environment, being effective, being interesting, ...
- **with appreciation** – individual leadership impulses per employee, listening, taking seriously, letting people finish speaking, ...
- **with positive attitude** – teams with self-responsibility, trust, creative power

### 10.7.2 Leadership – Conclusion

- Leadership is a two-way process.
- Project managers as leaders should/must have a repertoire of different leadership styles.
- Leadership concepts are becoming more and more complex.
- There are no standard recipes for leadership behavior.

The project manager as a leader should develop his own model of ideal leadership.

## 10.8 Working in a Team [60]

### 10.8.1 The Project Manager in the Classic Team

The focus lies on coordination, responsibility for the overall project and the 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.

### 10.8.2 The Project Manager/Scrum Master in the Agile Team

The focus lies on operational team management. The project manager:

- moderates 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
- ensures good working ability 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.

### 10.8.3 Methods & Tools for Successful Team Leadership

The project manager needs a method/toolbox to support him/her in these tasks. For example, he or she may use the following:

- Project management tools
- Communications techniques
- Moderation/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 autonomously and together arrive at results and decisions that are supported and implemented by the entire team in consensus.

### 10.8.4 Methods & Tools – Successful Meetings Require Facilitation

Good facilitation 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 moderator.

Facilitation combines targeted solution of tasks with the realization of the own interests of individual team members.

### 10.8.5 Team Development Phases According to Bruce Tuckman

Team development itself needs a methodical basis and a basic understanding. The use of models such as the team development model according to Tuckman 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 5 characteristic phases in the course of its development.

The table below depicts the roles and desired behaviors of the project manager within these 5

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	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 of the game", establishes these rules and processes and ensures compliance, acts in a task-oriented manner, 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 most of the necessary decisions and uses delegating style, can step back a bit, has focus on goal setting, 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

#### 10.8.6 Team Roles According to M. Belbin

The team members do not act as individuals, but they assume certain roles in their team.

The description of typical roles is provided, for example, by Meredith Belbin. He divides the roles into three main orientations, each of which includes three team roles:

- people-oriented (coordinator/integrator, team worker, resource investigator)
- action-oriented (shaper, implementer, completer / finisher / perfectionist)
- thought-oriented (plant/innovator, monitor / evaluator / observer, specialist)

Even a team with an optimal composition can only be truly effective if there is a positive atmosphere of mutual respect and functional processes for communication and conflict resolution can be developed.

The team role approach is important for understanding basic team processes. It can provide the project manager with clues for the distribution of tasks and help to understand conflicts and find solutions.

#### 10.8.7 Project Management Roles Requiring Social Competence

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

<b>Role</b>	<b>Task</b>	<b>Suitability / Ability</b>
Coordinator	Clarify goals, distribute work/tasks, organize processes, coordinate with others	obliging and consistent (persistent), diplomatic rather than dominant
Facilitator	let everyone have their say, make participants out of those affected, recognize and solve problems in communication, summarize, 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 perspectives, pointing out alternatives
Conflict manager	Solve role conflicts	Analyze communication structures and problems, have basic understanding of mediation techniques, openness and 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 aware of own effect

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

## 11 Maturity Models [35]

### Terms

### Learning Objectives

CPPM LZ 110 (K1) Be able to name the different maturity models (CMMI, SPICE)

CPPM LZ 111 (K2) Understand the principle of maturity models.

CPPM LZ 112 (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 SPICE. Both divide the requirements for the projects into so-called maturity levels, which build on each other and make statements about the degree of quality that the individual processes achieve.

In SPICE these levels are called capability levels.

The first achievable level in SPICE 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 initially stem from sequential approaches, but do not contradict agility. Process models (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

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## Appendix B – References

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see chapter 1 and 2

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